RURAL ELECTRIFICATION AGENCY
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THE WORLD BANK

# FINAL ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP) FOR THE FEDERAL UNIVERSITY, KASHERE, GOMBE INTERCONNECTED SOLAR-HYBRID PROJECTS UNDER THE NIGERIA DISTRIBUTED ACCESS THROUGH RENEWABLE ENERGY SCALE-UP (DARES) - REA-NEP/DARES/C/CQS/071/2025

**Submitted To**

***Federal Ministry of Environment***
***Mabushi, FCT, Abuja.***

**JUNE 2026**

**FINAL ESMP REPORT**

# Of the Proposed Solar Power Plant and Associated Infrastructure at the University of Kashere, Gombe State

**Under the Nigeria Distributed Access Through Renewable Energy Scale-up (DARES)**

**Submitted To**

***Federal Ministry of Environment***
***Mabushi, FCT, Abuja.***

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| | |
|---|---|
| APPI | Area of Potential Project Influence |
| ARAP | Abbreviated Resettlement Action Plan |
| BESS | Battery Energy Storage System |
| BMP | Biodiversity Management Plan |
| BOD | Biochemical Oxygen Demand |
| COPE | Care of the People |
| CWD | Coarse woody debris |
| DRG | Debt Relief Gains |
| EA | Environmental Assessment |
| ECN | Energy Commission of Nigeria |
| EEP | Energizing Education Programme |
| EIA | Environmental Impact Assessment |
| EIS | Environmental Impact Statement |
| EMF | Electromagnetic Field |
| EMS | Environmental Management Strategy |
| ERSED | Erosion and sediment control |
| ERRP | Emergency Reporting and Response Plan |
| ESCP | Erosion and Sediment Control Plan |
| ESIA | Environmental and Social Impact Assessment |
| ESMP | Environmental and Social Management Plan |
| ESCOs | Energy Service Companies |
| FEPA | Federal Environmental Protection Agency |
| FGN | Federal Government of Nigeria |
| FMEnv | Federal Ministry of Environment |
| GPS | Global Positioning System |
| GW | Gigawatt |
| Ha | Hectares |
| HSE | Health, Safety, and Environment |
| HT | High Tension |
| ICREEE | Inter-ministerial Committee on Renewable Energy and Energy Efficiency |
| LGA | Local Government Area |
| LT | Low Tension |
| NACOP | National Council on Power |
| MW | Megawatt |
| MWh | Megawatt hour |
| MWp | Megawatt peak |
| NEEAP | National Energy Efficiency Action Plan |
| NEP | Nigeria Electrification Project |
| NEPP | National Electric Power Policy |
| NERC | Nigerian Electricity Regulatory Commission |
| NESREA | National Environmental Standards and Regulations Enforcement Agency |
| NIMET | Nigerian Meteorological Agency |
| NML | Noise Management Level |

| | |
|---|---|
| NOx | Nitrogen oxides |
| NSITF | National Social Insurance Trust Fund |
| NUC | National University Commission |
| O&M | Operations and maintenance |
| PAPs | Project Affected Persons |
| PCT | Plant Community Type |
| PESCP | Progressive Erosion and Sediment Control Plan (aka ESCP) |
| PMP | Project Management Plan |
| PV | Photovoltaic |
| REA | Rural Electrification Agency |
| SE4All | Sustainable Energy for All |
| Sp./spp. | Species/species (plural) |
| SWMP | Soil and Water Use Management Plan |
| TCN | Transmission Company of Nigeria |
| TCP | Traffic Control Plans |
| TMP | Traffic Management Plan |
| TWA | Time Weighted Average |
| VLMP | Vegetation and Land Management Plan |
| WMP | Waste Management Plan |
| WPMP | Weed and Pest Management Plan |

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| Surv. Lakpa Wikee | Survey Assistant | Certified Surveyor |
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# EXECUTIVE SUMMARY

## ES01 INTRODUCTION

The Federal Government of Nigeria (FGN) has, over the past decade, prioritized expanding access to electricity as a critical driver of economic growth, social inclusion, and sustainable development. In 2018, this commitment materialized through the Nigeria Electrification Project (NEP), financed by concessional funding from the World Bank and the African Development Bank. The NEP was designed as a flagship off-grid electrification initiative to bridge the energy access gap in rural and underserved communities. Implemented by the Rural Electrification Agency (REA), the project successfully deployed mini-grids and standalone solar systems, delivering clean and reliable electricity to over seven million Nigerians, while stimulating private sector participation through results-based financing mechanisms.

The Rural Electrification Agency (REA) is a Nigerian government agency responsible for ensuring electricity reaches every part of the country. REA focuses on rural electrification projects, providing power solutions for on-grid and off-grid areas with an emphasis on renewable energy. As the Implementing Agency of the Federal Government of Nigeria, the team at REA is tasked with the electrification of rural and unserved communities across Nigeria. MISSION 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 a reasonable return on investment through an appropriate tariff that is economically responsive and supportive of the average rural customer. MANDATE - Promote Rural Electrification in the Country - Co-ordinate Rural Electrification Programs in the country - Administer the Rural Electrification Fund (REF) to promote, support, and provide rural electrification through Public and Private Sector Participation. The Abuja Office is located at No. 15 Constitution Avenue, Central Business District, FCT-Abuja.

### Project Specific Activities

This component of the project will involve activities undertaken during the various implementation phases of the project as follows;

- Site clearing
- Civil, mechanical and electrical works
- Installation of PV panels and associated plant facilities
- Construction of training centre
- Installation of streetlights as well as underground armoured cable for power evacuation
- An upgrade of some of the existing power distribution infrastructure within the University will be carried out.
- 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.
- Generation and distribution of electricity to different sections of the University campus
- Operation of the renewable energy training centre to support learning and capacity development in clean energy technologies
- Preventive and corrective maintenance aimed at maintaining optimal system performance throughout the plant's lifespan
- Periodic cleaning of photovoltaic (PV) panels to maintain their efficiency
- Regular safety inspections and implement measures aimed at preventing accidents, injuries, and occupational health risks
- Wastes management

### Objectives of the ESMP

The purpose of the Environmental and Social Management Plan (ESMP) is to ensure that Environmental and Social impacts identified during the ESMP process are effectively addressed during the construction, operation and closure of the project. The ESMP specifies the mitigation and management measures to

which the Proponent is committed and shows how the Project will mobilize organizational capacity and resources to implement these measures.
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 effective environmental and social management and communicate the objectives and requirements of the ESMP.
- Ensure compliance with applicable environmental and social laws, regulations, permit conditions, and Project commitments.
- Define clear roles, responsibilities, and accountability for implementing environmental and social measures.
- Integrate environmental and social considerations into Project planning, design, construction, and operation.
- Apply the mitigation hierarchy by avoiding, minimizing, restoring, and, where necessary, compensating for adverse impacts.
- Enhance positive environmental, social, and economic benefits generated by the Project.
- Serve as an action plan for implementing environmental and social management measures.
- Provide a framework for implementing and monitoring mitigation and enhancement measures identified in the ESMP.
- Support continual improvement through monitoring, reporting, and corrective actions.

**Rationale for ESMP**
The rationale for an Environmental and Social Management Plan (ESMP) is rooted in the necessity to bridge the gap between environmental policy and project implementation. In the context of large-scale development, the ESMP acts as the primary mechanism for ensuring that the findings of an Environmental and Social Impact Assessment (ESIA) are not merely academic, but are integrated into the daily operational workflow of a project.

**Scope of the ESMP**
The scope of the ESMP includes;

- Project Lifecycle Integration.
- Institutional and Regulatory Boundaries
- Environmental and Social Receptors
- Mitigation and Monitoring Protocols

**Work Execution Plan/Methodology**
This ESMP has been prepared in accordance with standard procedures for Environmental Assessment, including other applicable World Bank safeguard policies and Nigerian policy guidelines. The baseline status of the project area was obtained through consultations with the relevant stakeholders, a review of relevant literature as well as field studies.

Environmental data acquisition involved a multidisciplinary approach and was conducted in line with regulatory requirements and best international practices. This approach includes literature desktop review, designing, and development of field sampling strategy; confirmation of the sampling design and locations, pre-mobilization activities (job hazard analysis, sampling equipment/materials calibrations and checks and mobilization to the field; community consultations, sample collection, handling, documentation, and storage protocols and, and demobilization from the field, transfer of sample custody to the laboratory for analysis.

**Project Description**

Key Components of DARES are**:**

- Component 1: Solar Hybrid Mini Grids for Rural Economic Development: $410 million IDA commitment to deploy mini-grids for rural economic growth.
- Component 2: Stand-alone Solar Systems for Homes and MSMEs: $300 million IDA commitment to provide solar systems for households and micro, small, and medium-sized enterprises
- Component 3: Technical Assistance: $40 million IDA commitment for technical support and capacity building.

The Rural Electrification Agency (REA) is implementing DARES through its existing Project Management Unit (PMU). The project has already shown significant progress, with over 200 mini grids delivered nationwide. REA has also signed grant agreements with eight renewable energy companies to deploy solar home systems and mini grids, aiming to electrify underserved communities and drive economic growth.

**Description of Project Intervention**

The project is being implemented under the Distributed Access through Renewable Energy Scaleup (DARES) programme, which serves as a scale-up initiative from the Nigeria Electrification Project (NEP Given that this is an Energy-as-a-Service (EaaS) model, the same Energy Service Company (ESCO) responsible for the design and construction of the project will also manage its operations and maintenance (O&M) throughout the service period. This arrangement promotes lifecycle accountability because the ESCO has a direct incentive to ensure that the system is designed for reliability, efficiency, maintainability, and long-term performance. Its O&M responsibilities will typically include routine inspections, preventive and corrective maintenance, fault response, equipment replacement, spare-parts management, performance monitoring, and compliance with agreed service-level requirements and key performance indicators (KPIs).

The ESCO will also be responsible for maintaining appropriate environmental, health and safety (EHS) standards during operations, including electrical safety, emergency response, waste management, battery and e-waste handling, worker protection, and community health and safety. Performance and maintenance records should be regularly documented and reported, while any end-of-service handover should include asset condition assessments, updated maintenance records, operating manuals, outstanding repairs, and training where required. This integrated approach reduces interface risks between construction and operations and supports consistent performance throughout the project lifecycle.

The project intervention for a utility-scale solar photovoltaic (PV) plant involves a multi-phase transformation of land to harness solar irradiance for electrical power generation. The intervention begins with site preparation, which necessitates the clearing of vegetation and the leveling of terrain to accommodate the mounting structures. This phase is critical as it alters the local topography and drainage patterns, requiring careful management to prevent soil erosion and sedimentation.

The core of the intervention involves the installation of PV modules, which are typically arranged in arrays mounted on steel or aluminum racking systems. These systems may be fixed-tilt or utilize single-axis tracking mechanisms to optimize the angle of incidence, thereby maximizing energy yield.

The electrical infrastructure component includes the installation of inverters to convert direct current (DC) to alternating current (AC), transformers to step up the voltage for grid transmission, and a network of underground or overhead cabling. The intervention also requires the construction of access roads, perimeter fencing, and an operations and maintenance (O&M) building. The total land footprint is a function of the power capacity and the technology employed, often requiring significant spatial allocation to minimize inter-row shading. The intervention concludes with the grid interconnection, which links the

facility to the regional transmission network, marking the transition from the construction phase to the operational phase.

**Project Schedule**

The project is schedule to last till the last quarter of 2028, starting from the second quarter of 2026 (see **Table 2.1** in chapter 2 of the report)

**ES03 Relevant Policies, Legal and Administrative Framework**

The project shall ensure compliance with the relevant and applicable local and international regulations, policies, and standards throughout its life cycle.

**Policy Framework**

- National Environmental Policy/ National Policy on the Environment (Revised 2016)
- Social Protection Policies
- National Policy on Climate Change/ National Climate Change Policy for Nigeria 2021-2030
- The National Electric Power Policy (NEPP), 2001
- The National Energy Policy (NEP) 2013
- The National Energy Efficiency Action Plans of Nigeria

**National Legal Framework**

- The Environmental Impact Assessment Act No. 86, 1992/Environmental Impact
- Assessment Act Cap E12 LFN 2004
- Electricity Act, 2023
- Energy Commission of Nigeria Act CAP 109 LFN 1990
- Land Use Act, Cap. L5, Laws of the Federation of Nigeria (LFN) 2004
- The Nigerian Urban and Regional Planning Act CAP N138, LFN 2004
- Harmful Waste (Special Criminal Provisions) ACT CAP H1, LFN 2004
- The Endangered Species Act, CAP E9, LFN 2004
- Inland Fisheries Act, Cap I10, LFN 2004
- The Factories Act, 1987 (Factory Act cap 126, LFN, 1990)
- Wages Boards and Industrial Councils Act, Cap W1, LFN 2004
- Employees' Compensation Act, 2010 (ECA 2010)
- National Environmental Standards & Regulations Enforcement Agency (NESREA) Act, 2007
- National Environmental Regulations:
- EIA Procedural Guidelines:
- EIA Sectoral Guidelines (Infrastructures):
- FMEnv ESMP Guidelines for Solar Mini-Grid Projects in Nigeria

**International Legislation**

The International Conventions, to which Nigeria is a signatory, relevant to this programme are as follows:

- African Convention on the Conservation of Nature and Natural Resources
- Convention on Biological Diversity
- Endangered Species (Control of International Trade and Traffic)
- Conservation of Migratory Species of Wild Animals 1973
- Framework Convention on Climate Change 1992
- Convention to Combat Desertification 1994
- Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW)
- Human and Peoples' Rights on the Rights of Women in Africa 2005

- Civil and Political Rights Covenant
- Economic, Social and Cultural Rights Covenant
- Convention on the Elimination of All Forms of Violence Against Women
- Convention on the Rights of the Child

**Institutional Framework**

This section highlights the relevant institutions through which the planning and implementation of the program will be affected. Several institutions have been identified and will be involved in the overall implementation of this programme. These include:

- The Federal Government of Nigeria (FGN)
- Federal Ministry of Power
- Transmission Company of Nigeria (TCN)
- Federal Ministry of Environment (FMEnv)
- Nigerian Electricity Regulatory Commission (NERC)
- National Environmental Standards and Regulatory Enforcement Agency (NESREA)
- National University Commission (NUC)
- Relevant State Agencies: State Ministry of Lands, State Ministry of Environment and State Environmental Protection Agencies.
- Local Government Authority (LGA)

**ES04 Baseline Condition of the Project Area**

**Overview of the Project Environment**

Gombe, located in Gombe State in southwestern Nigeria, experiences a tropical wet-and-dry climate. The town is generally warm throughout the year, with average temperatures ranging between 26°C and 28°C. The hottest months are usually February and March, while cooler conditions are experienced during the rainy season.

Rainfall is an important feature of the climate in Gombe. The rainy season begins around March or April and lasts until October, with heavy rainfall commonly occurring between June and September. The dry season starts in November and continues until February. During this period, the Harmattan wind from the Sahara Desert brings dry, dusty, and cooler weather conditions.

Humidity is usually high during the rainy season because of moist winds from the Atlantic Ocean. The climate is mainly influenced by two air masses: the tropical maritime air mass, which brings rainfall, and the tropical continental air mass, which causes dry conditions. These climatic conditions support farming activities such as the cultivation of yam, cassava, maize, and cocoa.

Agriculture in Gombe depends heavily on climatic conditions because most farming activities are rain-fed. The fertile land and adequate rainfall support the cultivation of crops such as yam, cassava, maize, cocoa, and vegetables. However, changes in rainfall patterns, prolonged dry spells, or excessive rainfall can negatively affect agricultural productivity. In recent years, concerns about climate change have increased due to irregular rainfall, rising temperatures, flooding, and soil erosion observed in many parts of Gombe State.

The wind pattern in Gombe State changes according to the wet and dry seasons. During the rainy season, moist south-west winds from the Atlantic Ocean blow across the state. These winds bring heavy rainfall, cloudy weather, and high humidity between March and October. During the dry season, especially from November to February, the north-east trade wind known as the Harmattan becomes dominant. The

Harmattan wind is dry, dusty, and cooler, reducing humidity and rainfall across the state. This period is usually characterized by dry weather, hazy skies, and cooler mornings. Wind patterns in Gombe State influence rainfall distribution, temperature, humidity, and agricultural activities. The seasonal movement of winds helps determine the beginning and end of the rainy season in the region. The biophysical and physico-chemical properties of the proposed project's environment were adequately studied (see chapter Four).

**Socio-economic and Health Study**

This section presents the results and analysis of the survey questionnaire conducted as part of the Environmental and Social Impact Assessment (ESMP) for the proposed hybrid solar power plant at Federal University, Kashere in Akko LGA of Gombe State. A total of 40 respondents completed and submitted the questionnaire, providing comprehensive information on socioeconomic and demographic characteristics, health status, standard of living, gender-based violence concerns, environmental and cultural resources, project impact perceptions, and grievance redress mechanisms.

The data collected has been analyzed and presented using various visualization techniques including pie charts and bar charts to facilitate better understanding of the survey findings. The results are organized according to the survey sections: Household Data, Health Status, Standard of Living, Gender-Based Violence/Sexual Exploitation and Abuse, Resources/Cultural Property, Project Activities Impact Evaluation, Grievance Redress Mechanism, and World Bank Environmental and Social Standards (ESS).

**ES05 Description of Environmental and Social Impacts**

The basis for identification of potential environmental and social impacts that may be associated with the proposed Solar Power project was formed during field inspections and observations, issues arising from stakeholder consultations as well as project description and designs.

Highlights of the ESMP as the primary instrument for ensuring that a project's commitment to sustainability is maintained throughout its lifecycle, bridging the gap between theoretical impact prediction and practical field execution is presented here. By establishing a rigorous system of governance, the ESMP ensures that project activities remain in strict alignment with national regulatory requirements, international lending standards, and the fundamental principles of corporate social responsibility. It provides a systematic blueprint for the mitigation of environmental and social risks and as well delineates the institutional framework, clearly assigning roles and responsibilities to project developers, contractors, and environmental consultants to ensure accountability at every stage of development. It also integrates specific mitigation measures, monitoring protocols, and reporting requirements designed to protect natural ecosystems, minimize pollution, and safeguard the well-being of local communities.

**Evaluation of Impacts**

Positive Impacts: The anticipated positive impacts of the proposed solar power project have been rated as either major or moderate which include;

- Independent and reliable power supply to FUK through solar energy source and thus, improve the quality of education and other services within the institution as there will be longer hours available with better illumination for studying. Reduced noise and pollutants from generator sets, and natural habitats and human health will be protected from pollution arising from the use of fossil fuels.
- The renewable energy training centre constructed during the project implementation will provide capacity development through learning renewable energy technologies and practices in the University and consequently, the certification of trained individuals.
- The installation of streetlights as part of the proposed Project will improve safety by reducing hazards associated with flammable fuels and candles and enhance security within the school.

- Improve social cohesion and community development and generate new income as it would stimulate economic activities and offer new opportunities for small businesses in the University premises.
- The employment opportunities for skilled, semi-skilled, and unskilled labour associated with the project will multiply job creation, especially during construction to facilitate overall socioeconomic development.

Negative Impacts: Anticipated negative impacts of the proposed project have been rated as major, moderate, minor or even negligible and could include the following:

- Loss of terrestrial floral and faunal population during site clearing
- Disturbance of soil formation during excavation
- 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 will likely impact on air quality.
- Intermittent noise emissions could also occur from the operation of the machinery.
- Injury and accidents may occur especially when those involved are unskilled

**ES06 Environmental and Social Mitigation and Management Plan**

The ESMP also incorporates the actions needed to implement these measures, including the following features:

- Mitigation measures based on the potential environmental and social impacts describing with technical details each mitigation measure;
- The ESMP also includes monitoring objectives that specifies the type of monitoring activities that will be linked to the mitigation measures. Specifically, the monitoring section of the ESMP provides:
    - A specific description, and technical details, of monitoring measures that includes the parameters to be measured, frequency of measurements and definition of thresholds that will signal the need for corrective actions;
    - Monitoring and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures and to furnish information on the progress and results of mitigation.
- The ESMP provides a description of institutional arrangements i.e., who is responsible for carrying out the mitigating and monitoring measures (for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training);
- Additionally, the ESMP includes an estimate of the costs of the measures and activities recommended; and
- The ESMP is required all through the implementation stage of the project or sub-project.

**Mitigation/Action Plan**

Mitigation and management measures for the significant adverse impacts (rated as moderate or major) identified from the analysis and evaluation of the potential impacts from the proposed project activities are provided in T**able 6.1** of the report

**Environmental and Social Monitoring**

Environmental and Social monitoring is an important aspect of an ESMP during project implementation. It is a way of systematically monitoring both effects and compliance of the proposed project to existing regulations throughout the entire life cycle and shall oversee the effectiveness of impact mitigation

measures, including the extent to which mitigation measures are successfully implemented. This is presented in **Tagle 6.2** of this report.

**Capacity Building for Implementation of ESMP and Permit Conditions**

All staff employed will be trained in the following:

- General operation of the plant.
- Environmental management.
- Specific job roles and procedures.
- Occupational health and safety; and
- Contingency plans and emergency procedures. Training will include:
- Induction training on appointments.
- Specialist training (as required for specific job roles); and
- Refresher training as required.

The capacity building plan proposed to achieve this is provided in **Table 6.4** of the report.

**Roles, Responsibilities and Accountabilities**

The Rural Electrification Agency Project Management Unit (REA-PMU) supervises the implementation of the ESMP throughout the project life span while conformance with the mitigation measures will be ensured by the Engineering, Procurement and Construction (EPC) contractor during the construction phase and by the operations and maintenance (O&M) contractor during the operational phase of the project. This is presented in **Table 6.6** of this report.

**Estimated Budget for ESMP Implementation**

**Table 6.7** of this report provides a summary of the cost estimate required to effectively and efficiently implement the recommended mitigation measures and management plans required to address the potential and associated impacts of the proposed project. The total cost of implementing the ESMP is estimated at US$ **57,300** with the current Naira value of 1,3500 to 1 dollar.

**ES07 Incident Reporting and Emergency Response Plan**

The primary objective of the ERRP is to establish a clear protocol for the identification, notification, and mitigation of emergencies. The plan must be structured around a tiered response system.

**ES08 Remediation and Abandonment Plan**

The average life span of the solar Photovoltaic (PV) power plant to be provided as part of the proposed Project is 25years (which can be extended through regular maintenance), while the training center can last for 40 years or more. Even after 25 years, the PV panels can still generate up to 90% of the design capacity. Site abandonment shall be preceded by the following practices:

- Identification of the components of the power plant that will be abandoned and/or removed;
- The proposed methods for abandonment or re-use of the plant equipment/material are 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).

**ES09 Stakeholder Engagement and Grievance Redress Mechanism**

All consultation activities were properly documented, including relevant data, supporting evidence, participant lists with contact information, and photographic records. Information disclosure complied with the provisions of national regulations, including the EIA Act No. 86 of 1992 (as amended under Cap E12 LFN 2004), as well as the World Bank's Environmental and Social Safeguards Standards (ESSS)

The stakeholders were identified based on the direct project beneficiaries, adversely impacted groups, project supporters /proponents, regulatory/ planning, However, the stakeholders covered are;

- Rural Electricity Agency (REA)
- Federal Ministry of Environment (FMEnv)
- Gombe State Ministry of Environment
- Akko Local Government Area
- Federal University, Kashere community

Key feedback received during Stakeholder Consultations are presented in **Table 9.1** of the report

**Grievance Redress Mechanism**

The GRM serves as a structured framework that enables stakeholders to lodge complaints, track their progress, and receive timely feedback on resolutions. It ensures that grievances are handled in a fair, consistent, and efficient manner, thereby strengthening accountability and trust between project implementers and host communities.

The mechanism covers a wide range of issues, including environmental impacts, social concerns, land-related matters, and labor issues. Clear procedures are established for receiving, recording, assessing, and resolving grievances, with defined timelines and responsibilities at each stage.

To ensure effectiveness, the GRM will be widely communicated to all stakeholders throughout the project lifecycle. This includes raising awareness during consultations, community meetings, and through information disclosure channels.

Stakeholders will be informed about how to access the mechanism, the types of grievances that can be reported, and the expected timelines for resolution. In addition, a grievance register will be maintained to document all complaints received, actions taken, and outcomes achieved, ensuring transparency and enabling continuous improvement of the system.

The GRM will remain operational throughout the entire project lifecycle, ensuring that stakeholders have continuous access to a reliable platform for raising concerns and seeking redress, thereby contributing to the overall sustainability and social acceptability of the project.

**ES10 Conclusion and Recommendations**

The Environmental and Social Management Plan (ESMP) for the proposed solar power plant at the Federal University, Kashere, Akko LGA in Gombe State was prepared to comply with applicable government policies, regulatory requirements, financiers' standards, and stakeholder expectations. The objective is to ensure that proactive environmental and social considerations are integrated into the project design and implementation. This study was carried out in accordance with Nigeria's regulatory framework for environmental and social management, particularly the Nigerian EIA Act Cap E12 LFN 2004, which mandates EIAs for projects with the potential to cause significant environmental impacts.

The ESMP study recommends the following:

- Ensure full implementation of the Environmental and Social Management Plan (ESMP) throughout the project lifecycle.
- Conduct regular environmental monitoring for air quality, noise, groundwater, and waste management.
- Maintain continuous stakeholder engagement and effective community communication.
- Prioritize local employment, capacity building, and renewable energy training opportunities.
- Implement strong occupational health and safety measures, including emergency response systems.

- Establish and maintain an efficient Grievance Redress Mechanism (GRM) for timely resolution of complaints.
- Promote proper waste management, including safe disposal of hazardous and electronic waste.
- Ensure compliance with regulatory requirements through continuous oversight by the Rural Electrification Agency and relevant authorities.

## ACKNOWLEDGEMENTS

The Rural Electrification Agency would like to thank the ESMP Consultant, Chalton Consult Limited, for their commitment to the success of the ESMP study. We also thank the World Bank, Federal Ministry of Environment, the Gombe State Ministry of Environment, and other stakeholders, including the local communities in the Project area, for their valuable contributions and support.

# CHAPTER ONE
# INTRODUCTION

## 1.1 Background

The Federal Government of Nigeria partnered with the World Bank to launch the Distributed Access through Renewable Energy Scale-Up (DARES) Project, a $750 million initiative aimed at expanding electricity access to 17.5 million Nigerians in rural and underserved areas. This project builds on the success of the Nigeria Electrification Project (NEP), which has already provided clean and reliable electricity to over seven million people.

The Rural Electrification Agency (REA) is implementing DARES through its existing Project Management Unit (PMU). The project has already shown significant progress, with over 200 mini grids delivered nationwide. REA has also signed grant agreements with eight renewable energy companies to deploy solar home systems and mini grids, aiming to electrify underserved communities and drive economic growth.
In compliance with the Environmental Impact Assessment Act 86 of 1992 (codified as EIA Act CAP E12 LFN2004) and other extant laws of the Federation of Nigeria, the proposed project is subject to the EIA process for informed decision-making and consideration.

The Rural Electrification Agency (REA) is a Nigerian government agency responsible for ensuring electricity reaches every part of the country. REA focuses on rural electrification projects, providing power solutions for on-grid and off-grid areas with an emphasis on renewable energy. As the Implementing Agency of the Federal Government of Nigeria, the team at REA is tasked with the electrification of rural and unserved communities across Nigeria. MISSION 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 a reasonable return on investment through an appropriate tariff that is economically responsive and supportive of the average rural customer. MANDATE - Promote Rural Electrification in the Country - Co-ordinate Rural Electrification Programs in the country - Administer the Rural Electrification Fund (REF) to promote, support, and provide rural electrification through Public and Private Sector Participation. The Abuja Office is located at No. 15 Constitution Avenue, Central Business District, FCT-Abuja.

## 1.2 Project Specific Activities

This component of the project will involve activities undertaken during the various implementation phases of the project as follows;

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- Construction of training centre.
- Installation of streetlights as well as underground armoured cable for power evacuation.
- An upgrade of some of the existing power distribution infrastructure within the University will be carried out.
- 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.
- Generation and distribution of electricity to different sections of the University campus.
- Operation of the renewable energy training centre to support learning and capacity development in clean energy technologies.
- Preventive and corrective maintenance aimed at maintaining optimal system performance throughout the plant's lifespan.

- Periodic cleaning of photovoltaic (PV) panels to maintain their efficiency.
- Regular safety inspections and implement measures aimed at preventing accidents, injuries, and occupational health risks.
- Wastes management.

### 1.3 Objectives of the ESMP

The purpose of the Environmental and Social Management Plan (ESMP) is to ensure that Environmental and Social impacts identified during the ESMP process are effectively addressed during the construction, operation and closure of the project. The ESMP specifies the mitigation and management measures to which the Proponent is committed and shows how the Project will mobilize organizational capacity and resources to implement these measures. 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 effective environmental and social management and communicate the objectives and requirements of the ESMP.
- Ensure compliance with applicable environmental and social laws, regulations, permit conditions, and Project commitments.
- Define clear roles, responsibilities, and accountability for implementing environmental and social measures.
- Integrate environmental and social considerations into Project planning, design, construction, and operation.
- Apply the mitigation hierarchy by avoiding, minimizing, restoring, and, where necessary, compensating for adverse impacts.
- Enhance positive environmental, social, and economic benefits generated by the Project.
- Serve as an action plan for implementing environmental and social management measures.
- Provide a framework for implementing and monitoring mitigation and enhancement measures identified in the ESMP.
- Support continual improvement through monitoring, reporting, and corrective actions.

