RURAL ELECTRIFICATION AGENCY
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AFRICAN DEVELOPMENT BANK GROUP

PROPOSED NIGERIA ELECTRIFICATION PROJECT (DESERT TO POWER) PHASE II UNDER THE RURAL ELECTRIFICATION AGENCY

AT

FEDERAL UNIVERSITY OF TECHNOLOGY, IKOT ABASI, AKWA IBOM STATE.

DEVELOPMENT OF A 2.9 MW (DC) SOLAR HYBRID PHOTOVOLTAIC POWER PLANT

SUBMITTED TO FEDERAL MINISTRY OF ENVIRONMENT HEADQUARTER, MABUSHI, ABUJA

DRAFT ESIA REPORT

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Acronyms and Abbreviations

Acronym	Full Meaning
AfDB	African Development Bank
APPI	Area of Potential Project Influence
ARAP	Abbreviated Resettlement Action Plan
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
ESCP	Erosion and Sediment Control Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FEPA	Federal Environmental Protection Agency
FGN	Federal Government of Nigeria
FMEnv	Federal Ministry of Environment
FUTIA	Federal University of Technology, Ikot Abasi, Akwa Ibom State

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Executive Summary

ES1: Introduction

The Federal Government of Nigeria (FGN), through the Rural Electrification Agency (REA), has obtained financing from the African Development Bank (AfDB) to implement the Nigeria Electrification Project (NEP). Under this framework, the REA is executing the Desert to Power (DtP) Phase II Project, which includes the preparation of Environmental and Social Impact Assessments (ESIAs) for selected beneficiary institutions. The ESIA provides a systematic approach for identifying, evaluating, and mitigating potential environmental and social impacts associated with proposed developments, while ensuring compliance with national legislation and international best practices.

Through the Energizing Education Programme, the Project seeks to electrify twenty-four (24) Federal Universities and Teaching Hospitals across Nigeria using solar-hybrid mini-grid systems with installed capacities exceeding 1 MW per site. This intervention is designed to deliver reliable, sustainable, and cost-effective electricity to enhance academic delivery, research capacity, campus safety, and overall institutional performance. The Federal University of Technology, Ikot Abasi (FUTIA), Akwa Ibom State, is a beneficiary under the DtP Phase II Project. The proposed subproject at FUTIA involves the development of a solar-hybrid power plant of approximately 1 MW capacity, establishment of a renewable energy workshop and training centre, upgrading of campus street lighting, and improvement of existing electricity distribution infrastructure.

This ESIA has been prepared in line with relevant Nigerian legal and regulatory frameworks, including the Environmental Impact Assessment Act (Cap E12, LFN 2004), applicable Federal Ministry of Environment (FMEnv) guidelines, and the Nigerian Climate Change Act (2021). The proposed project has been assigned Environmental Assessment Category 2. This classification is considered appropriate because the anticipated environmental and social risks and impacts are expected to be site-specific, of moderate significance, largely reversible, and can be effectively avoided, minimized, or mitigated through the implementation of appropriate environmental and social management measures and safeguard instruments. It is also aligned with the AfDB Integrated Safeguards System and international good practice standards such as the IFC Performance Standards, ISO 14001, and ISO 45001. The ESIA establishes baseline environmental and socio-economic conditions, identifies sensitive receptors, assesses potential impacts, and proposes mitigation and management measures through an Environmental and Social Management Plan (ESMP), thereby supporting informed

decision-making and the sustainable implementation of the DtP Phase II Project at FUTIA.

ES2: Project Justification

The proposed solar-hybrid power project at the Federal University of Technology, Ikot Abasi (FUTIA) is justified by the growing demand for reliable, affordable, and sustainable electricity to support the University's academic and operational activities. Established in 2021 by the Federal Government of Nigeria, FUTIA is a young and rapidly expanding institution with increasing student enrolment, academic programmes, and infrastructure. However, power supply from the national grid remains unreliable, forcing the University to depend heavily on diesel-fuelled generators, which are costly to operate and environmentally unsustainable.

The proposed project forms part of the Nigeria Electrification Project (NEP), implemented by the Rural Electrification Agency (REA) and co-financed by the African Development Bank (AfDB). Specifically, it falls under the Desert to Power (DtP) Phase II programme, which aims to provide clean and dedicated electricity to federal universities across Nigeria. The project aligns with Nigeria's commitments under the Paris Agreement and its Nationally Determined Contributions (NDCs) to reduce greenhouse gas emissions by 20% by 2030.

The solar-hybrid power plant will be developed on a one-hectare parcel of land within FUTIA's main campus. The selected site is accessible, secure, free of sensitive environmental features, and suitable for solar deployment, with minimal impact on existing land use. When operational, the project is expected to generate approximately 3,566 MWh of clean energy annually, significantly reducing reliance on diesel generators, lowering operating costs, and improving energy security across academic buildings, hostels, and staff quarters.

ES3: Project Description

The proposed project entails the development of a 2.9 MW DC installed capacity / 2.4 MW AC export capacity solar-hybrid photovoltaic power plant within the campus of the Federal University of Technology, Ikot Abasi (FUTIA), Akwa Ibom State. The project is intended to provide a reliable, clean, and sustainable electricity supply to the University, reduce dependence on diesel generators, and improve overall energy security.

The facility will consist of ground-mounted photovoltaic (PV) modules installed on fixed-tilt structures, string inverters for DC-to-AC power conversion, transformers, a power station, internal access roads, control systems, and auxiliary infrastructure for operation

and maintenance. Electricity generated from solar radiation will be distributed through the University's internal network, with provisions for grid interfacing where required.

Water demand for the project will be minimal and limited mainly to periodic panel cleaning and domestic use. Water will be sourced from an on-site borehole and supplemented by rainwater harvesting. The project lifecycle covers pre-construction, construction, operation, and decommissioning phases, with an expected operational lifespan of about 25 years. Environmental, health, and safety measures will be implemented in line with applicable regulations and best practices.

ES4: Description of Existing Environment (Baseline Summary with Key Results)

This chapter presents a summary of the existing biophysical and socio-economic baseline conditions of the project area for the proposed Nigeria Electrification Project (Desert to Power Phase II) at the Federal University of Technology, Ikot Abasi (FUTIA), implemented by the Rural Electrification Agency (REA). The baseline establishes reference conditions against which potential impacts of the proposed 2.9 MW solar-hybrid power plant will be assessed. Baseline data were obtained through dry-season field surveys conducted between 4th and 20th February 2026, supported by laboratory analyses, stakeholder consultations, and secondary data review. A one-season survey was undertaken with Federal Ministry of Environment (FMEnv) approval, and all sampling points were geo-referenced using GPS.

Air Quality and Noise:

Ambient air quality measurements across ten sampling points indicate low pollution levels. Noise ranged from 42–51 dB, within the FMEnv limit of 50 dB. Gaseous pollutants were all below detection or well within limits: CO_2 <0.01 µg/m³, NO_2 <0.01 µg/m³, SO_2 <0.01 µg/m³, NH_3 <0.01 µg/m³, H_2S <0.01 µg/m³, and VOCs 0.004–0.006