### 1.4 Rationale for ESMP

The rationale for an Environmental and Social Management Plan (ESMP) is rooted in the necessity to bridge the gap between environmental policy and project implementation. In the context of large-scale development, the ESMP acts as the primary mechanism for ensuring that the findings of an Environmental and Social Impact Assessment (ESMP) are not merely academic but are integrated into the daily operational workflow of a project.

The fundamental rationale for the ESMP is the mitigation of uncertainty. During the planning phase, environmental impacts are often predicted through modeling and baseline studies. The ESMP provides a structured, iterative process to verify these predictions and manage unforeseen impacts as they arise during construction and operation. By establishing a formal management system, the ESMP ensures that the project developer fulfills their "duty of care" toward the environment and local communities, thereby reducing the risk of legal liability, project delays, and reputational damage.

Furthermore, ESMP is essential for the allocation of resources. It defines the institutional framework, assigning specific roles and responsibilities to contractors and environmental managers, which prevents the diffusion of accountability. From a financial perspective, international lending institutions such as

those adhering to the Equator Principles require an ESMP as a condition for project financing. The rationale here is to ensure that the project meets international environmental and social performance standards, which serves to protect the lender's investment by minimizing the risk of environmental litigation or social unrest.

### 1.5 Scope of the ESMP

The scope of the ESMP includes;

1. The ESMP will address the distinct environmental challenges associated with each phase. During construction, the scope focuses on site-specific impacts such as erosion, dust, noise, and waste management. During operation, the scope shifts toward long-term monitoring of emissions, resource consumption, and ongoing community engagement.
2. The scope defines the limits of responsibility for the project developer, contractors, and subcontractors. It establishes the legal and administrative framework within which all project personnel must operate to ensure adherence to environmental permits and licenses.
3. The plan also covers a wide array of receptors, including physical (air, water, soil), biological (flora, fauna, ecosystems), and social (local communities, cultural heritage, public health) elements. The scope is defined by the spatial and temporal boundaries established during the ESMP, ensuring that all areas directly or indirectly affected by the project are managed.
4. The scope includes the development of specific procedures for incident reporting, emergency response, and training. It mandates the use of quantitative benchmarks, where the effectiveness of management is evaluated against established quality standards.

### 1.6 Work Execution Plan/Methodology

This ESMP has been prepared in accordance with standard procedures for Environmental Assessment, including other applicable World Bank safeguard policies and Nigerian policy guidelines. The baseline status of the project area was obtained through consultations with the relevant stakeholders, a review of relevant literature as well as field studies. Environmental data acquisition involved a multidisciplinary approach and was conducted in line with regulatory requirements and best international practices. This approach includes literature desktop review, designing, and development of field sampling strategy; confirmation of the sampling design and locations, pre-mobilization activities (job hazard analysis, sampling equipment/materials calibrations and checks and mobilization to the field; community consultations, sample collection, handling, documentation, and storage protocols and, and demobilization from the field, transfer of sample custody to the laboratory for analysis. A summary of field sampling methods is discussed in the sub-sections below.

#### 1.6.1 Daily Toolbox Meeting

A daily toolbox meeting was held before work to ensure that team members understood the work plan of the day and the security and safety tips. These are geared toward achieving a successful data-gathering exercise and zero incidents.

#### 1.6.2 Data collection and information gathering

Data gathering for the biophysical and social components of the project environment was undertaken from 12th to 14th February 2026 (dry season), while the secondary data collection was obtained from existing sources, including the following:

- Stakeholders, including government agencies, community chiefs, elders, women, and youths in various communities and community-based organizations (cooperative societies, development committees, etc.).
- Local experts and research, and academic organizations

- National and state data sources (population data).
- Environmental Assessment of Cobalt in Akko Gombe 20214.

### 1.6.3 Sampling Design/ Protocol

Sampling maps were designed to provide spatial distributions of the sampling points within the study area.

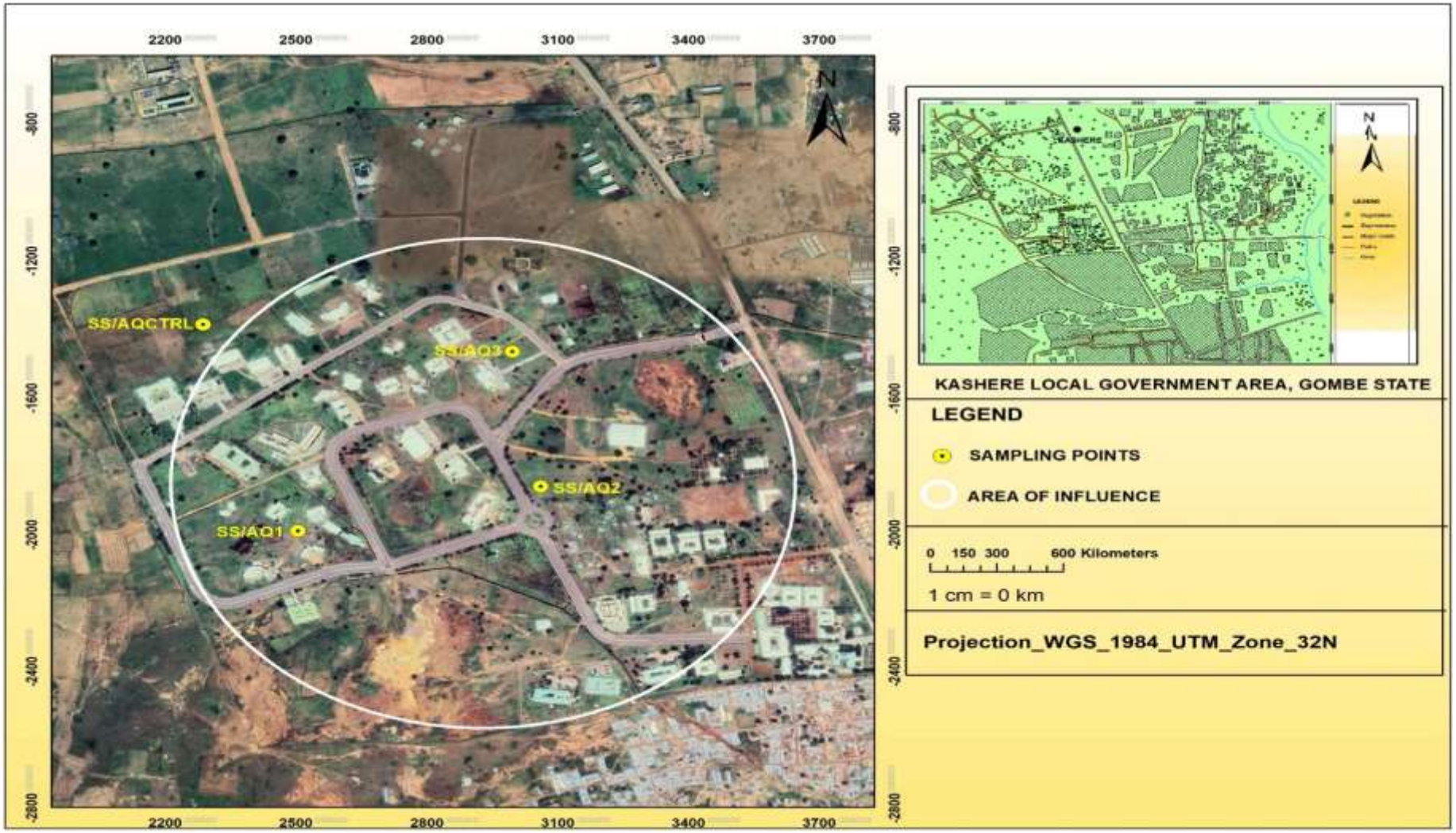


**Figure 1.1: Sampling Map**

### 1.6.4 Field Sampling Equipment and Methods

#### 1.6.4.1 Meteorology/Air Quality and Noise Measurements

Meteorological elements, namely wind, speed, wind direction, humidity, and temperature, were measured during the fieldwork from 4 predetermined locations (See Sampling Map – Figure 4.1). Each sampling location was adequately georeferenced with a GPS. Gombemax Gas Meter with Model No.2750 was used for the measurement of the following parameters: Carbon Monoxide (CO), Sulphur Dioxide ($SO_2$), Nitrogen Dioxide ($NO_2$), Carbon Dioxide ($CO_2$), and Hydrogen Sulphide ($H_2S$). Particulate Meter (PM) with Model No. DT-9880 was used to measure suspended particulate matter (SPM). The Noise levels at each point was measured with an Extech Noise Meter (Model No.407722). The sensor of the noise meter was directed toward the source of noise and the average reading over a period of three minutes was taken to be the Noise level at each point.

#### 1.6.4.2 Soil Sampling

Topsoil (0-15cm) and bottom soil (15-30cm) samples were collected from 3 points and 1 control using a hand auger. Two (2) auger bores were homogenized to form a composite sample. Samples for microbiology were taken in 25 ml sterilized vials. Samples for physico-chemical parameters were collected in pre-cleaned 250ml amber bottles. The samples were properly labeled and preserved in ice chests at 4°C.

#### 1.6.4.3 Vegetation and Wildlife Studies

The vegetation survey was carried out along designated sampling transects/sub-transects. The location of each sampling point was confirmed using GPS. Vegetation was studied in sampling quadrats measuring 20 m x 20 m. For each sampling point, information on habitat, vegetation structure and species were recorded. Habitat data included vegetation description, latitude, longitude, and signs of wildlife. Plant species were categorized into trees (4m or more), shrubs (0.5m to 4m), and herbs (less than 0.5m). Dendrometric parameters recorded included height (m), diameter (cm) and number of trees. A pair of binoculars (Model: Helios Fieldmaster 8x40) was employed to aid in the field identification of trees. Plants were also observed for any disease symptoms/conditions.

Field observations were made at each sampling location for evidence of vertebrate wildlife. Hideouts such as crevices, leaf litter, logs etc. were probed with props to root out any hidden animals. Tree canopies were observed for birds and other arboreal animals such as squirrels and snakes. The indirect count method was employed, particularly for animals that do not readily offer themselves for observation.

### 1.6.5 Quality Assurance/Quality Control

Standard methods and procedures were strictly adhered to in the course of this study. The quality assurance program covers all aspects of the study, including sample collection, handling, laboratory analysis, data coding, statistical analysis, presenting and communicating results.

Chain of custody procedures including sample handling, transportation, logging and cross-checking in the laboratory were also implemented. Trip blanks were used to assess the quality assurance/quality control of sample preservation, packaging, shipping, and storage.

The following precautions were also observed:

- Samples were collected in bottles that have been thoroughly washed with detergent (nutrient-free) and rinsed thoroughly;
- All sampling equipment is properly protected and maintained in accordance with manufacturers' manuals;
- Sampling bottles were adequately labeled with masking tapes and indelible markers to avoid mistaken identity;
- Only analytical grade (Analar) chemicals were used and where applicable, redistilled.
- Automated equipment is calibrated prior to field sampling.

Where samples were sent to another laboratory for analysis, a duplicate copy of the samples' information was sent along with the sample to the laboratory, independent of the sample. All movements of the samples were included in the sample record. Basic information was recorded together with the results of the analysis, in a sample registry. With proper, sustained calibration of the instrument and the use of standardized observational procedures, equipment errors were brought to an acceptable minimum.

#### 1.6.5.1 Sample Handling and Preservation

All the samples collected during the fieldwork were labeled clearly and secured in easily identifiable containers. Each label contained the following Information:

- Date and/or time of sampling
- Sample name and number
- Type of sample
- Type of preservative used if any.

### 1.6.6 Laboratory Analysis

After the fieldwork exercises, study samples were transported to Tudaka Analytical Nigeria Limited, Warri Delta State, Nigeria (accredited by FMEnv) for analyses**.** Samples brought to the laboratory were analyzed using standard analytical methods. The synoptic description of the laboratory methods and procedures employed for the various physical, chemical, and biological parameters, as well as the detection limits of these parameters in water and sediment samples.

# CHAPTER TWO
# PROJECT DESCRIPTION

## 2.1 Project Overview

The Federal University, Kashere Akko is located in Akko Local Government Area of Gombe State, a region that falls within the Sudan–Sahel ecological zone of northern Nigeria. The environmental conditions around the academy are largely shaped by a tropical savannah climate characterized by high temperatures, seasonal rainfall, and semi-arid features. The terrain is generally flat to gently undulating, with sparse vegetation dominated by grass, shrubs, and scattered drought-resistant trees typical of the savannah ecosystem.

Geographically, the project area falls within the approximate coordinates of Latitude 9°54'41" N to 9°55'55" N and Longitude 10°59'13" E to 11°00'34" E. These coordinates place the site within the Sudan Savannah ecological zone, which is characterized by high solar radiation intensity and favorable climatic conditions for solar photovoltaic energy generation. The area experiences long hours of sunshine throughout most of the year, making it highly suitable for the proposed solar power development. The specific location earmarked for the solar farm consists of an open and largely undeveloped parcel of land situated behind the Faculty of Education, Faculty of Agricultural Sciences, and the School of Remedial Studies buildings. The selected site is presently free from major structural developments and dense vegetation, thereby minimizing the need for extensive site clearance activities prior to construction.

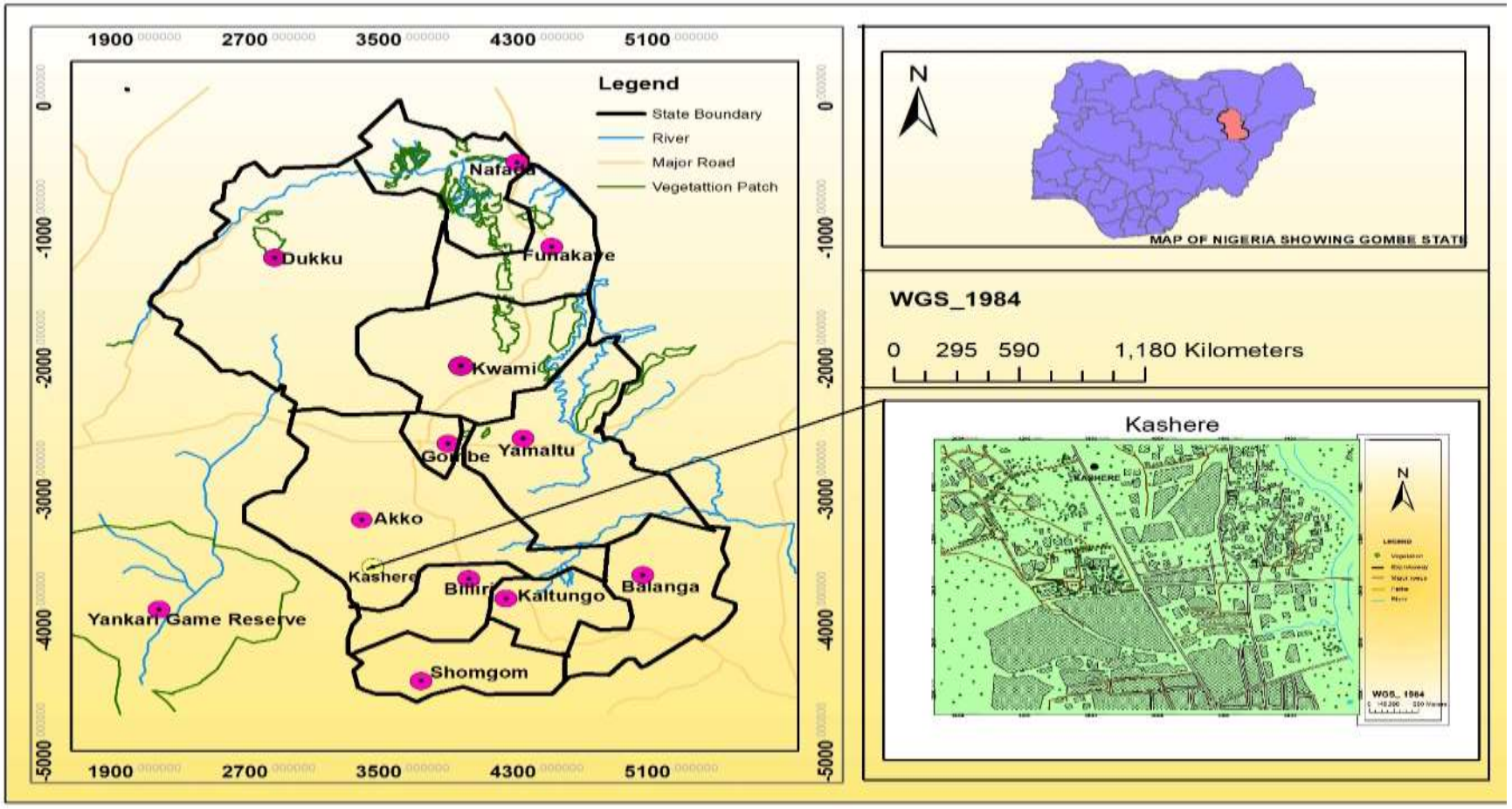


**Figure 2.1: Administrative Map of Gombe State Showing the Project Area**

## 2.2 Project Components

There are three key components of the project and the specific activities under these components are discussed below:

**Component One**: The deployment of Solar Hybrid Mini-Grids which represents a transformative approach to rural electrification, particularly in regions where traditional grid extension is economically unfeasible. The World Bank's International Development Association (IDA) has committed $410 million to scale these projects, recognizing that reliable electricity is a fundamental catalyst for rural economic growth. By integrating solar photovoltaic (PV) arrays with battery energy storage systems (BESS) and often a secondary power source such as a diesel generator or wind turbine these hybrid systems provide a stable, 24/7 power supply that supports local businesses, agricultural processing, and essential community services. The economic impact of these mini-grids is measured by their ability to foster "productive use of energy" (PUE), which allows rural entrepreneurs to transition from manual labor to mechanized processes.

**Component Two**: The deployment of stand-alone solar systems, often referred to as Solar Home Systems (SHS), represents a critical strategy for bridging the energy access gap for households and Micro, Small, and Medium-sized Enterprises (MSMEs). Supported by a $300 million commitment from the International Development Association (IDA), these systems provide decentralized power solutions that bypass the need for expensive and time-consuming grid infrastructure expansion.

By utilizing individual photovoltaic panels, charge controllers, and battery storage, these systems enable users to power essential lighting, communication devices, and small-scale business equipment, thereby fostering immediate economic activity in off-grid areas. To ensure reliability, the system must be sized to account for "days of autonomy," which refers to the number of consecutive days the battery can power the load without sufficient solar input. For MSMEs, these systems are often modular, allowing businesses to scale their energy capacity as their operational needs grow. The IDA funding is instrumental in lowering the barrier to entry for these technologies through innovative financing mechanisms, such as pay-as-you-go (PAYG) models, which allow low-income users to pay for their systems in affordable installments rather than a large upfront capital expenditure. This approach not only enhances the financial viability of the projects but also ensures the long-term sustainability of the energy assets by integrating maintenance and service support into the business model.

**Component Three**: The $40 million IDA commitment for Technical Assistance (TA) and capacity building serves as the foundational pillar for ensuring the long-term success and sustainability of solar energy interventions. While hardware deployment provides immediate access, technical assistance addresses the "soft" infrastructure policy frameworks, regulatory clarity, and local expertise required to maintain these systems. This funding is specifically designed to bridge the gap between international standards and local implementation capabilities, ensuring that projects are not merely installed but are effectively managed and integrated into the national energy strategy.

The assistance is to institutionalize best practices in project management, grid integration, and environmental compliance. This includes training local technicians in the operation and maintenance (O&M) of solar hybrid mini-grids and stand-alone systems, which is critical for reducing the Mean Time to Repair (MTTR) and ensuring system longevity. Furthermore, the TA program facilitates the development

of standardized procurement guidelines and quality assurance protocols, which help mitigate the risks associated with low-quality equipment. By investing in human capital, the IDA commitment ensures that the technical capacity to manage energy assets remains within the host country, fostering a self-sustaining ecosystem for renewable energy development. This capacity building often utilizes a "train-the-trainer" model, where local engineers are equipped with the skills to perform complex system diagnostics, such as analyzing the performance ratio of a plant.

The Rural Electrification Agency (REA) is implementing DARES through its existing Project Management Unit (PMU). The project has already shown significant progress, with over 200 mini grids delivered nationwide. REA has also signed grant agreements with eight renewable energy companies to deploy solar home systems and mini grids, aiming to electrify underserved communities and drive economic growth.

### 2.3 Description of Project Intervention

The project is being implemented under the Distributed Access through Renewable Energy Scaleup (DARES) programme, which serves as a scale-up initiative from the Nigeria Electrification Project (NEP

Given that this is an Energy-as-a-Service (EaaS) model, the same Energy Service Company (ESCO) responsible for the design and construction of the project will also manage its operations and maintenance (O&M) throughout the service period. This arrangement promotes lifecycle accountability because the ESCO has a direct incentive to ensure that the system is designed for reliability, efficiency, maintainability, and long-term performance. Its O&M responsibilities will typically include routine inspections, preventive and corrective maintenance, fault response, equipment replacement, spare-parts management, performance monitoring, and compliance with agreed service-level requirements and key performance indicators (KPIs). The ESCO will also be responsible for maintaining appropriate environmental, health and safety (EHS) standards during operations, including electrical safety, emergency response, waste management, battery and e-waste handling, worker protection, and community health and safety. Performance and maintenance records should be regularly documented and reported, while any end-of-service handover should include asset condition assessments, updated maintenance records, operating manuals, outstanding repairs, and training where required. This integrated approach reduces interface risks between construction and operations and supports consistent performance throughout the project lifecycle.

The project intervention for a utility-scale solar photovoltaic (PV) plant involves a multi-phase transformation of land to harness solar irradiance for electrical power generation. The intervention begins with site preparation, which necessitates the clearing of vegetation and the leveling of terrain to accommodate the mounting structures. This phase is critical as it alters the local topography and drainage patterns, requiring careful management to prevent soil erosion and sedimentation.

The core of the intervention involves the installation of PV modules, which are typically arranged in arrays mounted on steel or aluminum racking systems. These systems may be fixed-tilt or utilize single-axis tracking mechanisms to optimize the angle of incidence, thereby maximizing energy yield.

The electrical infrastructure component includes the installation of inverters to convert direct current (DC) to alternating current (AC), transformers to step up the voltage for grid transmission, and a network of underground or overhead cabling.

The total land footprint is a function of the power capacity and the technology employed, often requiring significant spatial allocation to minimize inter-row shading. The intervention concludes with the grid interconnection, which links the facility to the regional transmission network, marking the transition from the construction phase to the operational phase.

### 2.4 Project Schedule

The proposed Project is planned to be operational by the fourth quarter (Q4) of 2028. The tentative Project schedule is provided in **Table 2.1**.

**Table 2.1: Tentative Project Schedule**

| Project Schedule | Timeline | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2026 | | | | 2027 | | | | 2028 | | | |
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| Site allocation | | | | | | | | | | | | |
| Energy demand audit | | | | | | | | | | | | |
| Front-End Engineering Design | | | | | | | | | | | | |
| ESMP 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 THREE
# RELEVANT POLICIES, LEGAL AND ADMINISTRATIVE FRAMEWORK

## 3.1 Introduction

The proposed Project is part of the Federal Government of Nigeria's Energizing Education Programme, a component of the Nigeria Electrification Project being implemented by the Rural Electrification Agency. Several laws and regulations apply to the energy sector in Nigeria. In addition to the above, several laws, regulations, policies, and instruments have been established to support environmental and social management and the EIA process in Nigeria. This section provides an overview of the relevant statutory regulations, legislation, and guidelines for the proposed Project and the ESMP study. The project shall ensure compliance with the relevant and applicable local and international regulations, policies, and standards throughout its life cycle.

## 3.2 Policy and Legal Framework

### 3.2.1 FGN Requirements and Relevant Legislation

The Constitution of the Federal Republic of Nigeria (1999), as the national legal order, recognizes the importance of improving and protecting the environment and makes provision for it. The relevant sections are:

- **Section 20** makes it an objective of the Nigerian State to improve and protect the air, land, water, forest, and wildlife of Nigeria.
- **Section 12** establishes, though impliedly, that international treaties (including environmental treaties) ratified by the National Assembly should be implemented as law in Nigeria; and
- **Sections 33 and 34,** which guarantee fundamental human rights to life and human dignity, respectively, have also been argued to be linked to the need for a healthy and safe environment to give these rights effect.

The Policy, Legal, and Institutional Framework guiding the Environmental and Social Impact Assessment (ESMP) for the proposed project is anchored on applicable national policies, laws, and institutional arrangements, as well as relevant international standards. At the national level, the framework is defined by the Federal Ministry of Environment (FMEnv**)** regulations, including the Environmental Impact Assessment Act Cap E12 LFN 2004, FMEnv Procedural Guidelines (2017), and other sectoral environmental, social, health, and safety regulations. The assessment also aligns with the objectives of the Nigeria Electrification Project and the Rural Electrification Agency's implementation framework. At the international level, the ESMP is guided by the African Development Bank Integrated Safeguards System, alongside international good practice such as the IFC Performance Standards and relevant ISO standards, ensuring that the project complies with both national regulatory requirements and global environmental and social sustainability benchmarks.

### 3.2.2 Policy Framework

#### 3.2.2.1 National Environmental Policy/ National Policy on the Environment (Revised 2016)

The national environmental policy launched by Government in November 1989 revised in 2016, prescribed guidelines for achieving sustainable development in fourteen vital sectors of the nation's economy, namely: Human Population; Land Use and Soil Conservation; Water Resources Management; Forestry, Wildlife and Protected Natural Areas; Marine and Coastal Area Resources; Sanitation and Waste Management; Toxic and Hazardous Substances; Mining and Mineral Resources; Agricultural Chemicals; Energy Production; Air Pollution; Noise in the Working Environment; Settlements; Recreational Spaces, Green Belts, Monuments, and Cultural Property.

It also contains Nigeria's commitment to ensuring that the country's natural and built environment is safeguarded for the use of present and future generations. This commitment demands that efficient resource management and minimization of environmental impacts be the core requirements of all development activities. Accordingly, this Policy seeks to promote good environmental practices through environmental awareness and education. The goal of the National Policy on the Environment is to 'ensure environmental protection and the conservation of natural resources for sustainable development'. Its strategic objective is to coordinate environmental protection and natural resources conservation for sustainable development.

#### 3.2.2.2 Social Protection Policies

Social protection policy has been on the agenda since 2004, when the National Planning Commission, supported by the international community, drafted a social protection strategy. More recently, the National Social Insurance Trust Fund (NSITF) drafted a social security strategy. The social protection policy approached social protection using a life cycle and gender lens, recognizing both economic and social risks, including, for example, job discrimination and harmful traditional practices. The policy was organized around four main themes: social assistance, social insurance, child protection and the labour market.

However, only a few of the instruments of this approach were adopted in the national implementation plan, most notably the provision of specific and limited social assistance, social insurance (such as expanding national health insurance to the informal sector) and labour market programmes (such as developing labour-intensive programmes). Moreover, in practice, programmes to date have been focused largely on conditional cash transfers and two health financing mechanisms driven by the federal government with little inter-sectoral or state-federal coordination. A significant number of actors are involved in funding and implementing social protection, including those from government, donors, international non-governmental organisations and civil society. Federal government-led social protection includes three main programmes:

- The conditional cash transfer in Care of the People (COPE) (funded initially through the debt relief gains (DRG fund) targeted at households with specific social categories (those with children of school-going age that are female-headed or contain members who are elderly, physically challenged, or are fistula or HIV/ AIDS patients).
- The health fee waiver for pregnant women and children under five (financed through the debt relief gains (DRG fund); and
- The community-based health insurance scheme was redesigned in 2011 because the previous scheme had design challenges.

Other social assistance programmes are implemented in an ad hoc manner by various government ministries, departments and agencies at state level, and some are funded by international donors. These include conditional cash transfer programmes for girls' education (in three states), child savings accounts, disability grants, health waivers, education support (such as free uniforms) and nutrition support. HIV and AIDS programming at state level also include social protection sub-components (although not as the primary objective), including nutrition, health and education support. Labour market programmes include Federal and State level youth skills and employment programmes, and Nigeria also has agricultural subsidies/inputs.

#### 3.2.2.3 National Policy on Climate Change/ National Climate Change Policy for Nigeria 2021-2030

Given Nigeria's status as a fossil-fuel dependent economy with a large climate sensitive agricultural sector, the development of a climate change policy and response strategy is critical, as climate change presents a serious threat to poverty eradication and sustainable development in general.

One of the key pillars of Vision 20:2020 is investment in low-carbon fuels and renewable energy. Achieving the goal of low carbon, high-growth and resilient socio-economic system for equitable and sustainable socio-economic and environmental development faces some challenges which include stability and sustainability of the enabling environment, adequate institutional and human resource capacity and availability of adequate resources to address mitigation and adaptation initiatives to address climate change.

Thus, the Government needs to ensure that economic growth, resource management and climate change mitigation and adaptation can all happen simultaneously if this will be done effectively (Department of Climate Change 2017). The National Climate Change Policy for Nigeria 2021-2030 was established to promote a low-carbon, climate-resilient and gender-responsive sustainable socio-economic development. The revised National Policy on Climate Change was to define a new holistic framework to guide the country's response to the development challenge of climate change.

#### 3.2.2.4 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 privatisation of the electric power sector. The National Electric Power Policy (NEPP), 2001 outlines the realization of an adequate and reliable supply of electricity in three phases; the privatization of the state own utility NEPA and the introduction of the Independent Power Producers (IPPs); increasing the competition between market participants, partial removal of subsidies, and sale of excess power to distribution companies (DISCOs); and the freedom to select suppliers by large consumers and the creation of a fully liberalized and competitive market.

In 2004, the National Integrated Power Project (NIPP) was initiated to boost power supply by the launch of gas-powered stations. The National Electric Power Policy (NEPP) of 2001 resulted in the Electric Power Sector Reform (EPSRA) Act of 2005, establishing the Nigerian Electricity Regulatory Commission (NERC). The EPSRA provided the statutory basis for the privatization of the power sector.

#### 3.2.2.5 The National Energy Policy (NEP) 2013

The National Energy Policy (NEP) 2013 is 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.

#### 3.2.2.6 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.

### 3.3 National Legal Framework

#### 3.3.1 The Environmental Impact Assessment Act No. 86, 1992/Environmental Impact Assessment Act Cap E12 LFN 2004

The EIA Act makes it mandatory for any person, authority, corporate body private or public, to conduct EIA before the commencement of any new major development or expansion that may likely have significant effects on the environment. The Act sets out the EIA objectives and the procedures for consideration of EIA of certain public or private projects. The programme is a minor development, which is expected to have minimum impact on the environment. Hence, the programme is categorized as Category II (B) EIA. The EIA guidelines (procedural and sectoral) issued by the FMEnv derive from this Act and the programme proponents shall conduct their activities in conformance with these guidelines.

#### 3.3.2 Electricity Act 2023

It is more accurate to refer to the Electricity Act 2023 as the replacement Act, rather than simply calling it an amendment to the EPSRA. The 2023 Act expressly repealed the EPSRA 2005 and established a more comprehensive framework governing generation, transmission, system operation, distribution, supply and trading of electricity, as well as consumer rights and renewable energy.

One of its most important changes is decentralisation. States can now establish and regulate their own intrastate electricity markets, while NERC continues to regulate matters involving interstate electricity, the national grid, transmission, system operation and other federally regulated activities.

#### 3.3.3 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 responsibility for the strategic planning and co-ordination of national policies in the field of energy in all its ramifications. The mandates of ECN include statistical analysis of Electricity Generation, Transmission and Distribution.

#### 3.3.4 Land Use Act of 1978 and Resettlement Procedures

The Land Use Act (Cap 202, 1990), now Cap L5 Laws of the Federation of Nigeria 2004, is the key legislation that has direct relevance to this project. Relevant sections of these laws that may relate to this project with respect to land ownership and property rights, resettlement, and compensation are summarized in this section.

The Land Use Act is the applicable law regarding ownership, transfer, acquisition, and all such dealings on Land. The provisions of the Act are vast on every parcel of Land, in every State of the Federation, under the Executive Governor of the State. He holds such parcels of land in trust for the people and government of the State.

The Act categorized the land in a state into urban and non-urban or local areas. The administration of the urban land is vested in the Governor, while the latter is vested in the Local Government Councils.

At any rate, all land, irrespective of the category, belongs to the State, while individuals only enjoy a right of occupancy as contained in the Certificate of Occupancy, or where the grants are "deemed".

The concept of ownership of land as known in the Western context is varied by the Act. The Governor administers the land for the common good and the benefit of all Nigerians. The law makes it lawful for the Governor to grant statutory rights of occupancy for all purposes, grant easements appurtenant to statutory rights of occupancy, and to demand rent. The Statutory Rights of Occupancy are for a definite time (the limit is 99 years) and may be granted subject to the terms of any contract made between the state Governor and the Holder.

The Local Government Councils may grant customary rights of Occupancy for agriculture (including grazing and ancillary activities), residential and other purposes. But the limit of such grants is 500 hectares for agricultural purposes and 5,000 for grazing, except with the consent of the Governor. The local Government, under the Act, is allowed to enter, use, and occupy for public purposes any land within its jurisdiction that does not fall within an area compulsorily acquired by the Government of the Federation or of the relevant State, or subject to any laws relating to minerals or mineral oils.

The State is required to establish an administrative system for the revocation of the rights of occupancy and payment of compensation for the affected parties. So, the Land Use Act provides for the establishment of a Land Use and Allocation Committee in each State that determines disputes as to compensation payable for improvements on the land (Section 2 (2) (c)).

In addition, each Local Government is required to set up a Land Allocation Advisory Committee to advise the Local Government on matters related to the management of land. The holder or occupier of such revoked land is entitled to the value of the unexhausted development as at the date of revocation. (Section 6) (5). Where land subject to customary rights of Occupancy and used for agricultural purposes is revoked under the Land Use Act, the local government can allocate alternative land for the same purposes (section 6) (6).

If Local Government refuses or neglects, within a reasonable time, to pay compensation to a holder or occupier, the Governor may proceed to effect assessment under section 29 and direct the Local Government to pay the amount of compensation to the holder or occupier. (Section 6) (7).

Where a right of occupancy is revoked on the ground that the land is required by the Local, State or Federal Government for public purposes or for the extraction of building materials, the holder and the occupier shall be entitled to compensation for the value at the date of revocation of their unexhausted improvements. Unexhausted improvement has been defined by the Act as:

> *"Anything of any quality permanently attached to the land directly resulting from the expenditure of capital or labour by any occupier or any person acting on his behalf, and increasing the productive capacity the utility or the amenity thereof and includes buildings plantations of long-lived crops or trees, fencing walls, roads and irrigation or reclamation works, but does not include the result of ordinary cultivation other than growing produce*."

Developed Land is also defined in the generous manner under Section 50(1) as follows: land where there exists any physical improvement in road development services, water, electricity, drainage, building, structure or such improvements that may enhance the value of the land for industrial, agricultural or residential purposes. It follows from the foregoing that compensation is not payable on vacant land on which there exist no physical improvements resulting from the expenditure of capital or labour.

The compensation payable is the estimated value of the unexhausted improvements at the date of revocation. Payment of such compensation to the holder and the occupier as suggested by the Act may appear confusing, as it raises the following question: Does it refer to the holder in physical occupation of the land or two different parties entitled to compensation, perhaps in equal shares?

The correct view appears to follow from the general tenor of the Act.
First, the presumption is more likely to be the owner of such unexhausted improvements. Secondly, the provision of section 6 (5) of the Act, which makes compensation payable to the holder and the occupier according to their respective interests, gives a pre-emptory directive as to who shall be entitled to what.

Again, the Act provides in section 30 that where any dispute arises as to the amount of compensation calculated in accordance with the provisions of section 29, such disputes shall be referred to by the appropriate Land Use and Allocation Committee. It is clear from section 47 (2) of the Act that no further appeal will arise from the decision of such a committee. If this is so, then the provision is not only retrospective but also conflicts with the fundamental principle of natural justice, which requires that a person should not be a judge in his own cause.

The Act must, in making this provision, have proceeded on the basis that the committee is a distinct body quite different from the Governor or the Local Government. It is submitted, however, that it will be difficult to persuade the public that this is so since the members of the committee are all appointees of the Governor. Where a right of occupancy is revoked for public purposes within the state of the Federation, or on the grounds of the land for the extraction of building materials, the quantum of compensation shall be as follows:

- *In respect of the land, an amount equal to the rent, if any, paid by the occupier during the year in which the right of occupancy was revoked.*
- *In respect of the building, installation or improvements therein, for the amount of the replacement cost of the building, installation or improvements to be assessed based on the prescribed method of assessment as determined by the appropriate officer, less any depreciation, together with interest at the bank rate for delayed payment of compensation. With regards to reclamation works, the quantum of compensation is such cost as may be substantiated by documentary evidence and proof to the satisfaction of the appropriate officer.*
- *In respect of crops on land, the quantum of compensation is an amount equal to the value as prescribed and determined by the appropriate officer.*

Where the right of occupancy revoked is in respect of a part of a larger portion of land, compensation shall be computed in respect of the whole land for an amount equal in rent, if any, paid by the occupier during the year in which the right of occupancy was revoked less a proportionate amount calculated in relation to the area not affected by the revocation; and any interest payable shall be assessed and computed in the like manner. Where there are any building installations or improvements or crops on the portion revoked, the quantum of compensation shall follow that outlined in paragraph (ii) above, and any interest payable shall be computed in like manner.

### 3.3.5 The Nigerian Urban and Regional Planning Act CAP N138, LFN 2004

The Urban and Regional Planning Act is aimed at overseeing realistic, purposeful planning of the country to avoid overcrowding and poor environmental conditions. In this regard, the following sections are relevant:

- **Section 30 (3)** requires a building plan to be drawn by a registered architect or town planner.
- **Section 39 (7)** establishes that an application for land development would be rejected if such development would harm the environment or constitute a nuisance to the community.
- **Section 59** makes it an offence to disobey a stop-work order. The punishment under this section is a fine not exceeding ₦10,000 (Ten thousand naira) and in the case of a company, a fine not exceeding ₦50,000.
- **Section 72** provides for the preservation and planting of trees for environmental conservation.

### 3.3.6 Harmful Waste (Special Criminal Provisions) ACT CAP H1, LFN 2004

The Harmful Waste Act prohibits, without lawful authority, the carrying, dumping or depositing of harmful waste in the air, land or waters of Nigeria. The following sections are notable:

- **Section 6** provides for a punishment of life imprisonment for offenders as well as the forfeiture of land or anything used to commit the offence.
- **Section 7** makes provision for the punishment accordingly of any conniving, consenting or negligent officer where the offence is committed by a company.
- **Section 12** defines the civil liability of any offender. He would be liable to people who have suffered injury as a result of his offending act.

### 3.3.7 The Endangered Species Act, CAP E9, LFN 2004

This Act focuses on the protection and management of Nigeria's wildlife and some of their species in danger of extinction because of overexploitation. These sections are noteworthy:

- **Section 1** prohibits, except under a valid license, hunting, capture or trade in animal species, either presently or likely, in danger of extinction.
- **Section 5** defines the liability of any offender under this Act.
- **Section 7** provides for regulations to be made necessary for environmental prevention and control as regards the purposes of this Act.

Most of the proposed program locations are on virgin land that serves as wildlife habitats, which will be impacted by the programme. Hence, the programme activities shall be carried out to comply with the relevant provisions.

### 3.3.8 Inland Fisheries Act, Cap I10, LFN 2004

The Inland Fisheries focused on the protection of the water habitat and its species. The following section is relevant:

**Section 6** prohibits the taking or destruction of fish by harmful means. This offence is punishable with a fine of ₦3,000 or an imprisonment term of 2 years, or both. One of the integral components of solar hybrid systems is battery storage. During the operational phase of the project, there may be the possibility of battery leakages, which may leach into water bodies for project locations with flowing rivers. The chemical contents of these batteries are toxic to aquatic life (fisheries), which necessitates the relevance of this Act.

### 3.3.9 National Commission for Museums and Monuments Act, Cap. N19, LFN 2004

The Act provides for the dissolution of both the Antiquities Commission and the Federal Department of Antiquities and to create a National Commission for Museums and Monuments, with the responsibilities to establish and administer national museums, antiquities and monuments.

This also including antiquities, science and technology, warfare, African, Black and other antiquities, arts and crafts, architecture, natural history and educational services among others. Sections 12 to 18 provide the process/steps for the declaration of antiquities as national monuments, while section 19 deals with the restriction of excavations for the purpose of finding antiquities as well as the issuance of permits and section 20 deals with accidental discoveries. In case of any accidental find, the Commission shall be notified within seven (7) days.

### 3.3.10 The Factories Act, 1987 (Factory Act cap 126, LFN, 1990)

The Factories Act, as contained in the Laws of the Federation of Nigeria 1990, seeks to legislate and regulate the conduct of health and safety in the Nigerian work environment. It was enacted in June 1987 with the objective of protecting the workers and other professionals against exposure to occupational hazards. The Director of Factories at the Federal Ministry of Employment, Labour and Productivity is responsible for the administration of the provisions or requirements of this Act. Section 13 allows an inspector to take emergency measures or request that emergency measures be taken by a person qualified to do so, in cases of pollution or nuisances. This Act deals with working conditions at work sites, including construction sites, such as those to be undertaken under the EEP III. Hence, the occupational requirements applicable to construction sites, as well as other work sites to be used by the program, shall be subject to the provisions of this Act.

### 3.3.11 Labour Act, Cap. L1, LFN 2004

This Act deals with labour issues, including payment of wages, recruitment, discipline, employee welfare, employment of women and child labour. Sections 54 to 58 which deal with employment of women, prescribed period of absence from work for nursing mothers and allows her half an hour twice a day during her working hours to attend to the baby for a period of up to six months after she resumes work. Section 55 also exempted women from night work, except when they are employed as nurses. Sections 59-64 deal with the employment of young adults.

### 3.3.12. Wages Boards and Industrial Councils Act, Cap. W1, LFN 2004

Wages Boards and Industrial Councils Act, Cap. W1, LFN 2004 – provides the legal framework for establishing wages boards and industrial councils to regulate wages and conditions of employment and promote orderly employer–employee relations in Nigeria.

The Act provides for the establishment of a National Wages Board and Area Minimum Wages Committee for States and for Joint Industrial Councils for particular industries. It empowers the Minister to order or direct that an industrial wages board be established to perform, in relation to the workers described in the order and their employers, the functions specified in the provisions of this Act, including the minimum wage. The minimum wage is currently ₦100,000.00 per month, and all individuals contracted/employed in relation to this programme shall not earn less than the minimum wage.

### 3.3.13. Employees' Compensation Act, 2010

The Employees' Compensation Act, 2010 establishes a more comprehensive compensation scheme for employees who suffer work-related injuries, occupational diseases, disabilities or death arising out of or in the course of employment. It also provides benefits for dependants of deceased employees and is administered through the Nigeria Social Insurance Trust Fund (NSITF).

### 3.3.14 National Environmental Standards & Regulations Enforcement Agency (NESREA) Act, 2007

Administered by the Ministry of Environment, the National Environment Standards and Regulations Enforcement Agency (NESREA) Act of 2007, replaced the Federal Environmental Protection Agency (FEPA) Act. It is the embodiment of laws and regulations focused on the protection and sustainable development of the environment and its natural resources. The following sections are worth noting:

- **Section 7** provides authority to ensure compliance with environmental laws, local and international, on environmental sanitation and pollution prevention and control through monitoring and regulatory measures.
- **Section 8 (1)(K)** empowers the Agency to make and review regulations on air and water quality, effluent limitations, control of harmful substances, and other forms of environmental pollution and sanitation.
- **Section 27** prohibits, without lawful authority, the discharge of hazardous substances into the environment. This offence is punishable under this section, with a fine not exceeding 1,000,000 (One Million Naira) and an imprisonment term of 5 years. In the case of a company, there is an additional fine of ₦50,000 for every day the offence persists.

### 3.3.15 National Environmental Regulations

Section 34 of the NESREA Act, 2007, empowers the Minister of Environment to make regulations for a safe and sustainable environment. In exercise of this power, the minister issued the national environmental regulations covering various environmental components and sectors of development. The regulations relevant to the programme are as follows:

- National Environmental (Energy Sector) Regulations, 2014. S.I. 63.
- National Environmental (Electrical/Electronic Sector) Regulations, 2011, S.I. No. 23
- National Environmental (Wetlands, Riverbanks and Lake Shores) Regulations, 2009. S. I. No. 26.
- National Environmental (Sanitation and Wastes Control) Regulations, 2009. S. I. No. 28.
- National Environmental (Watershed, Mountainous, Hilly and Catchment Areas) Regulations, 2009. S. I. No. 27.
- National Environmental (Sanitation and Wastes Control) Regulations, 2009. S. I. No. 28.
- National Environmental (Noise Standards and Control) Regulations, 2009. S. I. No. 35.
- National Environmental (Air Quality Control) Regulations, 2013, S. I. No. 64,
- National Environmental (Soil Erosion and Flood Control) Regulations, 2010. S. I. No. 12.
- National Environmental (Surface and Groundwater Quality Control) Regulations, 2010. S. I. No. 22.
- National Environmental (Control of Vehicular Emissions from Petrol and Diesel Engines) Regulations, 2010. S. I. No. 20.

### 3.3.16. EIA Procedural Guidelines

This procedure prescribes the steps to be followed in the EIA process from project conception to commissioning and post-commissioning impact mitigation to ensure that the program is implemented with maximum consideration of environmental factors. This ESMP study will be conducted in compliance with this guideline.

### 3.3.17 EIA Sectoral Guidelines (Infrastructures)

This provides general guidelines for EIA of projects in the infrastructure sectors of Nigeria, with specific details for sub-sectors.

### 3.3.18. FMEnv ESMP Guidelines for Solar Mini-Grid Projects in Nigeria

The ESMP Guidelines for Solar Mini-Grid Projects in Nigeria was developed as an abridged form of the EIA Procedures Guidelines with the aim of simplifying the method of preparing ESMPs for proposed solar mini-grid projects. The simplified method is to also optimize the mini-grid projects EIA timeline and the cost of development.

## 3.4 International Legislation

The International Conventions, to which Nigeria is a signatory, relevant to this programme are as follows:

- African Convention on the Conservation of Nature and Natural Resources
- Convention on Biological Diversity
- Endangered Species (Control of International Trade and Traffic)
- Conservation of Migratory Species of Wild Animals 1973
- Framework Convention on Climate Change 1992
- Convention to Combat Desertification 1994
- Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW)
- Human and Peoples' Rights on the Rights of Women in Africa 2005
- Civil and Political Rights Covenant
- Economic, Social and Cultural Rights Covenant
- Convention on the Elimination of All Forms of Violence Against Women
- Convention on the Rights of the Child

## 3.5 Institutional Framework

This section highlights the relevant institutions through which the planning and implementation of the program will be affected. Several institutions have been identified and will be involved in the overall implementation of this programme. These include:

- The Federal Government of Nigeria (FGN)
- Federal Ministry of Power
- Transmission Company of Nigeria (TCN)
- Federal Ministry of Environment (FMEnv)
- Nigerian Electricity Regulatory Commission (NERC)
- National Environmental Standards and Regulatory Enforcement Agency (NESREA)
- National University Commission (NUC)
- Relevant State Agencies: State Ministry of Lands, State Ministry of Environment and State Environmental Protection Agencies
- Local Government Authority (LGA)

The responsibilities and roles of each of the institutions are discussed below:

### 3.5.1 The Federal Government of Nigeria

Section 20 of the Constitution of Nigeria makes it an objective of the Nigerian State to improve and protect the air, land, water, forest and wildlife of Nigeria. Sections 33 and 34 which guarantee fundamental human rights to life and human dignity, respectively, can also be linked to the need for a healthy and safe environment to give these rights effect. The Executive Council of the Federation approves all national policies including the National Policy on Environment.

### 3.5.2 Federal Ministry of Environment

The Federal Ministry of Environment is responsible for the overall environmental policy of the country. It has the responsibility for EIA implementation, approval and issuance of certificates. It has developed certain guidelines and regulations to protect the environment and promote sustainable development. It will monitor the implementation of mitigation measures when the project commences. They can also issue directives to the project on specific actions related to the environment in the project area. The Ministry normally involves the states and sometimes local governments in this responsibility depending on the specific activity.

**3.5.3 The National Environment Standards and Regulations Enforcement Agency (NESREA)** ensure the embodiment of laws and regulations focused on the protection and sustainable development of the environment and its natural resources are monitored and complied with. NESREA ensures that the operational phase of the solar power system Mini grid project complies with national environmental standards and regulations.

### 3.5.4 The National Universities Commission

The National Universities Commission (the Commission) was established in 1974 by the National Universities Commission Act CAP N81 to advise the Federal and state governments of all aspects of university education and the general development of universities in Nigeria. It is the dynamic regulatory agency acting as a catalyst for positive change and innovation for the delivery of quality university education in Nigeria. It is also the agency for channeling all external aid to the universities in Nigeria; To receive block grants from the Federal Government and allocate them as appropriate.

### 3.5.5 The Federal Ministry of Power

The Federal Ministry of Power 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, and the National Energy Policy, 2013 as described earlier in section 1.6.4. The following parastatals are under the ministry: Energy Commission of Nigeria (ECN) Nigerian Electricity Regulatory Commission (NERC) Power Holding Company of Nigeria (PHCN) Rural Electrification Agency (REA). The responsibilities of the Federal Ministry of Power are as follows:

- Initiating and formulating broad policies and programmes on the development of the power sector Initiating concessions in the power sector Licensing of electrical contractors and electric generating sets of 1MW capacity and below.
- Conducting investigation on electrical accidents and to ensure safety in the electricity industry in Nigeria.
- Conducting statutory tests and certification of electric poles (concrete, wooden, steel etc.) and other major electrical materials before they are used on the grid and networks in Nigeria.

• Implementing renewable energy programmes/ initiatives (solar, wind, biomass, small hydro etc.) Coordinating activities of the power sector.
• Handling policy matters relating to research and development in the power sector.
• Promoting the development of hydro power plants through public-private partnership (PPP), participating in bilateral and multilateral relations affecting the power sector.
• Facilitating the overall coordination of the activities of the parastatals under their supervision.

### 3.5.6 Nigerian Electricity Regulatory Commission (NERC)

The Nigerian Electricity Regulatory Commission (NERC) is an independent regulatory agency. NERC was established in 2005 as part of the economic reform agenda of the Obasanjo administration. The Electric Power Sector Reform Act of 2005 was the legislation that led to the establishment of NERC.

The Commission is required 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; and
iii. Ensure compliance with market rules and operating guidelines.

In order to create an enabling investment climate for rural electrification projects, NERC established the Mini-Grid Regulation in 2016; regulatory guidelines for mini-grids less than 100 kW and a light-handed regulation for mini-grids between 100 kW und 1 MW.

### 3.5.7 Transmission Company of Nigeria (TCN)

TCN emerged from the defunct National Electric Power Authority (NEPA) as a product of the merger of the Transmission and Operations sectors on April 1, 2004. TCN was incorporated in November 2005. Being one of the 18 unbundled Business Units under the Power Holding Company of Nigeria (PHCN), TCN was issued a transmission License on 1st July 2006. It was subsequently issued two licenses on June 10, 2013, for electricity transmission and system operations.

### 3.5.8 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 the electrification of rural and unserved communities. The mission is to provide access to a reliable electric power supply for rural dwellers irrespective of where they live and what they do, in a way that would allow for a reasonable return on investment through an appropriate tariff that is economically responsive and supportive of the average rural customer.

### 3.5.9 Federal Ministry of Women Affairs and Social Development

Promote actions to achieve the National Gender Policies and a gender budget among policymakers. The goals of the gender policy, among others, include:

- Eliminate cultural/religious gender-based biases and harmful cultural and religious practices which rise to inequalities in gender-role relations in Nigerian society. A culture that is amenable to development must be dynamic.
- Tap the potential of women for development.
- Eliminate all forms of gender-based violence.
- Ensure equal access to women, boys and girls to both formal and informal education.

Women's education is a priority because it is the key to gender equity, justice, and poverty reduction, improved skills and technological knowledge, as well as the general socioeconomic development of the nation.

### 3.5.10 State Institutions

**Gombe State Ministry of Environment**

The Ministry of Environment is currently responsible for environmental service matters and resources in the state. Other objectives include initiating formulation, execution, and monitoring of all issues relating to all environmental matters, solid waste management, and mineral resources. A recent law passed established the Gombe State Environmental Law 2021.

**Gombe State Ministry of Women Affairs and Social Development**

The ministry seeks to empower women and youth, promote the participation of women in governance, pay attention to women in rural areas, enhance the economic self-reliance of women, create awareness, and campaign against gender-based violence, etc.

**Gombe State Lands and Survey**

This Ministry was created for the purpose of overseeing the land resources in the state. They are also charged with the responsibility to plan, devise and implement the state policies on land and its resources.

## 3.6 Funding Agency Requirements

This programme is funded by the World Bank. Therefore, the World Bank Environmental and Social safeguard Standards will be integrated in the project cycle as well as other national and international environmental and social protection requirements, to comply with the best international practices. Both the main environmental and social requirements that the project needs to comply with are described in the following sections.

### 3.6.1 The Work bank Environmental and Social Safeguard Standards

The World Bank policies on the environmental and social safeguard 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 ESMP of the proposed Solar Hybrid Power Plant and Associated Infrastructure in FUK. As indicated in Table 3.1, the compliance status of the proposed along the various phases are presented below.

The framework was developed in alignment with applicable national environmental regulations and relevant Environmental and Social Framework (ESF) Environmental and Social Standards (ESS), particularly ESS1 (Assessment and Management of Environmental and Social Risks and Impacts), ESS2 (Labour and Working Conditions), ESS3 (Resource Efficiency and Pollution Prevention and Management), ESS4 (Community Health and Safety), and ESS10 (Stakeholder Engagement and Information Disclosure).

## 3.7 Institutional Arrangements for Environmental and Social Management

REA is 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 responsible. 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, Gombe 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 coordination of the Project, and monitor Project performance indicators.

**Table 3.1: Safeguards compliance Matrix for the power project**

**Pre-construction Phase**

| Aspect | Nigeria Legal Requirements | World Bank Standards triggered | International Agreements | Key Compliance Actions |
|---|---|---|---|---|
| Environmental Assessment | EIA Act (Cap E12 LFN 2004) | ESS1: Assessment of Environmental & Social Risks | Paris Agreement | Conduct EIA/ESMP; obtain approval from the Federal Ministry of Environment |
| Land Acquisition | Land Use Act (1978) | ESS5: Land Acquisition & Resettlement | International Labour Organization (land & livelihood rights) | Secure land titles; compensate affected persons |
| Stakeholder Engagement | National environmental guidelines | ESS10: Stakeholder Engagement | Aarhus Convention (principles) | Public consultations; disclosure of project info |
| Biodiversity Screening | NESREA Act | ESS6: Biodiversity Conservation | Convention on Biological Diversity | Identify sensitive habitats; avoid critical areas |
| Permits & Licensing | NERC mini-grid regulation | ESS1 compliance | NA | Obtain generation/distribution permits |

**Construction Phase**

| Aspect | Nigeria Legal Requirements | World Bank Standards triggered | International Agreements | Key Compliance Actions |
|---|---|---|---|---|
| Occupational Health & Safety | Factories Act; Labour Act | ESS2: Labor & Working Conditions | International Labour Organization conventions | Provide PPE; enforce safety procedures |
| Waste Management | NESREA Regulations | ESS3: Resource Efficiency & Pollution Prevention | Basel Convention | Proper disposal of hazardous waste (e.g., batteries) |
| Community Health & Safety | Public Health Act | ESS4: Community Health & Safety | WHO guidelines | Traffic management; site safety measures |
| Noise & Air Pollution | NESREA Air Quality Regulations | ESS3: Resource Efficiency & Pollution Prevention | Paris Agreement | Control emissions, dust, and noise |
| Cultural Heritage | National Commission for Museums Act | ESS8: Cultural Heritage | UNESCO conventions | Chance finds procedures in place |

**Operation and Maintenance Phase**

| Aspect | Nigeria Legal Requirements | World Bank Standards triggered | International Agreements | Key Compliance Actions |
|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| Energy Efficiency | National Energy Policy | ESS3: Resource Efficiency | Paris Agreement | Optimize system performance; reduce losses |
| Waste (Batteries, Panels) | NESREA e-waste regulations | ESS3: Resource Efficiency | Basel Convention | Safe recycling/disposal systems |
| Labor Conditions | Labour Act | ESS2: Labor & Working Conditions | International Labour Organization | Fair wages, worker rights compliance |
| Community Relations | Local governance laws | ESS10: Stakeholder Engagement | NA | Maintain grievance redress mechanism |
| Safety & Risk Management | Nigerian Electricity Safety Code | ESS4: Community Health & Safety | NA | Routine inspection and maintenance |

**Decommissioning Phase**

| **Aspect** | **Nigeria Legal Requirements** | **World Bank Standards triggered** | **International Agreements** | **Key Compliance Actions** |
|---|---|---|---|---|
| Environmental Restoration | EIA Act (closure requirements) | ESS1: Assessment of Environmental & Social Risks | Convention on Biological Diversity | Site rehabilitation and restoration |
| Waste Disposal | NESREA Regulations | ESS3: Resource Efficiency | Basel Convention | Dispose of solar panels, batteries safely |
| Worker Safety | Labour Act | ESS2: Labor & Working Conditions | International Labour Organization | Safe dismantling procedures |
| Community Safety | Public Health Act | ESS4: Community Health & Safety | NA | Secure site; prevent hazards post-closure |
| Asset Removal & Land Return | Land Use Act | ESS5: Land Acquisition & Resettlement | NA | Restore land to its original or agreed condition |

# CHAPTER FOUR
# BASELINE CONDITION OF THE PROJECT AREA

## 4.1 Overview of Project Environment

### 4.1.1 Climate and Meteorology

Gombe State is located in the North-Eastern region of Nigeria and falls within the Sudan Savannah ecological zone. The State experiences a tropical continental climate characterized by distinct wet and dry seasons, relatively high temperatures, and moderate to low annual rainfall. Climatic conditions in the State are largely influenced by the movement of two major air masses: the moist south-westerly maritime air mass from the Atlantic Ocean and the dry north-easterly continental air mass originating from the Sahara Desert.

The climatic and meteorological conditions of Gombe State are favorable for agriculture, livestock production, and renewable energy generation, particularly solar power projects. However, the State is also vulnerable to climate-related challenges such as drought, heat stress, soil erosion, and occasional flooding during periods of intense rainfall.

Temperatures in Gombe State are generally high throughout the year. The hottest period usually occurs between March and May, when daytime temperatures may exceed 38°C. During the cooler months, particularly between December and January, temperatures may drop to about 18–22°C, especially during the early mornings and nights due to the influence of the Harmattan winds.

The rainy season in Gombe State typically lasts from May to October, with peak rainfall occurring between July and September. Average annual rainfall ranges between 850 mm and 1,200 mm depending on location and topography. Rainfall distribution is seasonal and supports agricultural activities across the State.

Gombe experiences significant variations in RH due to its tropical savannah climate and distinct wet and dry seasons. During the dry season, especially under the influence of the Harmattan winds, RH is usually low, often ranging from 15% to 35% during the daytime. This results in dry, dusty air, increased evaporation, dehydration, and discomfort from heat. In contrast, the rainy season brings higher RH levels, sometimes reaching 60%–90%, because of increased rainfall and moist monsoon winds.

The variation in RH greatly affects agriculture, human comfort, and the environment in Gombe. Low RH during the dry season causes rapid loss of soil moisture and increases water demand for crops and humans, while high RH during the wet season supports plant growth but may encourage fungal diseases and mosquito breeding. RH also changes throughout the day: it is usually higher in the morning and night when temperatures are cooler, and lower in the afternoon when temperatures are highest. Therefore, understanding RH is important for weather forecasting, farming activities, health management, and proper storage of agricultural products in Gombe.

Wind conditions in the State are influenced by seasonal atmospheric circulation. During the dry season, the north-easterly Harmattan winds dominate, often carrying dust particles that reduce visibility and increase atmospheric dryness. In the rainy season, moist south-westerly winds prevail and contribute to precipitation.

Gombe State receives abundant sunshine throughout the year, with average daily sunshine duration ranging from 6 to 9 hours. The State also experiences high solar radiation intensity, making it highly suitable for solar energy development and other renewable energy projects.

### 4.1.2 The Local Geology

The proposed Project site at the Federal University of Kashere is located within the geological setting of the Upper Benue through in North-Eastern Nigeria. The area is predominantly underlain by sedimentary rock formations consisting mainly of sandstone, shale, clay, and limestone deposits formed during the Cretaceous period. These formations are characteristic of much of Gombe State and surrounding regions.

The surface geology of the Project area is generally composed of lateritic soils overlying weathered sedimentary materials. The soils are typically reddish-brown, sandy-loamy to clayey in texture, and moderately compacted. These soil conditions provide relatively good bearing capacity for light to medium-scale engineering structures such as solar panel mounting systems, access roads, and ancillary facilities associated with the Project.

Field observations indicate that the Project site is relatively stable with no evidence of major geological hazards such as landslides, faulting, or severe erosion features within the immediate area. The terrain is mostly flat to gently undulating, which further supports the suitability of the site for infrastructure development and minimizes the need for extensive ground modification during construction. Groundwater occurrence in the area is largely associated with weathered and fractured sedimentary formations. Boreholes within the surrounding communities and the University environment serve as important sources of water supply. Recharge of groundwater is primarily dependent on seasonal rainfall infiltration during the wet season.

Overall, the local geological conditions of the Project area are considered favorable for the proposed solar power development, with stable ground conditions, suitable soil characteristics, and minimal geotechnical constraints anticipated during construction and operation.

### 4.1.3 The Topography

Gombe State is characterized by a gently undulating terrain dominated by plains, low hills, and broad valleys typical of the Sudan Savannah region of North-Eastern Nigeria. The elevation across the State generally ranges between 300 and 700 metres above sea level, with variations influenced by local geological formations and drainage patterns.

The topography of the area surrounding the Federal University of Kashere is relatively flat to gently sloping, making it suitable for infrastructural development and renewable energy projects such as solar photovoltaic installations. The relatively level terrain minimizes the need for extensive earthworks during construction activities and supports efficient site drainage.

Several seasonal streams and minor river channels traverse parts of the State, contributing to the natural drainage system, especially during the rainy season. In some locations, isolated rocky outcrops and low ridges occur, although these features are not dominant within the Project area. The soils are generally sandy-loamy to lateritic in composition, with moderate permeability and good bearing capacity suitable for construction purposes.

The combination of open landscapes, minimal vegetation obstruction, and stable terrain conditions provides favorable environmental and engineering conditions for the proposed solar power development. In addition, the landforms topographic setting supports adequate solar exposure due to the absence of significant shading from surroundings.

### 4.1.4 Project Location from Flood Level

The proposed Project site within the main campus of the Federal University of Kashere is located on relatively elevated and gently sloping terrain, which reduces its vulnerability to flooding. Field observations indicate that the site is not situated within a known floodplain or along the immediate banks of major rivers or perennial streams that could pose significant flood risks.

Natural surface drainage within the area generally follows the existing topographic gradient, allowing stormwater runoff to flow away from the Project site during periods of rainfall. Although temporary surface water accumulation may occur during intense rainfall events, especially within low-lying depressions, the overall flood risk at the proposed solar farm location is considered low to moderate.

The site selection process also considered the need to avoid areas prone to seasonal flooding in order to ensure long-term stability and operational efficiency of the solar infrastructure. In addition, the relatively flat terrain and good drainage characteristics of the area are expected to minimize erosion and waterlogging issues during both the construction and operational phases of the Project.

To further reduce potential flood-related impacts, appropriate stormwater management measures such as drainage channels, runoff control systems, and erosion protection structures will be incorporated into the Project design where necessary. These measures will help maintain site stability, protect electrical infrastructure, and ensure uninterrupted operation of the facility during heavy rainfall events.

## 4.2 Description of Physical Environment

### 4.2.1 Air Quality and Noise Level

Baseline ambient air quality monitoring carried out within the Project area indicates that the environmental conditions are generally within the permissible limits established by the Federal Ministry of Environment (FMENV). Variations observed between the dry and wet seasons are mainly influenced by climatic conditions, including Harmattan dust, rainfall intensity, temperature, humidity, and wind movement.

Measured daytime noise levels during the dry season ranged between 54.2 and 61.5 dB(A), while control values averaged 63.4 dB(A). During the wet season, values ranged between 55.1 and 67.2 dB(A) with a control value of 68.0 dB(A). These levels are below the FMENV permissible limit of 90 dB(A) for daytime exposure. Slightly elevated wet season values may be associated with increased human activities, vehicular movement, and natural sounds during rainfall events.

Hour standards of ambient air quality are shown in **Table 4.1** while **Table 4.2** shows the air quality data obtained during field survey.

**Table 4.1: Hour Standards of Ambient Air Quality**

| Contaminant | Concentrations (ppm) | |
|---|---|---|
| | FMENV (FEPA, 1991) | World Bank (1999) |
| CO | 10 | - |
| $NO_X$ | 0.04 – 0.06 | 0.08 |
| $SO_2$ | 0.01 | - |
| $NH_3$ | 0.28 | - |
| $PM_{10}$ | - | 80 $\mu g/m^3$ |

| | | |
|---|---|---|
| TSP | 250 µg/m³ | 80 µg/m³ |

All values remained below the FMEnv limit of 90 dB(A), suggesting acceptable ambient noise conditions (see **Table 4.2**).

**Table 4.2: Nigeria's Standard Noise Levels (FEPA, 1991)**

| Duration per Day, hour | Permissible Exposure Limit, dB (A) |
|---|---|
| 8 | 90 |
| 6 | 92 |
| 4 | 95 |
| 3 | 97 |
| 2 | 100 |
| 1.5 | 102 |
| 1 | 105 |
| 0.5 | 110 |
| 0.25 or less | 115 |

**Table 4.3: Air Quality Around the Project Area (Dry and Wet Seasons)**

| | | | | ESMP MBIP, 2022 | | |
|---|---|---|---|---|---|---|
| **Parameters/Unit** | **Units** | **Dry Season Range** | **Dry Season Control** | **Wet Season Range** | **Wet Season Control** | **FMENV Limits (8 hr Avg.)** |
| Noise Level | dB(A) Day | 54.2 – 61.5 | 63.4 | 55.1 – 67.2 | 68.0 | 90 |
| SOx | µg/m³ | 0 – 1.2 | 1.0 | 0 – 0.8 | 0.5 | 26 |
| NOx | µg/m³ | 3.1 – 8.5 | 7.4 | 2.5 – 6.3 | 5.8 | 75 – 113 |
| SPM | µg/m³ | 32 – 48 | 45.6 | 28 – 39 | 35.2 | 250 |
| VOC | µg/m³ | 0 – 2.1 | 1.8 | 0 – 1.4 | 1.1 | 60 |
| CO | µg/m³ | 0.5 – 2.3 | 1.9 | 0.3 – 1.8 | 1.4 | 11.4 |
| $O_3$ | µg/m³ | 20 – 38 | 35.7 | 18 – 32 | 28.5 | NA |
| $CO_2$ | µg/m³ | 280 – 460 | 430.5 | 390 – 520 | 470.8 | NA |
| $H_2S$ | µg/m³ | 0 – 0.003 | 0.002 | 0 – 0.002 | 0.001 | 0.01 |
| Air Temperature | °C | 33.5 – 38.2 | 36.1 | 28.7 – 34.5 | 31.6 | NA |
| Wind Speed | m/s | 0.2 – 1.0 | 0.85 | 0.8 – 1.6 | 1.2 | NA |
| Humidity | % | 30 – 48 | 41.5 | 62 – 84 | 73.2 | NA |

Source of Data**:** *ESMP Report on Proposed Muhammadu Buhari Industrial Park (MBIP), 2022*

**Sulphur Oxides (SOx).**

SOx concentrations were generally very low across both seasons, ranging from 0 to 1.2 µg/m³ during the dry season and 0 to 0.8 µg/m³ during the wet season. These values are significantly below the FMENV limit of 26 µg/m³, indicating minimal contribution from industrial combustion or fossil fuel emissions within the Project area.

**Nitrogen Oxides (NOx)**

NOx concentrations ranged between 3.1 and 8.5 µg/m³ in the dry season and 2.5 and 6.3 µg/m³ during the wet season. The recorded values remain far below the FMENV permissible range of 75–113 µg/m³. Slightly higher dry season values may result from dust-generating activities, vehicular emissions, and atmospheric stagnation during hotter months.

**Suspended Particulate Matter (SPM)**
SPM concentrations showed noticeable seasonal variation. Dry season values ranged between 32 and 48 µg/m³, while wet season concentrations ranged from 28 to 39 µg/m³.
Although particulate levels were relatively higher during the dry season due to Harmattan dust and reduced atmospheric moisture, all measured values remained well below the FMENV threshold of 250 µg/m³. Rainfall during the wet season contributes to the removal of suspended particles from the atmosphere through wet deposition.

**Volatile Organic Compounds (VOC)**
VOC concentrations remained very low, with dry season values ranging from 0 to 2.1 µg/m³ and wet season values ranging from 0 to 1.4 µg/m³. These concentrations are substantially lower than the FMENV limit of 60 µg/m³, indicating limited industrial or chemical emission sources within the Project vicinity.

**Carbon Monoxide (CO)**
Measured carbon monoxide concentrations ranged between 0.5 and 2.3 µg/m³ during the dry season and 0.3 to 1.8 µg/m³ during the wet season. These values are significantly below the FMENV permissible limit of 11.4 µg/m³. The relatively low concentrations suggest minimal combustion-related pollution sources in the area.

**Ozone ($O_3$)**
Ground-level ozone concentrations ranged between 20 and 38 µg/m³ in the dry season and 18 to 32 µg/m³ in the wet season. Although there are no specific FMENV limits for ozone provided in the dataset, the recorded concentrations are considered moderate and typical of semi-urban environments influenced by sunlight intensity and atmospheric reactions.

**Carbon Dioxide ($CO_2$)**
$CO_2$ concentrations varied from 280 to 460 µg/m³ during the dry season and 390 to 520 µg/m³ in the wet season. Slightly higher wet season values may be linked to increased biological decomposition and atmospheric moisture conditions. Since no FMENV limit is specified for ambient $CO_2$ in this context, the observed values are considered within normal environmental background levels.

**Hydrogen Sulphide ($H_2S$)**
$H_2S$ concentrations were either absent or extremely low throughout both seasons, ranging from 0 to 0.003 µg/m³ in the dry season and 0 to 0.002 µg/m³ during the wet season. These values are below the FMENV limit of 0.01 µg/m³, indicating the absence of significant organic decomposition or industrial sulphide sources.

**Air Temperature**
Ambient temperatures were generally high, reflecting the tropical savannah climate of the region. Dry season temperatures ranged between 33.5 and 38.2°C, while wet season values ranged from 28.7 to 34.5°C. Higher temperatures during the dry season are associated with intense solar radiation and reduced cloud cover.

**Wind Speed**
Wind speed measurements ranged from 0.2 to 1.0 m/s during the dry season and 0.8 to 1.6 m/s in the wet season. Increased wind speeds during the rainy season may be linked to seasonal atmospheric circulation and storm activity. Wind movement plays an important role in dispersing airborne pollutants within the Project area.

**Relative Humidity**

Relative humidity exhibited significant seasonal differences. Dry season values ranged between 30 and 48%, while wet season values increased substantially to between 62 and 84% due to increased rainfall and atmospheric moisture. The lower humidity experienced during the dry season is characteristic of Harmattan conditions in Northern Nigeria.

### 4.2.2 SOIL QUALITY

#### 4.2.2.1 Physicochemical Parameters

The soil pH values obtained from the study area showed close agreement with the secondary data from ESMP MBIP (2022), although slight seasonal differences were observed. During the dry season, the measured pH ranged from 5.8–6.3 at 0–15 cm and 5.5–6.1 at 15–30 cm, compared with the control means of 5.4 and 5.2, respectively. This indicates that the study area soils were slightly less acidic than the control values during the dry season. In the wet season, pH increased to 6.2–6.8 at the surface and 6.0–6.5 at the subsurface, which were also slightly higher than the control means of 6.4 and 6.2. The similarity between the measured and control values suggests that the soil acidity status has remained relatively stable over time. The slight increase in wet-season pH compared to the secondary data may reflect increased organic matter decomposition and dilution of acidic compounds by rainfall.

Electrical conductivity (EC) values in the study area were generally higher than the secondary data, particularly during the wet season. In the dry season, EC ranged from 95–128 µS/cm at 0–15 cm and 110–146 µS/cm at 15–30 cm, compared with control means of 105 and 112 µS/cm. While some dry-season values were close to the controls, the upper dry-season values slightly exceeded the baseline data. During the wet season, EC increased significantly to 150–210 µS/cm and 170–235 µS/cm, respectively, compared with control means of 145 and 182 µS/cm. The higher EC values relative to the secondary data suggest increased dissolved ion concentrations in the study area soils, especially during the rainy season. This increase may be associated with enhanced leaching, runoff infiltration, and mobilization of soluble salts during periods of high rainfall.

Soil temperature values were generally comparable to the secondary data but showed slight seasonal deviations. During the dry season, measured temperatures ranged from 33.0–36.5°C at the surface and 31.8–34.2°C at the subsurface, compared with control means of 34.4°C and 32.8°C. The observed dry-season temperatures were therefore slightly higher at some locations than the baseline values. In the wet season, temperatures decreased to 29.5–32.8°C and 28.9–31.7°C, which were close to the control means of 30.4°C and 29.8°C. The overall similarity indicates that seasonal climatic conditions largely controlled soil temperature patterns in both the present study and the secondary dataset.

Nitrate concentrations in the present study were generally higher than the secondary data, particularly during the wet season. Dry-season nitrate concentrations ranged from 0.25–0.68 mg/kg and 0.18–0.55 mg/kg, compared with control means of 0.22 and 0.51 mg/kg. Some dry-season surface values therefore slightly exceeded the baseline data. During the wet season, nitrate increased to 0.75–1.24 mg/kg and 0.60–1.10 mg/kg, compared with control means of 0.92 and 0.81 mg/kg. The higher wet-season concentrations indicate increased nitrogen availability relative to the ESMP MBIP (2022) data. This may reflect enhanced microbial nitrification and decomposition processes under wetter soil conditions. See **Tables 4.4 – 4.6**

**Table 4.4: Physicochemical Characteristics of Soil Quality around the Project Area (Wet and Dry Season)**

| | | Concentration | | Control | | ESMP MBIP, 2022 | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Unit** | **Dry Season (0–15 cm)** | **Dry Season (15–30 cm)** | **Control Mean (0–15 cm)** | **Control Mean (15–30 cm)** | **Wet Season (0–15 cm)** | **Wet Season (15–30 cm)** | **Control (0–15 cm)** | **Control (15–30 cm)** |
| pH | - | 5.8 – 6.3 | 5.5 – 6.1 | 5.4 | 5.2 | 6.2 – 6.8 | 6.0 – 6.5 | 6.4 | 6.2 |
| Electrical Conductivity (EC) | µS/cm | 95 – 128 | 110 – 146 | 105 | 112 | 150 – 210 | 170 – 235 | 145 | 182 |
| Temperature | °C | 33.0 – 36.5 | 31.8 – 34.2 | 34.4 | 32.8 | 29.5 – 32.8 | 28.9 – 31.7 | 30.4 | 29.8 |
| Nitrate | mg/kg | 0.25 – 0.68 | 0.18 – 0.55 | 0.22 | 0.51 | 0.75 – 1.24 | 0.60 – 1.10 | 0.92 | 0.81 |
| Ammonia | mg/kg | 0.45 – 1.10 | 0.32 – 0.95 | 1.95 | 1.36 | 1.40 – 2.60 | 1.10 – 2.15 | 1.95 | 1.76 |
| Phosphate | mg/kg | 1.2 – 3.5 | 2.8 – 5.7 | 3.2 | 2.6 | 3.6 – 6.4 | 5.8 – 9.5 | 5.2 | 6.8 |
| Sulphate | mg/kg | 7.5 – 11.8 | 6.2 – 10.4 | 8.5 | 11.8 | 10.6 – 16.5 | 8.9 – 14.1 | 12.5 | 11.8 |
| Chloride | mg/kg | 0.8 – 1.9 | 1.0 – 2.4 | 0.4 | 0.1 | 1.5 – 3.2 | 2.0 – 3.8 | 2.4 | 3.1 |
| Total Organic Carbon (TOC) | % | 0.45 – 0.82 | 0.38 – 0.74 | 1.00 | 0.06 | 0.75 – 1.25 | 0.62 – 1.10 | 1.08 | 0.96 |
| Moisture Content | % | 4.8 – 7.5 | 5.2 – 7.0 | 8.3 | 7.1 | 8.5 – 14.2 | 9.1 – 15.6 | 12.3 | 13.1 |

*Source of Secondary Data: ESMP Report on Proposed Muhammadu Buhari Industrial Park (MBIP), 2022*

Ammonia concentrations showed mixed comparisons with the secondary data. During the dry season, measured ammonia concentrations of 0.45–1.10 mg/kg and 0.32–0.95 mg/kg were generally lower than the control means of 1.95 and 1.36 mg/kg. However, during the wet season, concentrations increased substantially to 1.40–2.60 mg/kg and 1.10–2.15 mg/kg, with some values exceeding the control means of 1.95 and 1.76 mg/kg. This suggests that while dry-season ammonia levels remain below baseline conditions, wet-season conditions promoted ammonia accumulation beyond the secondary data values. The increase may be associated with intensified organic matter decomposition and ammonification during the rainy season.

Phosphate concentrations in the study area were generally higher than the secondary data, especially at the subsurface during the wet season. Dry-season phosphate concentrations ranged from 1.2–3.5 mg/kg and 2.8–5.7 mg/kg, compared with control means of 3.2 and 2.6 mg/kg. While some surface dry-season values were lower than the controls, the subsurface concentrations exceeded the baseline values. During the wet season, phosphate increased further to 3.6–6.4 mg/kg and 5.8–9.5 mg/kg, compared with control means of 5.2 and 6.8 mg/kg. The higher wet-season phosphate concentrations suggest increased phosphorus enrichment relative to the ESMP MBIP (2022) data. This may indicate enhanced nutrient transport, runoff infiltration, and leaching processes within the study area.

Sulphate concentrations were also generally higher than the secondary data during the wet season. Dry-season sulphate values ranged from 7.5–11.8 mg/kg and 6.2–10.4 mg/kg, compared with control means of 8.5 and 11.8 mg/kg. Some dry-season values were therefore slightly lower than the baseline data. However, wet-season concentrations increased to 10.6–16.5 mg/kg and 8.9–14.1 mg/kg, exceeding the control means of 12.5 and 11.8 mg/kg at several sampling points. The higher wet-season sulphate concentrations may reflect enhanced mineral dissolution and organic matter decomposition during periods of increased rainfall.

Chloride concentrations in the present study exceeded the secondary data during both seasons. During the dry season, chloride concentrations ranged from 0.8–1.9 mg/kg and 1.0–2.4 mg/kg, compared with extremely low control values of 0.4 and 0.1 mg/kg. During the wet season, chloride increased further to 1.5–3.2 mg/kg and 2.0–3.8 mg/kg, compared with control means of 2.4 and 3.1 mg/kg. The consistently higher chloride concentrations relative to the secondary data suggest increased dissolved salt mobility and possible accumulation within the study area soils.

Total Organic Carbon (TOC) values showed both similarities and differences compared with the secondary data. During the dry season, TOC ranged from 0.45–0.82% and 0.38–0.74%, compared with control means of 1.00 and 0.06%. The surface dry-season values were generally lower than the control surface mean but substantially higher than the control subsurface value. During the wet season, TOC increased to 0.75–1.25% and 0.62–1.10%, closely matching or slightly exceeding the control means of 1.08 and 0.96%. This indicates improved organic carbon accumulation during the wet season relative to the secondary data.

Moisture content values were lower than the secondary data during the dry season but became comparable or slightly higher during the wet season. Dry-season moisture content ranged from 4.8–7.5% and 5.2–7.0%, compared with control means of 8.3 and 7.1%, indicating drier soil conditions than the baseline data. However, during the wet season, moisture content increased significantly to 8.5–14.2% and 9.1–15.6%, compared with control means of 12.3 and 13.1%. Some wet-season subsurface values therefore exceeded the control means, reflecting enhanced water retention and infiltration during the rainy season.

**Table 4.5: Major Cations**

| | | Concentration | | Control | | ESMP MBIP,2022 | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Unit** | **Dry Season (0–15 cm)** | **Dry Season (15–30 cm)** | **Control Mean (0–15 cm)** | **Control Mean (15–30 cm)** | **Wet Season (0–15 cm)** | **Wet Season (15–30 cm)** | **Control (0–15 cm)** | **Control (15–30 cm)** |
| Magnesium | mg/kg | 15.2 – 28.4 | 18.5 – 31.2 | 23.3 | 32.1 | 24.1 – 39.6 | 28.4 – 42.5 | 33.8 | 36.4 |
| Potassium | mg/kg | 2.1 – 4.5 | 2.6 – 5.1 | 3.1 | 4.2 | 4.8 – 7.9 | 5.5 – 8.4 | 6.7 | 7.2 |
| Sodium | mg/kg | 5.5 – 10.8 | 7.2 – 12.5 | 8.6 | 5.6 | 11.4 – 16.7 | 12.8 – 18.4 | 14.6 | 15.2 |

*Source of Secondary Data: ESMP Report on Proposed Muhammadu Buhari Industrial Park (MBIP), 2022*

**Table 4.6: Heavy Metals**

| | | Concentration | | Control | | ESMP MBIP,2022 | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Unit** | **Dry Season (0–15 cm)** | **Dry Season (15–30 cm)** | **Control Mean (0–15 cm)** | **Control Mean (15–30 cm)** | **Wet Season (0–15 cm)** | **Wet Season (15–30 cm)** | **Control (0–15 cm)** | **Control (15–30 cm)** |
| Copper | mg/kg | 1.2 – 2.8 | 1.5 – 3.1 | 3.9 | 4.8 | 2.4 – 4.6 | 3.0 – 5.2 | 3.6 | 4.1 |
| Iron | mg/kg | 65 – 112 | 88 – 135 | 193 | 120 | 140 – 215 | 175 – 248 | 198 | 220 |
| Lead | mg/kg | 0.05 – 0.42 | 0.10 – 0.55 | 0.18 | 0.11 | 0.30 – 0.82 | 0.45 – 0.96 | 0.78 | 0.91 |
| Zinc | mg/kg | 3.5 – 6.8 | 4.2 – 7.5 | 8.8 | 9.4 | 5.9 – 9.6 | 6.8 – 10.4 | 8.7 | 9.3 |
| Manganese | mg/kg | 0.4 – 1.5 | 0.7 – 1.8 | 2.9 | 2.0 | 1.2 – 2.7 | 1.6 – 3.1 | 2.4 | 2.8 |

*Source of Secondary Data: ESMP Report on Proposed Muhammadu Buhari Industrial Park (MBIP), 2022*

**Cations**

Magnesium concentrations showed clear seasonal variation and generally increased during the wet season compared with the dry season. During the dry season, magnesium concentrations ranged from 15.2–28.4 mg/kg at 0–15 cm and 18.5–31.2 mg/kg at 15–30 cm, while during the wet season the concentrations increased to 24.1–39.6 mg/kg and 28.4–42.5 mg/kg, respectively. This indicates that wet-season magnesium levels were considerably higher than dry-season levels at both depths. The increase may be attributed to enhanced mineral weathering, dissolution, and mobility of magnesium ions under wetter soil conditions. Subsurface soils consistently recorded slightly higher magnesium concentrations than surface soils, suggesting downward migration and accumulation of magnesium through leaching processes. When compared with the ESMP MBIP (2022) control means, the dry-season concentrations were generally lower than the control values of 23.3 mg/kg and 32.1 mg/kg, particularly at the subsurface. However, wet-season concentrations approached or exceeded the control means of 33.8 mg/kg and 36.4 mg/kg. For instance, the wet-season subsurface magnesium concentration reached 42.5 mg/kg, which exceeded the control mean of 36.4 mg/kg. This suggests increased magnesium enrichment during the wet season relative to the secondary data.

Potassium concentrations also increased significantly from the dry season to the wet season. During the dry season, potassium ranged from 2.1–4.5 mg/kg at 0–15 cm and 2.6–5.1 mg/kg at 15–30 cm, whereas wet-season concentrations increased to 4.8–7.9 mg/kg and 5.5–8.4 mg/kg, respectively. The seasonal increase indicates improved potassium availability during the wet season, likely due to enhanced decomposition of organic matter and increased release of potassium-bearing minerals under moist conditions. Subsurface soils again recorded slightly higher potassium concentrations than surface soils, indicating downward movement of soluble potassium ions through infiltration and leaching. Compared with the ESMP MBIP (2022) control means, the dry-season potassium concentrations were generally lower than the baseline values of 3.1 mg/kg and 4.2 mg/kg, especially at the lower concentration ranges. However, wet-season concentrations were comparable to or slightly higher than the control means of 6.7 mg/kg and 7.2 mg/kg. For example, the wet-season subsurface concentration reached 8.4 mg/kg, exceeding the control mean of 7.2 mg/kg. This suggests that potassium availability increased considerably during the wet season and may reflect enhanced nutrient cycling and accumulation within the study area soils.

Sodium concentrations followed a similar seasonal trend, with higher values recorded during the wet season than the dry season. During the dry season, sodium concentrations ranged from 5.5–10.8 mg/kg at the surface and 7.2–12.5 mg/kg at the subsurface, while wet-season concentrations increased to 11.4–16.7 mg/kg and 12.8–18.4 mg/kg, respectively. The increase in sodium during the wet season may be associated with enhanced dissolution and transport of soluble salts under wetter conditions. Subsurface soils consistently recorded higher sodium concentrations than surface soils, indicating downward migration and accumulation of sodium ions through leaching. Compared with the ESMP MBIP (2022) control values, the dry-season sodium concentrations were generally comparable to or slightly higher than the control means of 8.6 mg/kg and 5.6 mg/kg. Notably, the subsurface dry-season concentrations exceeded the control mean considerably, reaching up to 12.5 mg/kg compared with the control value of 5.6 mg/kg. During the wet season, sodium concentrations remained close to or slightly above the control means of 14.6 mg/kg and 15.2 mg/kg. For example, the wet-season subsurface concentration reached 18.4 mg/kg, exceeding the control mean of 15.2 mg/kg. This suggests moderate sodium enrichment within the study area during the wet season. However, despite the observed increases, the sodium concentrations remain within acceptable ranges and do not yet indicate sodicity problems in the soil.

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**Heavy Metals**

Copper concentrations in the study area showed noticeable seasonal variation, with higher values recorded during the wet season than during the dry season. During the dry season, copper concentrations ranged from 1.2–2.8 mg/kg at 0–15 cm and 1.5–3.1 mg/kg at 15–30 cm, while wet-season concentrations increased to 2.4–4.6 mg/kg and 3.0–5.2 mg/kg, respectively. The increase in copper concentration during the wet season may be attributed to enhanced weathering of copper-bearing minerals, increased mobility of dissolved metals under moist conditions, and decomposition of organic matter.

Subsurface soils generally recorded slightly higher copper concentrations than surface soils, indicating downward migration and accumulation through leaching processes. Compared with the ESMP MBIP (2022) control means of 3.9 and 4.8 mg/kg during the dry season, the measured dry-season concentrations were generally lower than the baseline values. However, during the wet season, the concentrations approached or slightly exceeded the control means of 3.6 and 4.1 mg/kg. For example, the wet-season subsurface copper concentration reached 5.2 mg/kg, which exceeded the control value of 4.1 mg/kg. This suggests moderate copper enrichment during the wet season relative to the secondary data.

Iron concentrations were the highest among all the heavy metals analyzed and showed substantial seasonal increases. During the dry season, iron concentrations ranged from 65–112 mg/kg at the surface and 88–135 mg/kg at the subsurface, while wet-season concentrations increased markedly to 140–215 mg/kg and 175–248 mg/kg, respectively. The higher wet-season iron concentrations may result from enhanced mineral dissolution and mobilization under wetter soil conditions. Subsurface soils consistently recorded higher iron concentrations than surface soils, indicating accumulation of iron compounds within deeper soil layers. Compared with the ESMP MBIP (2022) control values of 193 and 120 mg/kg during the dry season, the measured dry-season surface concentrations were generally lower than the control, while some subsurface values slightly exceeded baseline concentration. During the wet season, iron concentrations were comparable to or exceeded the control means of 198 and 220 mg/kg. For instance, the wet-season subsurface concentration reached 248 mg/kg, exceeding the control mean of 220 mg/kg. This suggests that iron mobility and accumulation were enhanced during the rainy season.

Lead concentrations also increased during the wet season. During the dry season, lead ranged from 0.05–0.42 mg/kg at 0–15 cm and 0.10–0.55 mg/kg at 15–30 cm, whereas wet-season concentrations increased to 0.30–0.82 mg/kg and 0.45–0.96 mg/kg, respectively. The increase may be associated with enhanced mobility of dissolved lead particles and runoff infiltration during rainfall periods. Subsurface soils recorded higher lead concentrations than surface soils, suggesting downward migration through leaching. Compared with the ESMP MBIP (2022) control means of 0.18 and 0.11 mg/kg during the dry season, some measured dry-season concentrations exceeded the control values, particularly at the subsurface. During the wet season, lead concentrations were generally comparable to the control means of 0.78 and 0.91 mg/kg, although the upper concentration ranges slightly exceeded these values. For example, the wet-season subsurface concentration reached 0.96 mg/kg, which was slightly above the control value of 0.91 mg/kg. This indicates slight lead enrichment during the wet season, although the concentrations remain relatively low overall.

Zinc concentrations followed a similar seasonal pattern, with higher values observed during the wet season than during the dry season. During the dry season, zinc concentrations ranged from 3.5–6.8 mg/kg at the surface and 4.2–7.5 mg/kg at the subsurface, while wet-season concentrations increased to 5.9–9.6 mg/kg and 6.8–10.4 mg/kg, respectively. The increase in zinc during the wet season may be

linked to enhanced mineral weathering and increased mobility of zinc ions under moist conditions. Subsurface soils generally recorded slightly higher zinc concentrations than surface soils, indicating accumulation within deeper soil horizons. Compared with the ESMP MBIP (2022) control means of 8.8 and 9.4 mg/kg during the dry season, the measured dry-season concentrations were generally lower than the baseline values. However, wet-season concentrations approached or slightly exceeded the control means of 8.7 and 9.3 mg/kg. For instance, the wet-season subsurface zinc concentration reached 10.4 mg/kg, exceeding the control mean of 9.3 mg/kg. This suggests increased zinc enrichment during the wet season relative to the secondary data.

Manganese concentrations also increased considerably during the wet season. During the dry season, manganese ranged from 0.4–1.5 mg/kg at 0–15 cm and 0.7–1.8 mg/kg at 15–30 cm, whereas wet-season concentrations increased to 1.2–2.7 mg/kg and 1.6–3.1 mg/kg, respectively. The higher wet-season manganese concentrations may be associated with enhanced decomposition of manganese-bearing minerals and increased ion mobility under wet conditions.
Subsurface soils consistently recorded slightly higher manganese concentrations than surface soils, suggesting downward migration and accumulation through leaching. Compared with the ESMP MBIP (2022) control values of 2.9 and 2.0 mg/kg during the dry season, the measured dry-season concentrations were generally lower than the control means. However, wet-season concentrations approached or slightly exceeded the control means of 2.4 and 2.8 mg/kg. For example, the wet-season subsurface manganese concentration reached 3.1 mg/kg, exceeding the control value of 2.8 mg/kg. This indicates moderate manganese enrichment during the rainy season.

### 4.3 Vegetation Studies

The vegetation of the Project area falls within the Sudan Savannah ecological zone, characterized by scattered trees, shrubs, grasses, and drought-resistant plant species adapted to semi-arid climatic conditions. The vegetation cover within and around the proposed Project site is generally sparse due to human activities such as farming, grazing, bush burning, and infrastructural development.

**Table 4.7: Vegetation Type and Conservation Status**

| S/N | Common Name | Scientific Name | Vegetation Type | Conservation Status* |
|---|---|---|---|---|
| 1 | Neem Tree | *Azadirachta indica* | Exotic Tree | Least Concern (LC) |
| 2 | Baobab | *Adansonia digitata* | Indigenous Tree | Least Concern (LC) |
| 3 | Shea Butter Tree | *Vitellaria paradoxa* | Savannah Tree | Vulnerable (VU) |
| 4 | African Locust Bean | *Parkia biglobosa* | Indigenous Tree | Vulnerable (VU) |
| 5 | Acacia | *Acacia senegal* | Savannah Shrub/Tree | Least Concern (LC) |
| 6 | Desert Date | *Balanites aegyptiaca* | Drought-resistant Tree | Least Concern (LC) |
| 7 | Tamarind | *Tamarindus indica* | Indigenous Tree | Least Concern (LC) |
| 8 | Eucalyptus | *Eucalyptus camaldulensis* | Exotic Tree | Least Concern (LC) |
| 9 | Guinea Grass | *Panicum maximum* | Grass Species | Least Concern (LC) |
| 10 | Spear Grass | *Imperata cylindrica* | Grass Species | Least Concern (LC) |
| 11 | Elephant Grass | *Pennisetum purpureum* | Grass Species | Least Concern (LC) |
| 12 | Hibiscus Shrub | *Hibiscus sabdariffa* | Shrub | Least Concern (LC) |
| 13 | Sickle Bush | *Dichrostachys cinerea* | Shrub | Least Concern (LC) |
| 14 | Date Palm | *Phoenix dactylifera* | Cultivated Tree | Least Concern (LC) |
| 15 | Wild Fig | *Ficus sycomorus* | Riparian Tree | Least Concern (LC) |

Conservation Status Explanation

- Least Concern (LC): Species that are widespread and currently not at risk of extinction.
- Vulnerable (VU): Species considered at risk due to habitat degradation, overexploitation, or environmental pressures.

**Ecological Observations**

The Project area is dominated by grasses and scattered drought-tolerant tree species typical of the Sudan Savannah ecosystem. Most plant species identified are common and widely distributed across Northern Nigeria. No critically endangered or endemic plant species were observed within the immediate Project footprint during the baseline assessment.

However, economically important species such as *Vitellaria paradoxa* (Shea Butter Tree) and *Parkia biglobosa* (African Locust Bean) may require conservation attention due to pressures from fuelwood harvesting, agricultural expansion, and land degradation. Appropriate vegetation management measures should therefore be implemented during Project development to minimize unnecessary clearing and preserve ecologically valuable plant species where practicable**.**

Vegetation within the Sudan Savannah zone of Gombe State is exposed to several environmental stresses and biological agents, including plant pathogens that may affect the health, productivity, and survival of plant species. The occurrence and spread of these pathogens are often influenced by seasonal climatic conditions, especially humidity, rainfall, temperature, and soil moisture.

**Table 4.8: Common Plant Pathogens and Their Effects**

| S/N | Pathogen Type | Common Pathogen | Affected Vegetation | Likely Effects | Conservation Concern |
|---|---|---|---|---|---|
| 1 | Fungus | *Fusarium* spp. | Grasses, shrubs, crops | Root rot and wilting | Moderate |
| 2 | Fungus | *Aspergillus* spp. | Stored seeds and crops | Seed deterioration | Low |
| 3 | Fungus | *Puccinia* spp. (Rust fungi) | Savannah grasses | Leaf rust and reduced growth | Moderate |
| 4 | Bacteria | *Xanthomonas* spp. | Tree and shrub species | Leaf spot and blight | Moderate |
| 5 | Virus | Mosaic viruses | Cultivated vegetation | Reduced photosynthesis and growth | Moderate |
| 6 | Nematodes | Root-knot nematodes | Agricultural plants | Root deformation and poor nutrient uptake | Moderate |
| **7** | Termites (Biological pest) | *Macrotermes* spp. | Trees and woody plants | Stem damage and weakening | High in dry season |
| **8** | Parasitic Plant | *Striga* spp. | Grasses and cereal crops | Nutrient depletion and stunted growth | High in farmlands |

**Seasonal Influence on Pathogens**

During the dry season, high temperatures and low humidity reduce the survival rate of many moisture-dependent pathogens. However, drought stress weakens vegetation and increases susceptibility to termite attacks and parasitic infestations such as *Striga* species. Dust accumulation and reduced soil moisture may also limit plant resistance and recovery.

The wet season generally favors the growth and spreads of fungal and bacterial pathogens due to increased humidity, rainfall, and soil moisture. Diseases such as leaf rust, root rot, and bacterial blight are more prevalent during this period because moist conditions promote pathogen reproduction and transmission.

**Conservation Considerations**

Most vegetation species within the Project area are classified as Least Concern (LC) under conservation categories, indicating that they are relatively widespread and stable. However, some economically and ecologically important species such as:

- *Vitellaria paradoxa* (Shea Butter Tree)
- *Parkia biglobosa* (African Locust Bean)

**Wildlife and Conservation Status**

**Table 4.9: Wildlife and Conservation Status**

| Common Name | Scientific Name | Group | Conservation Status (IUCN) | Remarks |
|---|---|---|---|---|
| West African Lion | *Panthera leo senegalensis* | Mammal | Critically Endangered | Extremely rare in West Africa; locally extinct in many areas |
| African Wild Dog | *Lycaon pictus* | Mammal | Endangered | Declining due to habitat loss and human conflict |
| Caracal | *Caracal caracal* | Mammal | Least Concern (locally threatened) | Still present but under pressure from hunting |
| Patas Monkey | *Erythrocebus patas* | Mammal | Near Threatened | Population decreasing, habitat degradation |
| African Golden Wolf | *Canis lupaster* | Mammal | Least Concern | Adaptable but affected by habitat changes |
| Spotted Hyena | *Crocuta crocuta* | Mammal | Least Concern | Declining in populated regions |
| Denham's Bustard | *Neotis denhami* | Bird | Vulnerable | Threatened by hunting and habitat loss |
| Secretary Bird | *Sagittarius serpentarius* | Bird | Vulnerable | Declining due to |

| Common Name | Scientific Name | Group | Conservation Status (IUCN) | Remarks |
|---|---|---|---|---|
| | | | | agricultural expansion |
| Northern Ground Hornbill | *Bucorvus abyssinicus* | Bird | Vulnerable | Sensitive to habitat disturbance |
| Hooded Vulture | *Necrosyrtes monachus* | Bird | Critically Endangered | Rapid decline due to poisoning and human activity |
| African Grey Hornbill | *Lophoceros nasutus* | Bird | Least Concern | Common but affected by deforestation |
| Nile Monitor Lizard | *Varanus niloticus* | Reptile | Least Concern | Found near water bodies |
| African Rock Python | *Python sebae* | Reptile | Near Threatened | Threatened by hunting and habitat loss |
| Senegal Coucal | *Centropus senegalensis* | Bird | Least Concern | Common in savanna and farmland |
| Grasshopper (various spp.) | Various | Insect | Not Evaluated | Important for ecosystem food chain |

**Flora and Fauna of the Project Area**

The Project area is located within the Sudan Savannah ecological zone of North-Eastern Nigeria, which is characterized by open grasslands, scattered trees, shrubs, and a variety of wildlife species adapted to semi-arid environmental conditions. Human activities such as farming, grazing, bush burning, and infrastructural development have significantly influenced the natural ecosystem, resulting in relatively sparse vegetation and reduced wildlife diversity within the immediate Project environment.

**Flora**

The flora of the Project area consists mainly of drought-resistant trees, shrubs, grasses, and herbaceous plant species commonly found in savannah ecosystems. The vegetation is generally open and discontinuous, with grasses dominating the ground layer and scattered woody species occurring across the landscape.

**Table 4.10: Common Plant Species Identified**

| S/N | Common Name | Scientific Name | Vegetation Type | Conservation Status |
|---|---|---|---|---|
| 1 | Neem Tree | *Azadirachta indica* | Exotic Tree | Least Concern (LC) |
| 2 | Baobab | *Adansonia digitata* | Indigenous Tree | Least Concern (LC) |
| 3 | African Locust Bean | *Parkia biglobosa* | Savannah Tree | Vulnerable (VU) |
| 4 | Shea Butter Tree | *Vitellaria paradoxa* | Indigenous Tree | Vulnerable (VU) |
| 5 | Acacia | *Acacia senegal* | Savannah Shrub/Tree | Least Concern (LC) |
| 6 | Tamarind | *Tamarindus indica* | Indigenous Tree | Least Concern (LC) |

| | | | | |
|---|---|---|---|---|
| 7 | Desert Date | *Balanites aegyptiaca* | Drought-resistant Tree | Least Concern (LC) |
| 8 | Guinea Grass | *Panicum maximum* | Grass Species | Least Concern (LC) |
| 9 | Spear Grass | *Imperata cylindrica* | Grass Species | Least Concern (LC) |
| 10 | Elephant Grass | *Pennisetum purpureum* | Grass Species | Least Concern (LC) |

**Flora Characteristics**

The vegetation cover within the Project area is typical of the Sudan Savannah region, with species adapted to prolonged dry seasons and relatively low rainfall conditions. Most of the identified species are common and widely distributed across Northern Nigeria. No endemic or critically endangered plant species were observed during the field assessment.

**Fauna**

The fauna of the Project area mainly comprises small mammals, reptiles, birds, amphibians, and insects adapted to savannah habitats and human-modified environments. Wildlife abundance within the immediate Project site is relatively low due to ongoing human disturbance and land use activities.

**Table 4.11: Common Faunal Species Identified**

| S/N | Common Name | Scientific Name | Faunal Group | Conservation Status |
|---|---|---|---|---|
| 1 | African Giant Rat | *Cricetomys gambianus* | Mammal | Least Concern (LC) |
| 2 | Ground Squirrel | *Xerus erythropus* | Mammal | Least Concern (LC) |
| 3 | Monitor Lizard | *Varanus niloticus* | Reptile | Least Concern (LC) |
| 4 | Agama Lizard | *Agama agama* | Reptile | Least Concern (LC) |
| 5 | House Gecko | *Hemidactylus mabouia* | Reptile | Least Concern (LC) |
| 6 | Cattle Egret | *Bubulcus ibis* | Bird | Least Concern (LC) |
| 7 | Village Weaver | *Ploceus cucullatus* | Bird | Least Concern (LC) |
| 8 | Pied Crow | *Corvus albus* | Bird | Least Concern (LC) |
| 9 | Grasshopper | *Zonocerus variegatus* | Insect | Least Concern (LC) |
| 10 | Termites | *Macrotermes* spp. | Insect | Least Concern (LC) |

**Fauna Characteristics**

The Project area supports mainly adaptable and widespread species capable of surviving under semi-arid and human-influenced conditions. Bird species are relatively common due to the availability of open feeding grounds and scattered vegetation. Small reptiles and rodents are also commonly observed within grassland and shrub areas. No endangered, endemic, or protected wildlife species were recorded within the immediate Project footprint during the baseline ecological survey. However, seasonal movements of birds and small mammals may occur in response to food availability, rainfall, and habitat conditions.

**Ecological Significance and Conservation Considerations**

The ecological sensitivity of the Project area is considered relatively low because the site has already experienced varying levels of human disturbance. Nevertheless, certain indigenous tree species such as *Parkia biglobosa* and *Vitellaria paradoxa* possess economic and ecological importance and should be preserved where practicable.

Potential ecological impacts during Project implementation may include temporary vegetation clearing, habitat disturbance, and displacement of small fauna. These impacts are expected to be localized and manageable through proper environmental management measures such as:

- Minimizing unnecessary vegetation removal

- Restricting construction activities to designated areas
- Avoiding bush burning
- Implementing proper waste management practices
- Encouraging re-vegetation and landscape restoration after construction

Overall, the flora and fauna within the Project area are typical of the Sudan Savannah ecosystem and do not indicate the presence of highly sensitive or endangered ecological resources that could significantly constrain the proposed development.

**Wildlife Migration Pathways**
Field observations and ecological assessments indicate that the proposed Project area does not serve as a major wildlife migration corridor or seasonal migratory route for large mammals or protected fauna species. The surrounding environment is largely characterized by human-modified landscapes including academic buildings, access roads, agricultural fields, and settlement activities, all of which limit large-scale wildlife movement. Wildlife species commonly observed within the area are primarily small mammals, reptiles, birds, and insects adapted to disturbed savannah habitats. These species generally exhibit localized movement patterns rather than long-distance migration.

**Bird Movement**
Some seasonal bird movements may occur within the wider savannah ecosystem, particularly during the rainy season when food resources and breeding conditions improve. However, no internationally recognized migratory bird flyways or critical avian habitats were identified within the Project area.

**Livestock Movement**
Informal movement of domestic livestock such as cattle, goats, and sheep may occasionally occur around surrounding communities due to grazing activities. These movements are socio-economic rather than ecological migration pathways and are not expected to significantly interfere with Project operations.

### 4.4 Socio-Economic and Health Study

This chapter presents the results and analysis of the survey questionnaire conducted as part of the Environmental and Social Impact Assessment (ESMP) for the proposed hybrid solar power plant at Kashere. A total of 40 respondents completed and submitted the questionnaire, providing comprehensive information on socioeconomic and demographic characteristics, health status, standard of living, gender-based violence concerns, environmental and cultural resources, project impact perceptions, and grievance redress mechanisms.

The data collected has been analyzed and presented using various visualization techniques including pie charts and bar charts to facilitate better understanding of the survey findings. The results are organized according to the survey sections: Household Data, Health Status, Standard of Living, Gender-Based Violence/Sexual Exploitation and Abuse, Resources/Cultural Property, Project Activities Impact Evaluation, Grievance Redress Mechanism, and World Bank Environmental and Social Standards (ESS).

### 4.4.1 Age Distribution and Marital Status

The age distribution of respondents indicates that the majority of the study population falls within the active and productive age bracket of 18–45 years, accounting for 65% of respondents (26 individuals). This is followed by respondents within the 46–65 years category, representing 30% (12 individuals), while only 5% (2 respondents) were below 18 years of age. The distribution reflects a predominantly young to middle-aged population, which is characteristic of a university environment where students, academic staff, and working-class individuals constitute the larger proportion of the community. The dominance of respondents within the 18–45 years category suggests a socially and economically active population with significant dependence on electricity for academic activities, research, ICT services, communication, and commercial operations.

The presence of respondents within the 46–65 years age bracket further indicates the contribution of experienced academic staff, administrative personnel, and business operators who are actively involved in institutional and economic activities within the campus. Overall, the demographic structure demonstrates a population that is highly dependent on reliable electricity supply to support educational, administrative, residential, and commercial functions within the university environment.

The marital status distribution revealed that 55% of the respondents were married, while 45% were single, with no respondent indicating divorce or widowhood as their marital status. The relatively high proportion of single respondents is expected in a university setting, as a large percentage of the population consists of undergraduate students who are predominantly unmarried youths. In contrast, the married respondents were mainly staff members and business operators within the campus community. This demographic composition reflects the mixed social structure of the university environment, where students coexist with employees and entrepreneurs. Married respondents are likely to have greater household and economic responsibilities, making stable electricity supply important for family welfare, productivity, and business sustainability. The findings therefore suggest that reliable electricity supply through the proposed solar photovoltaic project will not only support academic and institutional activities but also improve the socio-economic wellbeing of both students and staff within the university community.

### 4.4.2 Occupation Distribution

The occupation distribution in Kashere reflects the broader socio-economic structure of rural and peri-urban communities in northern Nigeria, where livelihoods are largely shaped by environmental conditions, cultural practices, and access to resources. The economy is predominantly informal and agrarian, with most residents engaged in primary production and small-scale enterprises.

Agriculture is the dominant occupation in Kashere, employing a large proportion of the population. Farmers cultivate staple crops such as millet, sorghum, maize, and groundnuts, which are well adapted to the semi-arid Sudan savanna climate. Farming is mostly rain-fed and seasonal, with increased activity during the rainy season and reduced productivity during the dry period. In addition to crop farming, many households' practice subsistence agriculture**,** producing mainly for local consumption with limited surplus for sale. Pastoral and agro-pastoral practices are widespread, with herders moving animals in search of pasture and water, especially during the dry season. This occupation plays a crucial role in supporting household livelihoods and food security.

Trade and commerce form another significant component of occupation distribution. Many inhabitants engage in petty trading, selling agricultural produce, grains, livestock products, and household goods in local markets. Small-scale businesses such as kiosks, food vending, and craft sales are common, particularly among women and youth. These activities provide daily income and support the circulation of goods within the community.

Artisan and vocational occupations are also present, though on a smaller scale. These include blacksmithing, tailoring, carpentry, leatherwork, and weaving, which are traditional skills passed down through generations. Such occupations contribute to local economic diversity and provide essential goods and services to the community.

A portion of the population is involved in public and private sector employment, including teaching, civil service, healthcare work, and security services. However, these formal jobs are relatively limited compared to agricultural and informal activities. Youth employment may also include casual labor, transportation services (such as motorcycle riding), and construction work.

### 4.4.3 Student Population and Staff Strength

The total staff population is 2,519, categorized as follows: Academic Staff: 827, Non-Academic Staff: 1,692, Staff Residing On-Campus: 29. The relatively small number of on-campus resident staff suggests that most employees commute daily and are affected indirectly by institutional power supply conditions during working hour. The university hosts a large daytime population (~19,878 persons) including students and staff. Approximately 2,346 people reside on campus, indicating constant (24-hour) electricity demand. High student population suggests significant electricity demand for: Teaching and learning, Research activities, ICT infrastructure and Residential services. The solar project will therefore support both academic productivity and residential welfare.

### 4.4.4 Diesel Consumption Profile (Last 5 Years)

The analysis of grid electricity expenditure over the last five years indicates that the university spent a total of ₦141,304,215 on public electricity supply. Although this amount appears relatively moderate for an institution of such size and operational capacity, it strongly suggests that the university experiences irregular and unreliable public power supply. The relatively low expenditure on grid electricity implies that the institution cannot depend solely on the national grid to meet its energy demands and has therefore resorted to alternative energy sources to sustain academic, administrative, residential, and commercial activities. In many Nigerian institutions, unstable grid electricity is characterized by frequent outages, voltage fluctuations, and inadequate supply duration, all of which can negatively affect institutional productivity and service delivery.

The assessment further revealed a very high dependence on diesel-powered generators as the major alternative source of electricity. Over the same five-year period, the university consumed approximately 900,000 litres of diesel at a total cost of ₦954,000,000. This translates to an average annual diesel consumption of 180,000 litres and an estimated yearly expenditure of about ₦190,800,000. The diesel expenditure is significantly higher than the total amount spent on grid electricity, indicating that diesel generators account for the dominant share of the institution's energy supply system. This situation reflects the extent to which unreliable public electricity has forced the university to depend on self-generated power to maintain continuous operations across academic facilities, laboratories, administrative offices, hostels, healthcare facilities, and commercial centres within the campus.

The heavy dependence on diesel generators has major financial implications for the institution. The enormous annual expenditure on diesel increases operational costs and places considerable pressure on the university's financial resources. Funds that could otherwise be invested in academic development, research infrastructure, staff welfare, and student services are instead directed toward fuel procurement and generator maintenance. In addition, the university remains highly vulnerable to fluctuations in fuel prices, which can lead to unpredictable increases in energy expenditure and long-term financial instability. The high cost of diesel generation also reduces the overall efficiency and sustainability of the institution's energy management system.

Beyond the economic implications, extensive diesel usage presents serious environmental concerns. Diesel combustion contributes significantly to greenhouse gas (GHG) emissions, which are major contributors to global climate change. In addition, diesel generators produce air pollutants such as particulate matter (PM), nitrogen oxides (NOx), and sulphur oxides (SOx), all of which negatively affect air quality and public health. Continuous generator operations also generate excessive noise pollution, which may disrupt academic activities and reduce environmental comfort within the university environment. The dependence on diesel therefore results in a high institutional carbon footprint and contributes to environmental degradation.

The proposed solar photovoltaic (PV) project offers a sustainable solution to these challenges by reducing the university's reliance on diesel generators and unstable grid electricity. The adoption of solar energy is expected to significantly lower operational energy costs, reduce greenhouse gas emissions, improve environmental quality, and enhance energy reliability across the campus. In addition, the project will promote clean energy transition and support sustainable institutional development while contributing positively to national and global environmental sustainability goals.

### 4.4.5 Gender Equity in the Community

Nigeria's legal and policy framework provides a strong foundation for the promotion of gender equality and social inclusion. Section 42 of the Constitution of the Federal Republic of Nigeria guarantees freedom from discrimination on the basis of sex, gender, religion, or ethnicity, thereby ensuring equal rights and opportunities for all citizens. In addition, the National Gender Policy (2021–2026) serves as the country's primary framework for advancing gender equality by addressing gender gaps, promoting women's empowerment, and advocating for 35% affirmative action in political and decision-making positions. The policy also emphasizes equal access to education, employment, leadership opportunities, and socio-economic resources for both men and women. These constitutional and policy provisions collectively support inclusive participation and provide a legal basis for ensuring fairness and equality within institutions and communities.

The findings from the study indicate different approaches through which gender equity is promoted within the community. About 30% of respondents stated that women are elected into public offices, while 25% indicated that gender quotas are maintained in the leadership of community-based organizations. However, the largest proportion of respondents (45%) identified equal access to education and employment opportunities for women as the primary means of ensuring gender equity. This suggests that educational and economic empowerment are widely recognized as essential tools for promoting inclusion and reducing gender disparities. In the university environment, equal access to education and employment enhances women's participation in academic, administrative, and economic activities, thereby contributing to social development, institutional productivity, and improved socio-economic wellbeing within the community.

### 4.4.6 Vulnerable Group

Vulnerable groups are individuals or populations who, due to certain conditions or circumstances, are at a higher risk of harm, discrimination, or exclusion from social, economic, educational, or health opportunities. They often need special protection, support, or attention in policies, institutions, and community programs to ensure fairness and inclusion.

At a university level, vulnerable groups may include Students with disabilities, Students from extremely poor backgrounds, Female students facing gender-related challenges, international students or minorities, Students with mental health difficulties. The Command's does not have any cadet with disabilities.

### 4.4.7 Resources/Cultural Property

This section assesses environmental challenges in the community and potential impacts of the proposed project on natural and cultural resources.

### 4.4.8 Expected Environmental Problems from Project Construction

Remarkably, 80% of respondents indicated that they do not expect any of the listed environmental problems (soil infertility, poor drainage, bad roads, low visibility, erosion, flooding, environmental degradation, infrastructure destruction, land encroachment, or pollution) to result from the proposed solar power project during construction. This unanimous perception reflects strong confidence in the project's environmental safety and proper management.

### 4.4.9 Positive Impacts of the Proposed Project

Respondents identified multiple positive impacts expected from the project, including constant power supply, increased productivity and efficiency, enhanced research and academic output for lecturers and students, promotion of economic development and prosperity, and reduction of noise and global warming. No negative impacts were identified by respondents, further demonstrating strong community support.

### 4.4.10 Community Expectations from the Project

The survey revealed several key expectations from the community. Employment of locals and contracting opportunities during construction was expected by 80% of respondents, capacity building for maintenance during implementation by 90%, and community input into final engineering design by 20%. Additionally, respondents emphasized the importance of durability, proper maintenance, and adequate security to protect against theft and robbery.

## 4.5 Grievance Redress Mechanism

The Grievance Redress Mechanism (GRM) within institutional environments in Gombe State plays an important role in promoting fairness, accountability, and peaceful conflict resolution among students, staff, and other stakeholders. A grievance may arise from academic concerns such as grading disputes, supervision challenges, and examination results, as well as administrative issues including delays, misconduct, harassment, discrimination, or unfair treatment in the workplace. Within institutions such

as universities and training establishments in Gombe State, an effective GRM provides a formal and transparent process through which complaints can be reported, reviewed, and resolved without fear of victimization. The mechanism is guided by key principles including fairness, impartiality, confidentiality, timely resolution of complaints, non-retaliation against complainants, and proper documentation for accountability purposes.

In the context of institutional development projects and educational administration within Gombe State, a functional GRM is essential for maintaining trust, protecting the rights of stakeholders, improving institutional governance, and ensuring a peaceful academic and working environment conducive to learning and productivity.

**Step-by-Step Process of Grievance Redress**

- Informal Resolution
- Departmental / Faculty Level
- Grievance Committee
- Appeal to the Commandant
- Grievances in the Last Three Years
- Grievance Reporting Channels
- Satisfaction with Grievance Resolution
- Specific Concerns about the Project

# CHAPTER FIVE
# DESCRIPTION OF ENVIRONMENTAL AND SOCIAL IMPACTS

## 5.1 Introduction

The basis for identification of potential environmental and social impacts that may be associated with the proposed Solar Power project was formed during field inspections and observations, issues arising from stakeholder consultations as well as project description and designs.

Highlights of the ESMP as the primary instrument for ensuring that a project's commitment to sustainability is maintained throughout its lifecycle, bridging the gap between theoretical impact prediction and practical field execution is presented here. By establishing a rigorous system of governance, the ESMP ensures that project activities remain in strict alignment with national regulatory requirements, international lending standards, and the fundamental principles of corporate social responsibility. It provides a systematic blueprint for the mitigation of environmental and social risks and as well delineates the institutional framework, clearly assigning roles and responsibilities to project developers, contractors, and environmental consultants to ensure accountability at every stage of development. It also integrates specific mitigation measures, monitoring protocols, and reporting requirements designed to protect natural ecosystems, minimize pollution, and safeguard the well-being of local communities.

## 5.2 Project Area of Influence

The immediate geographical area of influence of work for the proposed project is the land area allocated for the project while the larger geographical area of influence covers the Federal University, Kashere and a section of its environs.

### 5.2.1 Physical Environmental Media Influence

The physical environmental media to be potentially influenced by the activities of the proposed project are land (landscape), air quality, groundwater and any adjacent drain to any of the project sites. The landscape features include soil, flora and fauna at the proposed project site, which will be impacted by the project activities. Any adjacent drain to any of the project sites will be the recipient of runoff water from the project site. Any percolation of fuels through the soil may impact on groundwater resources. The air quality may also be impacted by dust and gaseous emissions from construction activities.

## 5.3 Impacts of the Project Activities on the Environmental and Social Components

Activities of potential environmental and social impacts identified with the proposed project are outlined under the four phases of the project activities; namely pre-construction; construction; operations/maintenance and decommissioning phases. The activities are discussed below

Pre-construction Phase Activities

- Siting of workers camp, where necessary
- Assessment of existing project location, selection of beneficiary institutions, field studies and environmental screening;
- Preparation of environmental and social screening reports;
- Statutory permitting activities from appropriate authorities.

Construction Phase Activities

- Site clearing and excavation works;

- Identification of storage area for construction material;
- Transportation and handling of materials and equipment;
- Civil, mechanical, and electrical works
- Construction of waste bin bays (where applicable); and
- Disposal of construction waste/rubble and waste in general.

Decommissioning activities after construction will involve:

- Removal of construction equipment
- Disposal of construction spoil and waste in general; and

Operations and Maintenance Phase Activities

- Housekeeping;
- Waste management (collection and disposal);
- Maintenance and repair work; and
- Materials management and storage (including personal protective equipment, etc.).

Decommissioning Phase

Decommissioning issues under this project will occur after construction and will cover the following:

- Dismantling of temporary work camp of the contractor;
- Waste management; and
- Restoration of landscape around construction site

## 5.4 Evaluation of Potential Positive Impacts

**Table 5.1: Evaluation of Potential Positive Impacts.**

| Activity | Receptor | Associated Impact | Significance |
|---|---|---|---|
| Reliable Power supply to the University community through solar energy source | FUK community | Improve the quality of education and other services within the institution as there will be longer hours available with better illumination for studying and will also contribute to the achievement of Nigeria's carbon emission reduction targets (20% reduction by the year 2030) in fulfilment of the nation's Nationally Determined Contributions (NDC) to climate change | MajorDESC |
| Reduced noise and pollutants from generator sets, and natural habitats | FUK community | Human health will be protected from pollution arising from the use of fossil fuels | Moderate |
| Construction of renewable energy training centre | FUK Community members. | Provide capacity development through learning renewable energy technologies and practices in the University and consequently, the | Moderate |

| Activity | Receptor | Associated Impact | Significance |
|---|---|---|---|
| | | certification of trained individuals | |
| The installation of streetlights | FUK Community members | improve safety by reducing hazards associated with flammable fuels and candles and enhance security within the school. | Moderate |
| Stimulate economic activities and offer new opportunities for small businesses in the University premises | FUK and nearby Communities | Improve social cohesion and community development and generate new income | Moderate |
| The employment opportunities for skilled, semi-skilled, and unskilled labour | University and nearby communities | Multiply job creation, especially during construction to facilitate overall socioeconomic development | Moderate |

## 5.5 Evaluation of Potential Adverse Impacts Associated with the Proposed Project

The potential adverse impacts from project activities are grouped into the following subjects and discussed further according to the different applicable phases – Preconstruction, Construction, Operation and Decommissioning phase as presented in **Table 5.2.**

**Table 5.2: Evaluation of potential adverse impacts**

| Activity | Receptor | Associated Impact | Significance |
|---|---|---|---|
| **Pre-construction Phase** | | | |
| Site Selection/ land | Existing crop farming on site | • Loss of land for farming activities due to land<br>• Take for the Project | Moderate |
| Site clearing and preparation | Terrestrial flora and fauna | • Vegetation loss<br>• 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 topsoil<br>• Soil compaction and degradation<br>• Increased erosion potential<br>• Reduction in structural stability and percolative ability of soil | Minor |
| | Air Quality and Noise | • Air quality impacts due to emissions from site clearing equipment<br>• Increase in ambient noise levels | Minor |
| | Workers Safety | • Injuries and accidents to workers during site clearing and preparation. | Minor |
| Mobilization of construction equipment | Air Quality and Noise | • Air quality impacts from vehicular emissions (TSP, NOx, CO, SOx)<br>• Increase in noise levels | Minor |

| Activity | Receptor | Associated Impact | Significance |
|---|---|---|---|
| and materials to site | 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 |
| **Construction Phase** | | | |
| Movement of Equipment, Personnel and Plant Materials | Air Quality | • Vehicular emissions (CO, $SO_2$, $NO_2$) from exhaust<br>• Contribution to global warming and ozone layer depletion<br>• Dust emissions from construction activities | Minor |
| | Social System (Road) | • Increased traffic from heavy-duty trucks en route to project site | Minor |
| | Health & Safety | • Risk of accidents involving personnel and assets due to vehicle movement | Minor |
| Civil and Electrical Works / Installation Activities | Air Quality | • Emissions from construction equipment (SPM, NOx, CO, SOx)<br>• Dust from land clearing and stockpiles | Minor |
| | Ambient Noise | • Increased noise levels from construction activities | Minor |
| | Soil | • Increased erosion from excavation<br>• Reduced soil stability and permeability due to compaction | Moderate |
| | Terrestrial Flora and Fauna | • Loss of plant species due to invasive species<br>• Loss of fauna due to human activity and noise | Minor |
| | Groundwater | • Depletion of groundwater from abstraction (e.g., concrete mixing, washing)<br>• Increased sediment load from erosion • Increased runoff and drainage formation from hard surfaces | Minor |
| | Gender | • Potential discrimination against women and GBV risks | Moderate |
| | Socio-economic & Health | • Influx of people leading to increased risk of sexually transmitted diseases | Moderate |
| | Infrastructure (Road) | • Road damage, traffic congestion, and safety concerns | Minor |
| | Construction Workers Safety | • Risk of injury during construction activities | Moderate |
| | Soil | • Soil contamination from construction waste (solid and liquid) | Minor |
| **Commissioning Phase** | | | |
| Waste Generation and Disposal | Groundwater | • Contamination from liquid construction waste streams | Minor |
| | Infrastructure (Waste Management Facility) | • Disposal of waste at existing facilities in project area | Negligible |
| Plant Testing | Ambient Noise | • Increase in ambient noise levels during testing activities | Minor |
| | Workers | • Occupational health and safety hazards (e.g., injuries, electrocution) due to incorrect electrical connections | Moderate |
| | Campus Occupants' Safety | • Risk of electrocution from wrong electrical connections | Minor |

| Activity | Receptor | Associated Impact | Significance |
|---|---|---|---|
| | Population Influx | • Temporary increase in population during commissioning phase | Negligible |
| | Infrastructure (Road) | • Increased traffic and risk of road accidents | Negligible |
| **Operational Phase** | | | |
| Power Generation and Distribution | Noise | • Noise from batteries and inverters during power generation and evacuation | Negligible |
| | Gender | • Discrimination of women during employment<br>• GBV (sexual harassment, assault, poor working conditions) | Minor |
| | Socio-economic (Visual) | • Landscape alterations causing unpleasant visual changes in the area | Negligible |
| | Socio-economic (Health Issues) | • Community health and safety concerns due to electromagnetic field (EMF) radiation | Negligible |
| | Health, Safety and Welfare of Staff (Plant Operation) | • Electric shock and injuries during plant operation<br>• Work-related issues (discrimination, denial of rights, unfair treatment, poor working conditions) | Moderate |
| Routine Maintenance | Soil | • Soil contamination from spent batteries and inverters | Minor |
| | Groundwater | • Groundwater abstraction from cleaning of PV panels | Minor |
| Waste Generation and Disposal | Soil & Groundwater | • Soil and groundwater contamination from waste streams | Negligible |
| | Health, Safety and Welfare of Staff (Maintenance) | • Electric shock and injuries during maintenance activities | Minor |

# CHAPTER SIX
# ENVIRONMENTAL AND SOCIAL MITIGATION AND MANAGEMENT PLAN

## 6.1 Introduction

The Environmental and Social Management Plan (ESMP) is a detailed plan and schedule of measures necessary to minimize, mitigate or control any potential negative environmental and social impacts identified under this project.

This ESMP consists of a set of mitigation, monitoring and institutional measures to be taken during the implementation and operation of the proposed project to eliminate negative environmental and social impacts, offset them or reduce them to acceptable levels.

The ESMP also incorporates the actions needed to implement these measures, including the following features:

- Mitigation measures based on the potential environmental and social impacts describing with technical details each mitigation measure;
- The ESMP also includes monitoring objectives that specifies the type of monitoring activities that will be linked to the mitigation measures. Specifically, the monitoring section of the ESMP provides:

    - A specific description, and technical details, of monitoring measures that includes the parameters to be measured, frequency of measurements and definition of thresholds that will signal the need for corrective actions;
    - Monitoring and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures and to furnish information on the progress and results of mitigation.

- The ESMP provides a description of institutional arrangements i.e. who is responsible for carrying out the mitigating and monitoring measures (for operation, supervision, enforcement, monitoring of implementation, remedial action, financing, reporting, and staff training);
- Additionally, the ESMP includes an estimate of the costs of the measures and activities recommended; and
- The ESMP is required all through the implementation stage of the project or sub-project.

## 6.2 Mitigation/Action Plan

Mitigation and management measures for the significant adverse impacts (rated as moderate or major) identified from the analysis and evaluation of the potential impacts from the proposed project activities are provided in table 6.1.

**Table 6.1: Mitigation measures/actions for potential significant adverse environmental impacts**

| No | Project Activities | Potential Environmental and Social Impacts | Proposed Mitigation Measures/Actions | Responsibility | location | Cost |
|---|---|---|---|---|---|---|
| | | | **Pre-construction Phase** | | | |
| **1** | Site selection/Land | Loss of land for farming activities | REA shall:<br>• Engage affected communities through consultation and participation | Director of Works and Physical Planning/PIU | **Project site/affected community** | **850,000** |
| 2 | Site clearing and preparation | • Vegetation loss<br>• Direct and indirect impacts on flora and fauna | REA shall:<br>• Minimize clearing footprint<br>• Conduct pre-clearance ecological surveys<br>• Avoid clearing during breeding seasons<br>• Implement biodiversity management plan | Site Engineer | Project footprint | 1,275,000 |
| | | • Loss of topsoil<br>• Soil compaction and erosion<br>• Reduced soil stability | REA shall:<br>• Strip and store topsoil<br>• Restrict heavy machinery movement<br>• Implement erosion control (mulching, silt fences)<br>• Progressive restoration | Site Engineer | Site clearing areas | 1,020,000 |
| | | • Air emissions from equipment<br>• Increased noise levels | REA shall:<br>• Maintain machinery regularly<br>• Apply dust suppression (water spraying)<br>• Limit work to daytime<br>• Provide PPE for noise protection | Site Engineer | Project site | **765,000** |
| | | Injuries and accidents | REA shall:<br>• Implement OHS procedures (ILO standards)<br>• Provide PPE<br>• Conduct safety training/toolbox talks | HSE | Project site | 1,360,000 |

| No | Project Activities | Potential Environmental and Social Impacts | Proposed Mitigation Measures/Actions | Responsibility | location | Cost |
|---|---|---|---|---|---|---|
| | | | • Enforce supervision | | | |
| 3 | Mobilization of Construction Equipment & Materials | • Vehicular emissions (TSP, NOx, CO, SOx)<br>• Increased noise levels | REA shall:<br>• Maintain vehicles to emission standards<br>• Optimize logistics<br>• Enforce speed limits and reduce idling<br>• Use low-sulfur fuels | Site engineer | Access roads/project site | 850,000 |
| | | | **Construction Phase** | | | |
| 1 | Movement of Equipment, Personnel & Materials | • Vehicular emissions (CO, $SO_2$, $NO_2$)<br>• Dust emissions | REA shall:<br>• Maintain vehicles regularly<br>• Use low-sulfur fuels<br>• Apply dust suppression (water spraying, covering trucks)<br>• Limit idling and enforce speed limits | Site Engineer | Access roads/project site | 1,020,000 |
| | | • Increased traffic and congestion | REA shall:<br>• Implement Traffic Management Plan<br>• Schedule deliveries off-peak<br>• Use designated routes<br>• Community awareness and signage | Site Engineer/Traffic Control Officer | Access roads/nearby communities | 1,275,000 |
| | | • Risk of accidents | REA shall:<br>• Train drivers<br>• Enforce speed limits<br>• Conduct vehicle inspections<br>• Use traffic marshals and signage | Site Engineer/HSE | Haulage/access routes | 850,000 |

| No | Project Activities | Potential Environmental and Social Impacts | Proposed Mitigation Measures/Actions | Responsibility | location | Cost |
|---|---|---|---|---|---|---|
| 2 | Civil & Electrical Works / Installation | • Air emissions and dust generation<br>• Increased noise levels | REA shall:<br>• Maintain equipment<br>• Apply dust suppression<br>• Limit work during high winds<br>• Provide PPE<br>REA shall:<br>• Restrict work to daytime<br>• Use silencers<br>• Provide hearing protection<br>• Establish buffer zones | Site Engineer | Construction areas | 1,275,000 |
| | | • Soil erosion and compaction | REA shall:<br>• Install silt fences and drainage<br>• Restrict machinery movement<br>• Rehabilitate progressively<br>• Proper grading | Site Engineer | Civil works/excavation areas | 1,275,000 |
| | | • Loss of flora and fauna | REA shall:<br>• Minimize clearing<br>• Control invasive species<br>• Restrict worker movement<br>• Implement biodiversity plan | Site Engineer | Project footprint | 1,020,000 |
| | | • Groundwater depletion and contamination | REA shall:<br>• Use water efficiently<br>• Monitor abstraction<br>• Install sediment traps<br>• • Prevent contamination | Site Engineer | Project site/water points | 850,000 |
| | | • GBV and discrimination risks | REA shall:<br>• Implement Gender & GBV Action Plans<br>• Enforce code of conduct<br>• Awareness training<br>• Grievance mechanism | State Ministry of Women's Affairs & Social Development (GBV/SEA Service Provider) | Site/host community | 1,700,000 |

| No | Project Activities | Potential Environmental and Social Impacts | Proposed Mitigation Measures/Actions | Responsibility | location | Cost |
|---|---|---|---|---|---|---|
| | | • Spread of STDs | REA shall:<br>• Carry out Health awareness programs<br>• Provide testing access<br>• Enforce worker conduct<br>• Collaborate with health agencies | Director of Physical planning/PIU | Site/host community | 1,020,000 |
| | | • Road damage and congestion | REA shall:<br>• Traffic management plan<br>• Maintain roads<br>• Control vehicle loads<br>•Coordinate with authorities | Site Engineer | Project access roads | 1,700,000 |
| | | • Worker injuries and accidents | REA shall:<br>• Implement OHS system (ILO aligned)<br>• Provide PPE<br>• Conduct training<br>•Emergency preparedness | SITE Engineer/HSE | Construction site | 2,040,000 |
| | | | **Commissioning Phase** | | | |
| | Plant Testing | • Increase in ambient noise levels during testing activities | REA shall:<br>• Restrict testing to daytime hours<br>• Use well-maintained equipment with noise suppression features<br>• Notify nearby occupants in advance<br>• Provide hearing protection (PPE) to workers | Director of Physical planning/PMU | Testing/plant area | 510,000 |
| | | • Occupational health and safety hazards (injuries, electrocution due to incorrect connections) | REA shall:<br>• Implement electrical safety procedures (lockout/tagout)<br>• Use certified personnel only<br>• Provide PPE (insulated gloves, boots) | Site Engineer/HSE | Electrical installations | 1,020,000 |

| No | Project Activities | Potential Environmental and Social Impacts | Proposed Mitigation Measures/Actions | Responsibility | location | Cost |
|---|---|---|---|---|---|---|
| | | | • Conduct safety checks and supervision<br>• Ensure emergency response readiness | | | |
| | | • Risk of electrocution to campus occupants | REA shall:<br>• Restrict access to testing areas<br>• Install warning signage and barriers<br>• Ensure proper grounding and insulation<br>• Supervise all testing activities | Site Engineer | Plant/site boundary | 680,000 |
| | | | **Operational Phase** | | | |
| 1 | Power Generation & Distribution | • Discrimination of women in employment• GBV (sexual harassment, assault, poor working conditions) | REA shall:<br>• Implement Gender Action Plan & GBV prevention (World Bank aligned)<br>• Enforce equal opportunity employment<br>• Worker code of conduct & training<br>• Confidential grievance mechanism | PMU/Site Engineer | Plant/workplace | 1,020,000 |
| | | • Electric shock and injuries<br>• Workplace discrimination | REA shall:<br>• Implement OHS system (ILO aligned)<br>• Install LOTO systems & signage<br>• Provide PPE (insulated gloves, boots)<br>• Conduct training & audits<br>• Enforce fair labor practices | PMU/Site Engineer/Director of Physical works | Generation/distribution facilities | 680,000 |
| 2 | Routine Maintenance | • Soil contamination from batteries and inverters | REA shall:<br>• Store hazardous materials in sealed/labeled containers<br>• Implement hazardous waste plan<br>• Use certified waste handlers<br>• Install secondary containment & spill response | PMU/Site Engineer | Battery/inverter area | 1,700,000 |

| No | Project Activities | Potential Environmental and Social Impacts | Proposed Mitigation Measures/Actions | Responsibility | location | Cost |
|---|---|---|---|---|---|---|
| | | • Groundwater use for panel cleaning | REA shall:<br>• Use water-efficient/dry-cleaning methods<br>• Harvest/reuse rainwater<br>• Monitor abstraction & comply with permits<br>• Apply water conservation measures | Site Engineer | Solar array/water source | 1,020,000 |
| 3 | Waste Generation & Disposal | • Electric shock and injuries during maintenance | REA shall:<br>• Enforce LOTO procedures<br>• Provide PPE & insulated tools<br>• Conduct competency-based training<br>• Routine inspection & supervision | Site Engineer | Operational facilities | 680,000 |
| | | | | | | |
| | | | **Decommissioning Phase** | | | |
| 1 | Dismantling of Plant & Equipment | • Dust emissions<br>• Emissions from machinery and vehicles | REA shall:<br>• Apply dust suppression (water spraying)<br>• Use low-emission equipment<br>• Cover haulage trucks<br>• Limit idling | Director of Public Works/ Site Engineer | Decommissioning site | 1,020,000 |
| | | • Increased noise levels | REA shall:<br>Restrict daytime hours<br>• Use silencers<br>• Provide hearing PPE<br>• Notify nearby communities | Director of Public Works/ Site Engineer | Plant/nearby receptors | 680,000 |
| | | • Injuries and electrocution risks | REA shall:<br>• Implement OHS procedures (ILO aligned)<br>• Apply LOTO systems<br>• Provide PPE<br>• Use trained personnel<br>• Emergency preparedness | Director of Public Works/ Site Engineer | Plant/electrical areas | 1,700,000 |

| No | Project Activities | Potential Environmental and Social Impacts | Proposed Mitigation Measures/Actions | Responsibility | location | Cost |
|---|---|---|---|---|---|---|
| 2 | Removal of Foundations & Civil Works | • Soil disturbance, erosion, compaction | REA shall:<br>• Minimize excavation footprint<br>• Implement erosion controls<br>• Reinstate topsoil<br>• Progressive rehabilitation | Director of Public Works/ Site Engineer | Former plant footprint | 1,020,000 |
| | | • Groundwater contamination risks | REA shall:<br>• Proper storage of fuels/chemicals<br>• Spill prevention & response plan<br>• Prevent contaminant discharge<br>• Regular inspections | Director of Public Works/ Site Engineer | Decommissioning area | 680,000 |
| 3 | Waste Generation & Disposal | • Soil & groundwater contamination from waste | REA shall:<br>• Implement waste management plan<br>• Use licensed contractors<br>• Secure hazardous waste storage<br>• Comply with regulations | Director of Public Works/ Site Engineer | Site/approved disposal facilities | 1,360,000 |
| | | • Pressure on waste infrastructure | REA shall:<br>• Coordinate with approved facilities<br>• Schedule transport efficiently<br>• Promote recycling and recovery | Director of Public Works/ Site Engineer | Approved waste facilities | 1,700,000 |
| 4 | Transportation of Decommissioned Materials | • Emissions and noise from vehicles | REA shall:<br>• Maintain vehicles<br>• Optimize logistics<br>• Enforce speed limits<br>• Use designated routes | Director of Public Works/ Site Engineer | Haulage routes | 2,550,000 |
| | | • Traffic congestion and road safety risks | REA shall:<br>• Traffic Management Plan<br>• Trained drivers & signage<br>• Off-peak scheduling<br>• Repair road damage | Director of Public Works/ Site Engineer | Access/public roads | 1,275,000 |
| | | • Community accident risks | REA shall:<br>• Community awareness programs | Director of Public Works/ Site Engineer | Communities along haulage routes | 1,020,000 |

| No | Project Activities | Potential Environmental and Social Impacts | Proposed Mitigation Measures/Actions | Responsibility | location | Cost |
|---|---|---|---|---|---|---|
| | | | • Warning signs and barriers<br>• Escort oversized loads<br>• Enforce safety protocols | | | |
| 5 | Site Restoration & Rehabilitation | • Habitat loss prior to restoration | REA shall:<br>• Re-vegetate with native species<br>• Restore habitat conditions<br>• Monitor ecological recovery<br>• Prevent invasive species | Director of Public Works/ Site Engineer | Entire disturbed project area | 2,550,000 |
| | | • Loss of employment post-closure | REA shall:<br>• Worker transition programs<br>• Skills training<br>• Job placement support<br>• Stakeholder engagement | Director of Public Works/ Site Engineer | Workforce/host community | 1,700,000 |

## 6.3 Environmental and Social Monitoring

Environmental and Social monitoring is an important aspect of an ESMP during project implementation. It is a way of systematically monitoring both effects and compliance of the proposed project to existing regulations throughout the entire life cycle and shall oversee the effectiveness of impact mitigation measures, including the extent to which mitigation measures are successfully implemented. Particularly, monitoring shall:

- Improve environmental and social management practices;
- Check the efficiency and quality of the ESMP processes;
- Establish the scientific reliability and credibility of the ESMP for the project (as well as the quality of specialists providing ESMP consultancy services
- Provide the opportunity to report the results on safeguards and impacts and proposed mitigation measures implementation.

Upon commencement of sub-project implementation in the construction works, the environmental and social specialist and the safeguard unit of Gombe NUWSRP3 will begin monitoring as an important feedback mechanism. This ensures compliance with the environmental and social measures of the ESMP.

Methods for monitoring the implementation of mitigation measures or environmental impacts should be as simple as possible, consistent with collecting useful information, so that the implementation process can easily be applied.

These indicators could be used to ensure participation processes involved in project activities:

- Number and percentage of affected households/individuals/institutions consulted during the planning stage;
- Levels of decision-making of affected people;
- Level of understanding of project impacts and mitigation;
- Effectiveness of local authorities to contribute and make relevant decisions;
- Frequency and quality of public meetings; with community heads and general public;

The environmental and social monitoring plan is shown in **Table 6.2**.

**Table 6.2: Environmental and Social Monitoring Plan**

| No. | Environmental/ Social Component | Monitoring Parameters | Monitoring Site | Frequency | Responsibility (Implementation/ Supervision) | Cost Estimate/ ~~Year~~ (NGN) |
|---|---|---|---|---|---|---|
| 1. | Soil impacts | • Presence of habitats or vegetation at the site | Construction site | Daily (throughout the construction period) | PIU Safeguards Specialist, Project Contractor/ Engineering Consultant | No additional costs |
| 2. | Air quality/ Noise | • Observation of air borne particulates (dust) and exhaust fumes<br>• Records of dust level measurements (dust concentration should be below 150µg/$m^3$)<br>• Records of dampening of construction sites and routes for vehicles/trucks<br>• Daily noise levels. | • Construction site<br>• Immediate environs | Daily<br>During Peak construction period | PIU Safeguards Specialist, Project Contractor/ Engineering Consultant | 500,000.00 |
| 3. | Vibration and noise nuisance | • Complaints on noise nuisance | • Construction site<br>• Immediate environs | Daily (during construction) | PIU Safeguards Specialist, Project Contractor/ Engineering Consultant | |
| 4. | Visual Intrusion | • Hoarding in place<br>• Condition of areas around construction site | • Construction site<br>• Immediate environs | Daily (during construction) | PIU Safeguards Specialist, Project Contractor /Engineering consultant | No additional costs |
| 5. | Waste Management | • Transportation for monitoring of the provision and use of bins in project area<br>• Records on frequency and location of waste disposal site of domestic and construction waste | Construction site | Monthly (during construction) | PIU Safeguards Specialist, Project Contractor/ Engineering Consultant, FMEnv, GSMEnF | 500,000.00 |
| 6. | Occupational Health and Safety | • Transportation for monitoring workers' awareness of Contractor's health and safety policy<br>• Availability and proper use of PPEs | Construction site | Daily (during construction) | PIU Safeguards Specialist, Project Contractor/ Engineering Consultant | |

| No. | Environmental/ Social Component | Monitoring Parameters | Monitoring Site | Frequency | Responsibility (Implementation/ Supervision) | Cost Estimate/ ~~Year~~ (NGN) |
|---|---|---|---|---|---|---|
| | | • Availability and proper use of warning signs<br>• Availability of first aid kit<br>• Adherence to health and safety procedures<br>• Records on frequency, type and source of illness/accident/injury<br>• Records on non-compliances<br>• Absence of unauthorized persons at active construction sites | | | | |
| 7. | Public safety and traffic issues | • Transportation for monitoring availability and proper use of warning signs<br>• Hoarding of site<br>• Use of caution tape around trenches/ excavations<br>• Records on frequency, type and source of illness/accident/injury<br>• Absence of unauthorized persons at active construction sites | Construction Site | Daily (during construction) | PIU Safeguards Specialist, Project Contractor/Engineering consultant | 150,000 |
| 8. | Sanitation issues, health and safety impacts | • Availability and use of bins<br>• Records on frequency and location of waste disposal site of domestic and construction waste<br>• Mobile toilet facilities in place<br>• Presence of stagnant water in trenches | Construction site | Daily (during construction) | PIU Safeguards Specialist, Project Contractor/ Engineering Consultant | |
| 9. | Public Complaints/ Grievances Redress | Transportation for monitoring of Grievance Redress issues, which will include such elements as:<br>• Lodging and registration of PAPs grievance by grievance redress committee; | Project host community | Weekly (during construction) | GSMEnF ,PIU Safeguards Specialist, Project Contractor/ Engineering Consultant/school heads/medical director of hospital | No additional costs |

| No. | Environmental/ Social Component | Monitoring Parameters | Monitoring Site | Frequency | Responsibility (Implementation/ Supervision) | Cost Estimate/ ~~Year~~ (NGN) |
|---|---|---|---|---|---|---|
| | | • Redress decision, feedback and implementation;<br>• Dissatisfaction and alternative action; and<br>• Monitoring and evaluation | | | | 150,000.00 |
| 10. | Monitoring of Social Impacts | • Transportation to monitor impacts such as, labor influx, GBV and SEA, VAC and STDs. Potential temporary physical or economic displacement, if any and provide | Project host Community | Weekly (during construction) | **GSMEnF** , PIU Safeguards Specialist, Project Contractor/ Engineering Consultant/ medical director of hospital, Community Liaison Officer/Health centers | |
| 11 | Routine Maintenance | • Implementation of hazardous waste plan<br>• Implementation of Gender Action Plan and GBV prevention<br>• Worker code of conduct and training<br>• Provide PPE (insulated gloves, boots) | Project site and host community | Quarterly (during operation) | PIU and PMU | 350,000 |
| **TOTAL** | | | | | | **1,650,000.00** |

**Table 6.3: Specific Environmental Monitoring Plan**

| Impact Parameter | Project Phase | Impact Indicator | FMEnv Limits | Sampling Location | Sampling Frequency | Sampling Method | Monitoring Duration | Monitoring Personnel |
|---|---|---|---|---|---|---|---|---|
| Ambient Air Quality | Site preparation, Construction and Operation and decommissioning | TSP | 600µg/$m^3$ | Receiving air - upwind and downwind of site | Daily, during site preparation, construction; Quarterly during operation | Air Sampler | Short-term<br>Long-term | PMU-REA Contractor **GSMEnF** and FMEnv |
| | | $NO_2$ | 100 µg/$m^3$ | | | | | |
| | | $SO_2$ | 300 µg/$m^3$ | | | | | |
| | | CO | 20 ppm | | | | | |
| Noise | Site Preparation and Construction | Noise Level | 80 dBA (8-hr) | Work Site and 200m away | Daily (During site preparation, construction | Decibel oise Meter | Short-term | PIU-REA Contractor |

| Impact Parameter | Project Phase | Impact Indicator | FMEnv Limits | Sampling Location | Sampling Frequency | Sampling Method | Monitoring Duration | Monitoring Personnel |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | **GSMEnF** and FMEnv |
| Soil | Site Preparation and construction. | Particle Size, TOC, Oil and Grease Heavy Metals, Nutrients, | As specified in FMEnv Guidelines | Within and around construction area. | Once, before and after construction | Visual Inspection and Soil auger | Short-term | PIU-REA Contractor **GSMEnF** & FMEnv |
| Socio-economics | Construction stage | Absence of Contractor/community conflict, increase/ decrease in economic activities | National/ World Bank guidelines and procedures | Host FUK community | Monthly during construction | Socio-economic survey, observations and interviews | Short term | PIU-NUWSRP3 Contractor **GSMEnF** & FMEnv |
| Health | Construction and operation | Presence/ absence of alien diseases | National health survey guidelines | Host FUK community | Monthly at construction and bi-annually at operation stages | Interview and medical examinations and records | Long term | PIU-REA and **GSMEnF** |

## 6.4 Capacity Building for Implementation of ESMP and Permit Conditions

REA shall identify, plan, monitor, and record training needs for personnel whose work may have a significant adverse impact on the environmental or social conditions. Employees at each relevant phase of the project must be aware of the potential environmental impacts of their activities and the occupational hazards associated with the work; as well as their roles and responsibilities in achieving conformance with the management documented in this report. Thus, a formal training process will be organized for employees on environmental management programs, plans and procedures associated with the project.

All staff employed will be trained in the following:

- General operation of the plant.
- Environmental management.
- Specific job roles and procedures.
- Occupational health and safety; and
- Contingency plans and emergency procedures. Training will include:
- Induction training on appointments.
- Specialist training (as required for specific job roles); and
- Refresher training as required.

Training for the local community on general environmental awareness and ESMP mitigation measures on community health, safety, and security shall also be provided.

**Objectives of the training**

The main objective of the capacity building and training activities is to create, enhance and develop the necessary skills and abilities for successful implementation of the proposed project.

It is recommended that the site meetings to discuss the ESMP issues and any health and safety issues identified in the course of the month. Non-compliances identified during monitoring should be reviewed and corrective actions taken. The capacity building plan proposed to achieve this is provided in **Table 6.3**.

**Table 6.4: Capacity building plan for implementation of the ESMP.**

| No. | Activity | Target Group/Participants | Timeline/Duration | Proposed Facilitator | Cost USD |
|---|---|---|---|---|---|
| 1. | **Specialized Training on Environmental & Social Management** (ESMP, safeguards, monitoring, reporting) | PMU, Environmental & Social Safeguard Officers | 3 days (annually | Consultant / PMU | 4,500 |
| 2. | **ESMP Implementation Training** (mitigation measures, roles & responsibilities, monitoring procedures) | Project Team (PMU, Site Engineer, Supervisors) | 3 Days (annually) | Consultant / PMU | 1,500 |
| 3 | **Contractor Training on ESMP Compliance** (mitigation measures, | Contractor's management, workers, HSE Officers | 1 day (annually) | Consultant / PMU | 1,500 |

| No. | Activity | Target Group/Participants | Timeline/Duration | Proposed Facilitator | Cost USD |
|---|---|---|---|---|---|
| | Code of Conduct, OHS requirements) | | | | |
| 4 | **Driver & Traffic Management Training** (fleet management, road safety, traffic control within project area) | Drivers, Transport Officers, HSE Officers, Security Personnel | 1 day (quarterly | Transport/Traffic Specialist / PMU | 1,200 |
| 5 | **GBV/SEA/SH Prevention & Response Training** (Code of Conduct, reporting channels, survivor-centered approach) | Project Team, Safeguard Officers, Contractors | 3 Days (biannually) | GBV Specialist / Consultant / PMU | 2,500 |
| 6 | **Grievance Redress Mechanism (GRM) Training** (complaint handling, documentation, resolution process) | GRC Members (project & management levels), PMU | 3 days (biannually) | Consultant / PMU | 2,000 |
| **Total** | | | | | **13,000** |

**Table 6.5: Description of cost breakdown**

| Description | Cost (USD) |
|---|---|
| Professional fee for 2 Consultants | 3,500 |
| Rent/Hiring of venue | 4,500 |
| Feeding of participants - tea break | 2,000 |
| Feeding of participants (4 days) | 3,200 |
| **Total** | **13,200** |

**Output of the Training**

An efficient capacity building programme takes into consideration the health, safety, environmental and social management measures as provided in this chapter. The focus is to ensure the effective implementation of the ESMP and the permit conditions. All monthly and progress reports shall capture health, safety and environment capacity building activities carried out.

## 6.5 Institutional Arrangements

Institutional arrangement for the implementation of the Framework of this ESMP shall comprise:

- REA Project Office
- The Federal Government of Nigeria (FGN)
- Federal Ministry of Power
- Transmission Company of Nigeria (TCN)
- Federal Ministry of Environment (FMEnv)
- Nigerian Electricity Regulatory Commission (NERC)
- National Environmental Standards and Regulatory Enforcement Agency (NESREA)
- National University Commission (NUC)

- Gombe State Ministry of Lands
- Akko Local Government Area (LGA)

**Roles and Responsibilities for the Implementation of the Framework ESMP**

The Rural Electrification Agency Project Management Unit (REA-PMU) supervises the implementation of the ESMP throughout the project life span while conformance with the mitigation measures will be ensured by the Engineering, Procurement and Construction (EPC) contractor during the construction phase and by the operations and maintenance (O&M) contractor during the operational phase of the project. **Table 6.4** indicates the roles and Responsibilities of the Stakeholders in the Implementation, Monitoring and Review of the ESMP.

| Table 6.6: The Roles and Responsibilities of the Stakeholders in the Implementation, Monitoring and Review of the ESMP | | | | | |
|---|---|---|---|---|---|
| **Stakeholder** | **Pre-Construction Phase** | **Construction Phase** | **Commissioning Phase** | **Operational Phase** | **Decommissioning Phase** |
| **Director of Works / Physical Planning** | • Approve site and land use<br>• Review ESMP and ensure institutional commitment<br>• Appoint & train Site Engineer<br>• Ensure livelihood restoration before mobilization | • Supervise ESMP implementation• Ensure contractor compliance<br>• Address grievances and enforce corrective actions | • Oversee safe plant testing<br>• Ensure stakeholder communication<br>• Confirm readiness for operation | • Review ESMP reports<br>• Recommend improvements to PMU/O&M<br>• Ensure safeguards (OHS, GBV, environment) | • Oversee decommissioning activities<br>• Ensure site restoration<br>• Support livelihood transition |
| **REA – PMU** | • Approve ESMP and integrate into contracts<br>• Coordinate stakeholders and regulators<br>• Allocate ESMP budget | • Monitor compliance and conduct audits• Report to regulators<br>• Enforce corrective actions | • Ensure compliance during testing<br>• Approve transition to operation | • Oversee ESMP implementation• Ensure monitoring, audits, reporting• Address non-compliance | • Supervise dismantling compliance<br>• Ensure waste management<br>• Prepare closure reports |
| **Site Engineer** | • Support ESMP planning<br>• Participate in training | • Implement ESMP daily on-site• Monitor EHS compliance• Maintain records and reports | • Supervise testing<br>• Ensure safety procedures (LOTO, PPE)<br>• Report incidents | • Monitor operations & maintenance<br>• Ensure ESMP compliance• Report environmental & safety issues | • Supervise dismantling<br>• Monitor waste handling<br>• Support site rehabilitation |
| **NESREA / FMEnv Representatives** | • Review and approve ESMP/ESMP• | • Monitor ESMP implementation | • Monitor compliance during commissioning | • Monitor ESMP implementation | • Monitor decommissioning activities |

| Table 6.6: The Roles and Responsibilities of the Stakeholders in the Implementation, Monitoring and Review of the ESMP | | | | | |
|---|---|---|---|---|---|
| | Issue environmental permits | (environmental compliance)<br>• Conduct inspections and enforce regulations<br>• Engage stakeholders on compliance issues | • Verify environmental and safety readiness | (environmental compliance)<br>• Conduct periodic audits and inspections<br>• Discuss ESMP improvements with PMU, Director, and O&M Contractor to address non-compliance and emerging risks | • Verify environmental restoration<br>• Approve closure compliance<br>• Recommend corrective actions where necessary |
| State Ministry of Women's Affairs & Social Development (GBV/SEA Service Provider) | • Review Gender/GBV Action Plans• Support stakeholder engagement on GBV risks | • Monitor implementation of gender and GBV mitigation measures• Provide GBV/SEA support services• Conduct awareness programs | • Monitor GBV risk during commissioning activities• Ensure reporting and response mechanisms are active | • Monitor Gender Action Plan implementation<br>• Handle GBV/SEA cases confidentially<br>• Provide survivor support services<br>• Engage with PMU, Director, and Gender Officer on improvements | • Monitor GBV risks during workforce demobilization<br>• Support vulnerable groups and affected persons<br>• Ensure proper closure of GBV cases and services |

### 6.6 Estimated Budget for ESMP Implementation

**Table 6.7** provides a summary of the cost estimate required to effectively and efficiently implement the recommended mitigation measures and management plans required to address the potential and associated impacts of the proposed project. The total cost of implementing the ESMP is estimated at US$ **57,300** with the current Naira value of 1,3500 to 1 dollar.

**Table 6.7: Cost of ESMP**

| S/N | ESMP Activity | Cost (USD) | Key Cost Components | Justification |
|---|---|---|---|---|
| 1 | Pre-Construction Phase | 8,000 | Stakeholder engagement, ESMP disclosure, livelihood restoration planning, training of safeguards staff | Required to address social risks early, prevent conflicts, and ensure readiness before project mobilization |
| 2 | Construction Phase | 13,000 | Daily monitoring, mitigation measures (dust, erosion, OHS), PPE, inspections, reporting | Most impact-intensive phase requiring continuous supervision and high resource allocation |
| 3 | Commissioning Phase | 800 | Testing supervision, safety monitoring, stakeholder notification | Short-term phase with limited activities but critical safety requirements |
| 4 | Operational Phase | 13,500 | Routine monitoring, OHS audits, waste management, GBV/SEA implementation, reporting | Long-term phase requiring sustained compliance, monitoring, and system maintenance |
| 5 | Decommissioning Phase | 4,000 | Dismantling supervision, waste disposal, site restoration, livelihood transition | Ensures safe closure, environmental restoration, and social safeguards at project end |
| 6 | Mitigation & Monitoring | 7,000 | Environmental sampling, inspections, compliance audits, documentation | Dedicated funding ensures effective tracking of impacts and regulatory compliance |
| 7 | Capacity Building | 11,000 | ESMP training, OHS training, GBV/SEA awareness, GRM training | Builds stakeholder capacity for effective ESMP implementation and sustainability |
| | **TOTAL** | **57,300** | | **Cost reflects full lifecycle ESMP implementation aligned with international standards** |

# CHAPTER SEVEN
# INCIDENT REPORTING AND EMERGENCY RESPONSE PLAN

## 7.1 Introduction

For a project of this nature, Incident Reporting and Emergency Response Plan (ERRP) is a specialized component of the ESMP that addresses the unique risks associated with large-scale photovoltaic (PV) installations, such as electrical hazards, chemical spills from battery energy storage systems (BESS), and fire risks.

The primary objective of the ERRP is to establish a clear protocol for the identification, notification, and mitigation of emergencies. The plan must be structured around a tiered response system.

## 7.2 Key components

The key components of ERRP include:

1. **Emergency Organization and Responsibilities:** The plan must define the "Emergency Coordinator" role, who holds the authority to halt site operations. This individual is responsible for maintaining communication with local emergency services, such as fire departments and medical facilities, which is critical given the remote locations often chosen for solar farms.
2. **Hazard-Specific Procedures:** Solar projects require specific protocols for:
    - **Electrical Hazards:** Procedures for de-energizing arrays during maintenance or fire events to prevent arc flash injuries.
    - **Battery Energy Storage System (BESS) Safety:** If the project includes lithium-ion battery storage, the plan must detail thermal runaway mitigation, including specialized fire suppression techniques and hazardous material containment to prevent toxic gas release.
    - **Natural Disasters:** Protocols for high-wind events (e.g., stowing trackers in a "park" position) and flood mitigation for inverter stations.
3. **Reporting and Investigation:** Every incident, including "near misses," must be documented in an Incident Log. The reporting process follows a strict timeline: initial notification within 2 hours, and a detailed Root Cause Analysis (RCA) report within 48 hours. This data is used to calculate the incident frequency rate, ensuring that the project remains within the safety thresholds defined during the design phase.
4. **Communication and Training:** The ERRP mandates regular emergency drills—such as fire evacuation and spill response—to ensure that all personnel, including subcontractors, are familiar with assembly points and alarm signals

# CHAPTER EIGHT
# REMEDIATION AND ABANDONEMENT PLAN

## 8.1 Remediation Plan After Decommissioning/ Closure

Upon the completion of useful life cycle of a project, there is a need to abandon and/or decommission such project if it no longer becomes economically viable either as a result of depleted feed stock or competing technology. The proposed solar project is expected to have a life span of 25 years. It is envisaged that technology and environmental policies could have changed so drastically by then, hence a definite decommissioning plan cannot be put in place for now. However, it is of importance that abandonment activities be planned in advance in accordance with the Nigerian regulatory requirements.

## 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 Photovoltaic (PV) power plant to be provided as part of the proposed Project is 25years (which can be extended through regular maintenance), while the training center can last for 40 years or more. Even after 25 years, the PV panels can still generate up to 90% of the design capacity.

During decommissioning, REA shall ensure that the project sites are returned to a safe and environmentally acceptable condition. 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;
- Restore the environment to allowable baseline conditions and monitor the process in line with legislative and regulatory requirements and best industry standards; and
- Assess the residual impacts, if any, that the project has on the environment; and specifically, if there are any future restrictions for other activities.

## 8.3 Management of Decommissioning Activities

In the event of decommissioning, REA, in conjunction with the leadership of the Academy, 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;
- 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.
  - 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; o 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 should be carried out before any demolition and should 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 the operational phase) and 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.

**8.4 Abandonment Plan**

Before site abandonment, REA shall establish a standard procedure for incorporating the following practices:

- Identification of the components of the power plant that will be abandoned and/or removed;
- The proposed methods for abandonment or re-use of the plant equipment/material are 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).

In the event of the project being abandoned, this shall be done in accordance with strict compliance with legislative requirements and international best practices. The decommissioning, abandonment and/or closure programme shall generally be managed by a team of competent personnel from the REA-Project Management Unit, the Department of Works and Physical Planning Department of the Academy. The abandonment process shall be carried out as follows:

- Relevant stakeholders shall be duly informed;
- Physical Asset Verification (PAV) of the facilities shall be carried out;
- National Sectoral Regulations, as they affect the abandonment of the project, shall be strictly complied with to ensure:
- Restoration and rehabilitation of the environment.

- Management of residual impacts of the project in strict compliance with extant
- National/ FMEnv sectoral regulations.

In addition, a site close-out permit shall be obtained as appropriate and a close-out report shall be prepared and archived for future reference.

# CHAPTER NINE
# STAKEHOLDERS ENGAGEMENT AND GRIEVANCE REDRESS MECHANISM

## 9.1 PREAMBLE

Consultations play a crucial role in identifying the key environmental and social issues that are central to the preparation of this ESIA. A Stakeholder Engagement Plan (SEP) was developed to support the effective and sustainable implementation of all phases of the Project lifecycle, including pre-construction, construction, operation, and decommissioning.

The SEP outlines the methods used to identify stakeholders, the approaches adopted for engaging them, and the outcomes of consultations conducted to date. It also details the measures taken by the Project to ensure that relevant information was appropriately disclosed to stakeholders.

## 9.2 Stakeholder Engagement

A Stakeholder Engagement Plan (SEP) is the process of managing stakeholder expectations, which influences project decisions throughout the life cycle of the project. This process provides a plan to interact effectively with stakeholders and support the project's interests. It is very important to plan these activities well so that they appraise the contribution of stakeholders on projects, manage their expectations, and achieve project objectives. The stakeholder engagement process emphasized free, prior, and informed consultation (FPIC) with affected communities and other relevant stakeholders, while considering appropriate approaches for involving vulnerable and marginalized groups. Consultations included early disclosure of information in formats that are accessible and easily understood, as well as key informant interviews, focus group discussions (segmented by men, women, and youth), and broader public meetings.

**Table 9.1: Stakeholders Engagement Plan (SEP)**

| Groups and individuals | Date | Type of Engagement | Discussion |
|---|---|---|---|
| Management of the University of Kashere | 11/02/2026 | Consultation /homage | Overview of the ESIA, benefits of the proposed REA Solar project |
| University Community | 12/02/2026 | Focal Group Discussion, | An overview of the ESIA and the benefits of the proposed REA solar project. |

All consultation activities were properly documented, including relevant data, supporting evidence, participant lists with contact information, and photographic records. Information disclosure complied with the provisions of national regulations, including the EIA Act No. 86 of 1992 (as amended under Cap E12 LFN 2004), as well as the World Bank's Environmental and Social Safeguards Standards (ESSS).

## 9.3 Objectives of Stakeholder Engagement

The purpose of public participation in an ESIA is to ensure that potentially affected and interested stakeholders are provided with adequate, clear, and accessible information in an objective manner. This enables them to identify key concerns, contribute meaningful input, and propose options for improving project benefits and considering alternatives.

The stakeholder engagement process has been structured in line with the requirements of the Nigerian EIA Act as well as applicable international standards. For this Project, the main objectives of stakeholder engagement are as follows:

- Identify key stakeholders that can influence the Project and its activities;
- 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;
- Identify the most effective methods and structures through which to disseminate project information, and to ensure regular, accessible, transparent and appropriate consultation;
- 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.

## 9.4 Disclosure and Participation Plan

Information disclosure is a critical activity, not only as a means of engagement but also as a foundation for enabling other engagement processes to be carried out in an informed and participatory manner. This section outlines the procedures to be followed for information disclosure and stakeholder participation as part of the implementation of the EEP. In accordance with the World Bank Safeguards requirements, the REA is expected to disclose the environmental and social assessment, along with a documented record of stakeholder engagement. This record should include details of the stakeholders consulted, a summary of the feedback received, and a clear explanation of how the feedback was incorporated into the Project, or the reasons why it was not adopted.

### 9.4.1 Disclosure Mechanism

The process of information disclosure can be undertaken in two ways: either voluntary disclosure or disclosure as part of the regulatory requirements (EIA requirements, public hearing). While regulatory disclosure involves the provisioning of information as required by the authorities and agencies involved in the project, voluntary disclosure refers to the process of disclosing information to the various stakeholders in a voluntary manner. This disclosure not only allows for trust to be built amongst the stakeholders through the sharing of information, but it also allows for more constructive participation in the other processes of consultation and resolution of grievances due to availability of accurate and timely information.

### 9.4.2 Process for Disclosure of Information

As a standard practice, this ESIA will be released for public review according to the WB disclosure procedures, and for a period of 21 days in accordance with Nigerian Regulatory Frameworks. Distribution of the disclosure material will be done by making them available at venues and locations convenient for the stakeholders and places to which the public have unhindered access. The language of the ESIA is in English. The report will be made accessible for the public at the following locations:

- The EA Department of the Federal Ministry of Environment;
- The Gombe State Ministry of Environment,
- The Federal University of Kashere
- Other designated public locations to ensure wide dissemination of the materials.

Electronic copies of the ESIA report will be made available on the websites of the World Bank and FMEnv, enabling stakeholders with internet access to review information on the proposed development and participate in the public consultation process.

Stakeholder input will be facilitated through various mechanisms, including press releases and media announcements, as well as notifications to local, regional, and national NGOs, relevant professional bodies, and other interested parties regarding the disclosed materials.

### 9.5 Stakeholder Identification/Mapping and Analysis

The stakeholders were identified based on the direct project beneficiaries, adversely impacted groups, project supporters /proponents, regulatory/ planning,

However, the stakeholders covered are;

- Rural Electricity Agency (REA)
- Federal Ministry of Environment (FMEnv)
- Gombe State Ministry of Environment
- Akko Local Government Area

**Major Points of the Initial Consultation** Key agenda points included:

- Introduction of Stakeholders
- Opening Remarks
- Description of the Proposed Project by REA/Consultant
- Overview of The ESIA and Public Consultation by Consultant
- Questions, Comments and Remarks by other stakeholders
- Closing Remark

Key feedback received during Stakeholder Consultations are presented below;

**Table 9.2: Engagement with the Management of the University**

| Comments / Questions | Corresponding Responses |
|---|---|
| Whether there were any land-related disputes between the University and host community concerning the proposed project site. | The Vice Chancellor clarified that there were no disputes, as the proposed land is within the legally designated perimeter of the University. |
| Whether the project would benefit off-campus students and the surrounding host community. | The Vice-Chancellor stated that this would depend on the magnitude, capacity, and coverage of the installed solar plant, but expressed optimism about wider benefits. |
| Concern about maintenance challenges commonly associated with government projects. | The Director of Works and Maintenance emphasized that sustainability mechanisms should be incorporated into the project design. |
| Need for adequate security due to reported theft of infrastructure on campus. | University management assured the team of its commitment to proper implementation, supervision, maintenance, and security of the facility. |


**Plate 9.1: Consultation at different Levels**

### 9.6 Grievance Redress Mechanism

A Grievance Redress Mechanism (GRM) shall be established for the proposed Solar Power Plant Project at the Federal University Kashere, Gombe State, to provide an accessible, transparent, and effective process for receiving and resolving complaints or concerns arising from project activities. The GRM is designed to strengthen stakeholder confidence, promote accountability, and ensure that issues affecting students, staff, contractors, and host communities are addressed in a timely and fair manner. The mechanism will serve as an important tool for preventing conflicts and enhancing cooperation among all parties involved in the project implementation.

The primary objective of the GRM is to provide affected persons and stakeholders with a formal platform through which grievances can be lodged and resolved amicably. The mechanism will ensure that complaints relating to environmental impacts, social concerns, labor issues, security matters, or operational disturbances are properly documented, investigated, and addressed. It will also help to improve communication between the project proponents, the University management, the Rural Electrification Agency (REA), contractors, and surrounding communities.

The scope of grievances to be handled under the mechanism includes concerns relating to land use, noise and dust generation, occupational health and safety, damage to infrastructure, employment and labor disputes, community health and security concerns, theft or vandalism of project facilities, and any dissatisfaction associated with project activities. Sensitive issues such as harassment, discrimination, and gender-based violence shall also be handled confidentially and in accordance with established safeguarding procedures.

To ensure effective implementation, a Grievance Redress Committee (GRC) shall be constituted. The committee may comprise representatives of the Federal University Kashere management, the Rural Electrification Agency, Charlton Consult Limited, contractors, community representatives, student representatives, security personnel, and environmental and social safeguard officers. The committee will be responsible for receiving complaints, conducting investigations, facilitating dialogue among parties, and ensuring that corrective measures are implemented where necessary.

Stakeholders shall be able to submit grievances through multiple channels to ensure accessibility and inclusiveness. Complaints may be lodged verbally or in writing through complaint boxes placed within the University premises, dedicated telephone lines, email addresses, community liaison officers, or directly through the University's Works and Maintenance Department. Anonymous complaints shall also be accepted and treated with confidentiality to encourage openness and protect complainants from fear of retaliation.

Upon receipt of grievance, the complaint shall be formally registered and acknowledged within a reasonable timeframe. The Grievance Redress Committee will then assess and investigate the matter to determine appropriate corrective actions. Resolution outcomes shall be communicated clearly to the complainant, and where necessary, follow-up actions shall be monitored to ensure satisfactory implementation. In situations where the complainant is dissatisfied with the decision reached, an appeal process shall be provided to allow for further review of the grievance.

All grievances and their resolutions shall be documented in a grievance register containing details such as the nature of the complaint, date received, actions taken, resolution status, and date of closure. Periodic monitoring and reporting of grievances will help improve transparency, accountability, and overall project performance. Continuous awareness creation and stakeholder engagement will also be carried out to ensure that all affected persons understand the grievance process and can access it without difficulty.

The establishment of an effective Grievance Redress Mechanism is essential for the successful implementation and sustainability of the proposed solar power project at Federal University Kashere. By ensuring that concerns are addressed promptly and fairly, the GRM will contribute significantly to maintaining good relationships among stakeholders and promoting the long-term social and environmental sustainability of the project.

### 9.6.1 Grievance Redress Mechanism Process

The key steps in the GRM process are as follows

1. Grievance Submission – Complaint is lodged through available channels.
2. Acknowledgment & Registration – Complaint is recorded and acknowledged.
3. Screening & Assessment – Issue is reviewed and categorized.
4. Investigation – Facts and evidence are collected.
5. Resolution – Appropriate corrective action or solution is provided.
6. Appeal/Escalation – Unresolved complaints may be reviewed at a higher level.
7. Closure & Documentation – Case is closed and documented for future improvement.

### 9.6.2 Publicizing and Disclosure of the GRM

The GRM will be disclosed to the stakeholders through written and verbal communication. The mediums to be used for this purpose are public meetings, group discussions The GRM disclosure will be done along with the disclosure of other management plans.

### 9.6.3 Receiving and Recording Grievances

As part of the GRM, the grievances from the stakeholder or their representatives may be communicated verbally (in person or over a telephonic conversation) or in written form to the project representatives or to the designated Grievance Officer (GO) directly. If grievance is received directly by the GO or other project representatives, it will be recorded directly into the Grievance Form as soon as the personnel return to site.

### 9.6.4 Maintaining a Grievance Register

Each grievance thus received, shall be recorded in a grievance register. This grievance register shall be updated at each stage of the grievance redressal. Once the grievance is recorded in the register, a preliminary analysis shall be undertaken by the social standard officer/ manager to ensure that the grievance is within the scope of the GRM.

### 9.6.5 Acknowledgment of Grievance

Once the grievance has been recorded, the stakeholder will receive an acknowledgment of receipt along with a summary of the complaint.

### 9.6.6 Resolution, Escalation, and Closure

Based on the understanding developed, the Social Safeguard Officer, in consultation with relevant departments, shall determine an appropriate resolution to the issue. This may include providing information to clarify the situation, implementing corrective actions to address identified problems, offering compensation; either financial or in kind for any damage caused, and introducing mitigation measures to prevent recurrence. The agreed resolution shall be communicated to the complainant within 10 working days after completion of the site investigation.

Where the issue falls outside the mandate of the Social Safeguard Officer, it shall be escalated to the Head of the PMU under the NEP, and the complainant shall be duly informed of the escalation. The Head of the PMU shall make efforts to resolve the grievance within 10 working days of receiving it.

If grievance remains unresolved and no adequate solution can be identified by the Head of the PMU, a formal response shall be provided to the complainant, along with guidance on alternative avenues for redress. This may include referral to a citizens' rights mediation centre for resolution before pursuing legal action.

At any stage, if the complainant is dissatisfied with the proposed resolution, they may request that the grievance be escalated to the next level. In cases where a grievance is determined to be unfounded, a clear and reasoned explanation shall be provided to the complainant.

### 9.6.7. Update of Records

The grievance register shall be updated on a weekly basis to reflect the status of each complaint. Once a grievance has been resolved and the outcome communicated to the complainant, it shall be formally closed in the register. The register should also document how each grievance was addressed, providing a clear record of the resolution process. These records will serve as useful references for handling similar grievances in the future. Where there is evidence of recurring issues or repeated grievances, such matters should be escalated to the Head of the PMU under the NEP for assessment to determine whether modifications to the project design are necessary.

# CHAPTER TEN
# CONCLUSION AND RECOMMENDATION

## 10.1 Conclusion

The Environmental and Social Impact Assessment (ESMP) for the proposed solar power plant at the Federal University, Kashere, Gombe, was conducted to comply with applicable government policies, regulatory requirements, financiers' standards, and stakeholder expectations. The objective is to ensure that proactive environmental and social considerations are integrated into the project design and implementation. This study was carried out in accordance with Nigeria's regulatory framework for environmental and social management, particularly the Nigerian EIA Act Cap E12 LFN 2004, which mandates EIAs for projects with the potential to cause significant environmental impacts. Additionally, the ESMP aligns with the World Bank's Environmental and Social Standards.

The ESMP process is intended to provide comprehensive information to support informed decision-making and promote environmentally sound and socially sustainable development. Stakeholder consultations have been conducted and will continue throughout the project lifecycle. These engagements ensured that concerns and questions regarding the proposed project were adequately addressed to the satisfaction of stakeholders.

Baseline environmental and social conditions covering both biophysical and socio-economic aspects were established through field surveys and sampling, supported by literature reviews, maps, and other secondary data sources. This baseline information will serve as a reference point for future monitoring and evaluation. The assessment examined interactions between the project activities and existing environmental and socio-economic conditions to identify, characterize, and evaluate potential impacts. Appropriate mitigation measures and recommendations were subsequently developed based on the mitigation hierarchy of avoiding impacts where possible, minimizing unavoidable impacts, restoring affected resources, and compensating for residual impacts where necessary. These measures were informed by industry best practices, available technologies, and health, safety, and environmental (HSE) considerations.

An Environmental and Social Management Plan (ESMP) was also developed to guide the management of potential adverse impacts during project implementation and operation. The ESMP outlines procedures for implementing environmental and social commitments and includes a monitoring framework to track changes in environmental conditions over time. In this regard, the Rural Electrification Agency (REA) will ensure that parameters such as air quality, noise levels, and groundwater conditions are monitored in compliance with the Federal Ministry of Environment (FMEnv) and World Bank standards. Mitigation measures implemented under the ESMP followed the hierarchy of avoid, minimize, restore, and compensate.

## 10.2. Recommendation

The ESMP study recommends the following:

- Ensure full implementation of the Environmental and Social Management Plan (ESMP) throughout the project lifecycle.

- Conduct regular environmental monitoring for air quality, noise, groundwater, and waste management.
- Maintain continuous stakeholder engagement and effective community communication.
- Prioritize local employment, capacity building, and renewable energy training opportunities.
- Implement strong occupational health and safety measures, including emergency response systems.
- of Establish and maintain an efficient Grievance Redress Mechanism (GRM) for timely resolution complaints.
- Promote proper waste management, including safe disposal of hazardous and electronic waste.
- Ensure compliance with regulatory requirements through continuous oversight by the Rural Electrification Agency and relevant authorities.

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## APPENDICES

# Appendix – Laboratory Report -Soil

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15th April 2026

Soil Physico -Chemical Properties of Federal University of Kashere

| Parameter | Unit | S1 0–15 cm | S1 15–30 cm | S2 0–15 cm | S2 15–30 cm | S3 0–15 cm | S3 15–30 cm | Control 0–15 cm | Control 15–30 cm |
|---|---|---|---|---|---|---|---|---|---|
| pH | - | 5.8 | 5.5 | 6.1 | 5.8 | 6.3 | 6.1 | 5.4 | 5.2 |
| EC | µS/cm | 95 | 110 | 116 | 128 | 128 | 146 | 105 | 112 |
| Temperature | °C | 33.0 | 31.8 | 34.8 | 33.0 | 36.5 | 34.2 | 34.4 | 32.8 |
| Nitrate | mg/kg | 0.25 | 0.18 | 0.46 | 0.36 | 0.68 | 0.55 | 0.22 | 0.51 |
| Ammonia | mg/kg | 0.45 | 0.32 | 0.78 | 0.64 | 1.10 | 0.95 | 1.95 | 1.36 |
| Phosphate | mg/kg | 1.2 | 2.8 | 2.4 | 4.3 | 3.5 | 5.7 | 3.2 | 2.6 |
| Sulphate | mg/kg | 7.5 | 6.2 | 9.6 | 8.3 | 11.8 | 10.4 | 8.5 | 11.8 |
| Chloride | mg/kg | 0.8 | 1.0 | 1.4 | 1.7 | 1.9 | 2.4 | 0.4 | 0.1 |
| TOC | % | 0.45 | 0.38 | 0.64 | 0.56 | 0.82 | 0.74 | 1.00 | 0.06 |
| Moisture Content | % | 4.8 | 5.2 | 6.2 | 6.1 | 7.5 | 7.0 | 8.3 | 7.1 |
| Magnesium | mg/kg | 15.2 | 18.5 | 21.6 | 24.8 | 28.4 | 31.2 | 23.3 | 32.1 |
| Potassium | mg/kg | 2.1 | 2.6 | 3.3 | 3.9 | 4.5 | 5.1 | 3.1 | 4.2 |
| Sodium | mg/kg | 5.5 | 7.2 | 8.2 | 9.7 | 10.8 | 12.5 | 8.6 | 5.6 |
| Copper | mg/kg | 1.2 | 1.5 | 2.0 | 2.3 | 2.8 | 3.1 | 3.9 | 4.8 |
| Iron | mg/kg | 65 | 88 | 91 | 112 | 112 | 135 | 193 | 120 |
| Lead | mg/kg | 0.05 | 0.10 | 0.24 | 0.33 | 0.42 | 0.55 | 0.18 | 0.11 |
| Zinc | mg/kg | 3.5 | 4.2 | 5.1 | 5.9 | 6.8 | 7.5 | 8.8 | 9.4 |
| Manganese | mg/kg | 0.4 | 0.7 | 0.9 | 1.2 | 1.5 | 1.8 | 2.9 | 2.0 |

Thank you for your patronage.

Bayo Lawal
**Managing Director**

TUDAKA Analytical Nig. Ltd.

# QUESTIONNAIRES

## ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PLAN (ESIA) PHASE III: ENERGIZING EDUCATION PROGRAM (EEP) PROJECT

NOTE:

Please read each question carefully. Your answers are completely confidential and will be included only in summaries where individual answers cannot be identified. Unless otherwise instructed, please tick appropriate answer category that best describes your opinion. It will take approximately 20 minutes to complete this questionnaire.

SECTION A: Household data

Location/Name of School……..

1. Gender of Respondent: (a) Male (b) Female
2. Age: (a) Below 18 yrs (b) 18-45 yrs (c) 46-65 yrs (d) Above 66 yrs
3. Marital Status: (a) Single (b) Married (d) Divorced/Separated (e) Widowed
4. Occupation: (a) Civil Servant (b) Daily Labourer (c) Trading & Shop Keeping (d) Artisans (e) Employed (salary)(f) Retired (g) Famer (h) Unemployed (i) Others specify……
5. Residential Status: (a) Permanent Resident (b) Back Home (Returnee) (c) Nonresidents, Visiting
6. Ethnic Group: (a) Ebira (b) Igala (c) Hausa-Fulani (d) Igbo (e) Hausa Yoruba (f) others……
7. Religion: (a) Islam (b) Christianity (c) Traditional
8. Relationship to Household Head (HH): (a) Self (b) Spouse (c) Child (d) Parent (e) Other, specify……
9. Size of the HH ……
10. How long have you been living/working in this area? (a) 0-2 yrs (b) 3-5 yrs (c) 6-9 yrs (d) 10 yrs and Above
11. Education: (a) NO formal education (b) Primary School (c) Secondary School (d) Tertiary (Excluding University) (e) University Graduate (f) University Postgraduate

SECTION B: Health Status

1. How do you manage your health conditions when sick? (a) Attend hospital/clinic (b) Buys drugs from nearby chemist (c) Traditional medicine (d) None (e) Others Specify……
2. If you do attend hospital/clinic, when last did you visit one? (a) last six months (b) last one year (c) last five years (d) more than five years ago (e) Never visited one.
3. Please tick one or more of the under-mentioned ailment/sicknesses, you suffer from most accordingly?
4.

| Ailment | √ | Ailment | √ |
|---|---|---|---|
| Whooping Cough | | Rheumatism | |

| | | | |
|---|---|---|---|
| Tuberculosis | | Rashes | |
| Asthma | | Eczema | |
| Dysentery | | Ringworm | |
| Diarrhoea | | Eye pains | |
| Cholera | | Cataract | |
| Pile | | Glaucoma | |
| Hypertension | | Typhoid fever | |
| Congestive health problem | | Malaria | |
| Pneumonia | | Sickle cell anaemia | |
| Sexually transmitted diseases | | Epilepsy | |

7. Do you think your health condition will be affected by the proposed Infrastructure intervention? (a) Yes (b) No

8. If yes, how? ……

9. Please suggest how this can be averted during construction and implementation……

SECTION C. Standard of Living /Socioeconomic Activities

1.0 Assets

| 1.1 What sort of housing does your household live in? | | | | | |
|---|---|---|---|---|---|
| a. Construction material- Walls | | Plastered mud | c. Number of rooms | | 1-2 |
| | | Cement blocks | | | 3-4 |
| | | Other (specify) | | | Other (specify) |
| b. Construction material- roofing | | Corrugated roofing | d. Other structures on plot | | Animal Pen |
| | | Aluminium | | | Granary |
| | | Asbestos | | | Shops |
| | | Tile | | | Kiosks |
| | | Other (specify) | | | Other (specify) |
| e. Construction material- floor | | Earthen | | | |
| | | Concretes | | | |
| | | Tiles | | | |
| | | Other (specify) | | | |
| f. Toilet Facility | | Pit latrine | | | |
| | | Water closet | | | |

| | | |
|---|---|---|
| | | Toilet facility outside dwelling |
| | | Pier latrine |
| | | Other (specify) |
| | | None |
| g. Tenure of housing | | Owned |
| | | Rented |
| | | Occupied rent free |
| | | Other |
| h. Tenure of land | | Owned |
| | | Rented |
| | | Occupied rent free |
| | | Lease hold |
| | | Others specify |

1.2 Indicate household refuse disposal for solid waste? (Multiple options) (a) Depositing refuse at backyard of the house (b) Dumping in water body (c) Dumping in community refuse/garbage pit/dumpsite (d) Burning after gathering together (e) Waste collector (f) Other specify……..

## 2.0 Household Services

2.1 Rank in order of availability and usability the source(s) of lighting for the household? (Please use 1, 2,in hierarchical order with 1 indicating the most available and used source)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| (a) PHCN | (b) Generator | (c) Lantern | (d) Candle | (e) Palm Oil Lamp | (f) Torchlight Battery | (g) Wood | (h) Kerosene | (i) Gas |

2.2 Using the method in 2.1, indicate major source of energy for cooking?

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| (a) Fire Wood | (b) Coal | (c) Kerosene | (d) Electricity | (e) Animal dropping | (f) Gas | (g) Crop Residue/saw dust | Others |

3.0 Sources of Water

| Sources | for drinking | for cooking | for bathing and washing |
|---|---|---|---|
| a.Well | | | |
| b. Borehole/Water pump | | | |
| c. Community tap | | | |
| d. Piped water outside dwelling | | | |
| e. River | | | |
| f. Rain harvesting | | | |

| | | | |
|---|---|---|---|
| g. Water vendor | | | |
| h. Tanked water | | | |
| i. Other (specify) | | | |

## 4.0 Income and source livelihood

| | |
|---|---|
| Please, state your main income per month and source livelihood | ₦ |

### 4.1 Remittances

| | | | | |
|---|---|---|---|---|
| 1. Does anyone in the family who lives elsewhere send money to you? | 1 | YES | 2 | NO |
| 2. If yes, how much (per month) | ₦ | | | |

5. In your opinion, how has the standard of living of your household changed over the previous three years? (a) Same (b) Better (c) Worse
6. Is the option in 5 propelled by the state of the electricity provision/availability? (a) Yes (b) No
7. If 6 is YES, do you think the proposed infrastructure intervention will improve the situation? (a) Yes (b) No
8. If 7 is YES specify how the project will improve the situation ……

SECTION D: Gender-Based Violence/Sexual Exploitation and Abuse

1. Are there any provisions which restrict women's access to health and other social services? In particular which:

*(Please specify in the space provided for this purpose "yes" or "no")*

( ) require the consent of a male relative/husband for a married woman's medical examination or treatment or access to contraceptives or abortion,

( ) require parental consent in case of adolescents' access to contraceptives abortion;

( ) allow medical practitioners to refuse provision of a legal medical service on grounds of conscientious objection

( ) prohibit certain medical services, or require that they be authorized by a physician, even where no medical procedure is required; in particular:

( ) IUDs (intrauterine devices) or hormonal contraceptives

( ) Emergency contraceptives, including the morning-after pill, ( ) Sterilization on request;

( ) Early abortion (in first trimester of pregnancy) at the pregnant woman's request

( ) Medically assisted reproduction (e.g., in vitro fertilization) 2. Are the following acts criminalized?

*(Please specify in the space provided for this purpose "yes" or "no")*

( ) adultery

( ) prostitution

(If yes, who is criminally responsible? (a) the sex worker (b) the procurer and/or the customer) (c) both

3. Are there any measures and programs put in place in order to increase women's participation safety e.g. in public urban spaces, in public transportation, etc.? (a) Yes (b) No (c) No idea

4. Are there specific training programs for medical and legal professionals on the issue of gender-based discrimination in the area of health and safety? (a) Yes (b) No (c) No idea

5. How do you ensure gender equity in the community? (a) Women are elected in public office (b) Females are given equal opportunity and access to education and employment (c) Quotas on genders are ensures in leadership of community-based organizations (d) Others specify……..

SECTION E: Resources/ Cultural Property

1. Please indicate the environmental problems which your community experiences? (a) Soil infertility (b) Poor drainage system (c) Bad road (d) Bad lands (e) environmental degradation (f) Degraded land (i) Destruction of infrastructures (j) Others

(specify) ……..

2. Please indicate the environmental problems which your community would likely experience and whose cause can be linked to the proposed Infrastructure intervention project during construction?

(a) Soil infertility (b) Poor drainage system (c) Bad road (d) Low visibility

(e) Erosion Problems (f) Flooding (g) Environmental degradation

(h) Destruction of infrastructures (i) encroachment of land properties (j) Pollution (air, surface water, ground water, noise) (k) others (specify)

……

3. Do you think the proposed Infrastructure intervention project will affect any valued resource/cultural/archaeological property in your area? (a) YES (b) NO

4. If yes mention the name(s) of the valued resource/cultural/archaeological property

……

5. How will valued resource/cultural/archaeological property be affected? (a) Displacement of such valued cultural properties (b) Vandalization of sacred items/locations (c) Possible theft of sacred/archaeological items (d) Others,

specify:……

SECTION F: Intervention Project Activities Impact Evaluation

1. Are you aware of the proposed Solar Power Project? (a) Yes (b) No

2. If yes, from which source (a) Community meetings (b) Media (TV, Radio, Newspaper, Internet) (c) Others specify……..

3. Do you think the proposed Infrastructure intervention project can cause restiveness in your community? (a) YES (b) NO

4. If 3 is yes how will the proposed Infrastructure intervention result in restiveness? (a) Disrespect of norms and culture by contractors (b) loss of farmland / Property (c) Possible theft of sacred/archaeological items (d) local people not employed during

construction (e) Others, specify: ……

5. How will the proposed Infrastructure intervention project impact on your livelihood and environment?

| Positive impacts | Negative impacts |
|---|---|
| (a) | |

| | |
|---|---|
| (b) | |
| (c) | |

6. Can you name some of the animals and other habitat that may be affected by the proposed Infrastructure intervention project? ……

7. What do you expect from the activities of solar power Infrastructure intervention? (a) employment of Locals during construction (b) compensation for those whose properties will be affected (c) capacity building for maintenance during implementation (d) community input into final engineering design (e) Others please specify……..

## Section G: Grievance Redress Mechanism

1. Have you had grievances issue in this community in the last three years? (a) Yes (b) No

2. If 1 is yes, what was the cause of the grievance? (a) Land issue (b) theft of valuables (c) vandalization of property (d) Others, please specify…….

3. Who do you report your grievances in this community to? (a) School authority/management (b) Law enforcement (c) My landlord/CDA (d) traditional/community leader (e) Others, please specify……

4. Are grievances satisfactorily addressed or resolved by option(s) chosen in question 3 above? (a) Yes (b) No

5. Are there any other issue(s) of concerned as regards the proposed intervention project in your area, please state clearly?.....

## Section H: World bank ESS

| | World Bank ESS | Question | Yes | No |
|---|---|---|---|---|
| 1 | ESS1: Assessment and Management of Environmental and Social Risks and Impacts | Will the project activities impact or lead to disruption of the ecosystem? | | |
| 2 | ESS2: Labour and Working Conditions | Are labour rights and safe working conditions ensured? | | |
| | ESS3: Resource Efficiency and Pollution Prevention | Will waste be generated from this project | | |
| | ESS4: Community Health and Safety | are community health and safety near by be affected by this project? | | |
| | ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement | Will farmer within the university by displaced | | |

| | | | | |
|---|---|---|---|---|
| | ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources | How is biodiversity protected? | | |

**MINUTE OF MEETING HELD AT THE FEDERAL UNIVERSITY KASHERE, GOMBE STATE WITH THE MANAGEMENT OF THE UNIVERSITY.**

| | |
|---|---|
| **Title** | Stakeholder's Consultation meeting for the Environmental and Social Impact Assessment for the Deployment of the Proposed Solar Power Plant Project in the Federal University Kashere (FUK), Gombe State, Nigeria. |
| **Date** | Wednesday 11th February, 2026 |
| **Language** | English language |
| **Location** | Vice Chancellor's Conference Hall, Federal University Kashere, Gombe State |
| **Participants** | Prof. Mohammed Inuwa Ja'afar (Vice Chancellor), Prof. S. L. Kela (Deputy Vice-Chancellor, Academic), Prof. A.U. Gurama (Deputy Vice-Chancellor, Admin), Muhammad Imam Yunus (Director, Physical Planning), Abdullahi Adamu Yunusa (Director, Works and Maintenance Services), Mr. Isa Adamu Amaza (Bursar), Alhaji Nasir Lawan Abdullahi (Registrar), Dr. Tukur Abba (University Librarian), Bar Salamatu Isa Waziri(Head of Legal), Engr. Ahmed Hamman (Works dept), Engr Abubakar Manzo (Works dept), Samson Kwasau Gaji (Commercial Rep), Prof. Iyaji Adejoh (Lecturer) and Dr Collins E. Odu (Consultant representative for Charlton Consult Limited). |
| **Introduction** | The Deputy Vice-Chancellor, Academics, Prof. S. L. Kela introduced the management team of the Federal University Kashere, starting with the Vice Chancellor, Prof. Mohammed Inuwa Ja'afar, whom he stated just assumed duty and was currently on familiarization tour of the University.<br><br>Prof. S. L. Kela confirmed that the University was in receipt of a letter dated 15th of January, 2026 from the Rural Electrification Agency (REA) introducing the Charlton Consult limited as one of its consultants to undertake the preliminary studies and design for the proposed Solar Power Plant project. On that note he welcomed and introduced the Consultant representative of Charlton consult and his adhoc team. |
| **Presentation by Charlton Consult Limited** | The consultant's representative, Dr Collins Odu congratulated the Vice Chancellor for successfully assuming duty on the day of this visit. He appreciated the management team and other stakeholders for honoring the invitation despite their busy schedules. In his remarks, he explained that the meeting formed part of the Environmental and Social Impact Assessment (ESIA) process, which was a mandatory requirement before the commencement of such a project.<br><br>The Consultant representative also congratulated the University for been selected to benefit from the Distributed Access through Renewable Electricity Scale-up (DARES) programme of the REA in collaboration with the World bank. He stated that access to uninterrupted, reliable and affordable electricity was germane to industrialization and in particular, a must for universities to strive as centers of excellence for research and academic purposes. He mentioned that the proposed project was in line with the Energy Transition Programme and aligns with the SDG 7.<br><br>The specific purpose of the visit was stated as the conduct of an Environmental and Social Impact Assessment of the proposed Federal Government solar energy installation via the Rural Electrification Agency's Nigeria Electrification project- for energizing the Education sector and specifically within the Federal University of Kashere, Gombe, Gombe State. During the briefing, it was explained that the assessment was intended to evaluate the perceived environmental and social implications of the project from the standpoint of the University's leadership and other stakeholders. The consultant representative noted that the overall objective of the assessment was to confirm and validate that the project was deemed socially responsible and environmentally safe. |
| **Response by the Vice Chancellor** | In his response, the Vice-Chancellor, Prof. Mohammed Inuwa Ja'afar described the proposed solar energy project as timely, necessary, and highly welcome, particularly given the persistent electricity challenges facing the University at the time. He noted that inadequate power supply had significantly affected academic, administrative, and research activities within the institution. According to him, the solar plant would greatly enhance energy stability and improve overall institutional productivity. He also explained that the proposed solar power system, when installed will improve the standard |

| | |
|---|---|
| | of living and provide eco-friendly sustainable energy. He therefore appreciated the Federal Government, the World Bank and the REA for the laudable initiative.<br><br>The Vice-Chancellor further encouraged the consulting team to collaborate closely with relevant units and stakeholders within the University to ensure proper planning, smooth implementation, and long-term sustainability of the project and assured the visiting team of the University's readiness to partner with REA for a seamless implementation of the project. |
| **Comments and Questions** | During the interaction session, enquiry was made as to whether there were any land-related disputes between the University and the host community concerning the proposed project site.<br><br>Clarification was sought as to whether, upon successful implementation, the project would extend benefits to students residing off-campus and to the surrounding host community.<br><br>Abdullahi Adamu Yunusa, Director, Works and Maintenance Service, further highlighted that a major challenge commonly associated with government projects was the issue of maintenance, which often undermined effective utilization.<br>Prof. Iyaji Adejoh, a lecturer in Sociology Department raised the issue of the need for adequate security for the proposed project consequent upon reported cases of theft of some infrastructure within the campus. |
| **Responses by Stakeholders** | The Vice-Chancellor clarified that there were no disputes, as the proposed land was entirely within the legally designated perimeter of the University.<br><br>The Vice-Chancellor responded that, the extent of benefits to off-campus students and the immediate community would depend largely on the magnitude, capacity, and coverage of the installed solar plant. However, he expressed optimism that the project would have broader positive implications beyond the campus if adequately designed.<br><br>Abdullahi Adamu Yunusa, Director, Works and Maintenance Service, emphasized that sustainability mechanisms needed to be incorporated into the project design.<br><br>Nevertheless, the University management speaking through the Vice Chancellor assured the consulting team of its commitment to ensuring proper implementation, supervision, maintenance and security of the facility for optimal functionality.<br><br>The session ended on a positive note, with mutual assurances of cooperation and commitment toward the successful execution of the proposed solar energy project. |
| Closing | The meeting came to a close by 12.00 pm. |



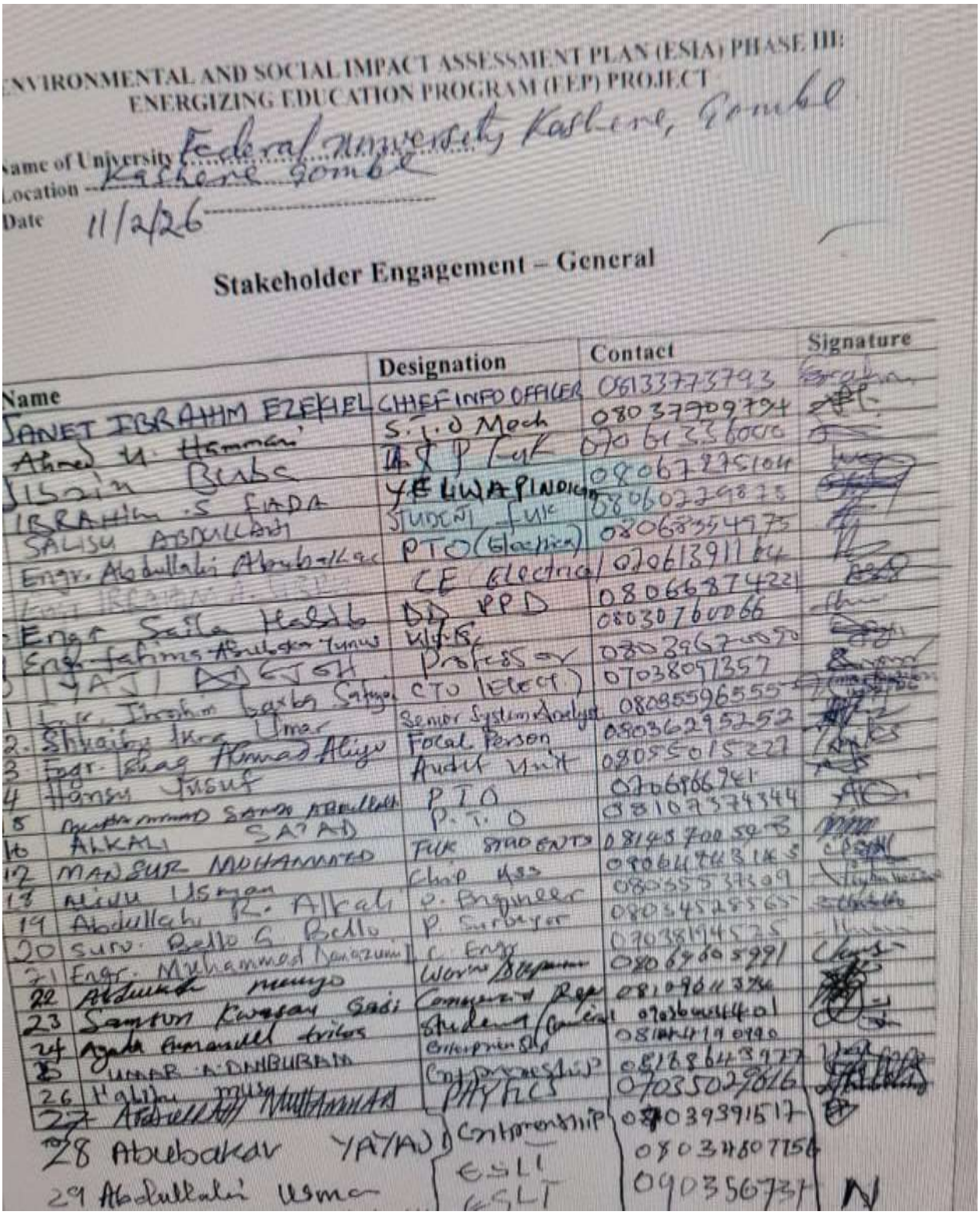
**ATTENDANCE**

**Management Consultation**

Meeting with Vice-Chancellor:
Professor Mohammed Inuwa Ja'afar

The following principal officers were present at the meeting:

1. **Prof. S. L. Kela** – Deputy Vice-Chancellor (Academic)
2. **Muhammad Imam Yunus** – Director, Physical Planning
3. **Abdullahi Adamu Yunusa** – Director, Works and Maintenance Services
4. **Mr. Isa Adamu Amaza** – Bursar
5. **Alhaji Nasir Lawan Abdullahi** – Registrar
6. **Dr. Tukur Abba** – University Librarian



ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PLAN (ESIA) PHASE III:
ENERGIZING EDUCATION PROGRAM (EEP) PROJECT

Name of University: Federal University Kashere, Gombe
Location: Kashere Gombe
Date: 11/2/26

## Stakeholder Engagement – General

| | Name | Designation | Contact | Signature |
|---|---|---|---|---|
| | JANET IBRAHIM EZEKIEL | CHIEF INFO OFFICER | 06133773793 | |
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| 1 | Engr. Ibrahim Garba Satiyo | Professor | 08038967090 | |
| 2. | Shuaibu Ibra Umar | CTO (Elect) | 07038097357 | |
| 3 | Engr. Ibrahim Ahmad Aliyu | Senior System Analyst | 08085596555 | |
| 4 | Hamsa Yusuf | Focal Person | 08036295252 | |
| 5 | Muhammad Sanda Abdullahi | Audit Unit | 08055015227 | |
| 6 | ALKALI SAAD | P I O | 07068667241 | |
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| 8 | Alidu Usman | FUK STUDENTS | 08145700595 | |
| 9 | Abdullahi R. Alkali | Chief Hss | 08064768145 | |
| 10 | Suru Bello G Bello | P. Engineer | 08035537109 | |
| 11 | Engr. Muhammad Nasiru | P. Surveyor | 08034528563 | |
| 12 | Abdulmumini Mungo | C. Engr | 07038194535 | |
| 13 | Samson Kwasau Gadi | Works Supervisor | 08067605991 | |
| 14 | Agada Emmanuel Iniobo | Community Rep | 08109611376 | |
| 15 | UMAR A DANBURAM | Student (Civil) | 07036444401 | |
| 16 | Hajiya Mu'a Muhammad | Entrepreneur | 08114419090 | |
| 17 | Abdullahi Muhammad | Contractor | 08168643977 | |
| 18 | Abubakar YAYA | PHYSICS | 07035029016 | |
| 19 | Abdullahi Usman | Entrepreneurship | 08039391517 | |
| | | ESLT | 08031480756 | |
| | | ESLT | 09035673 | N |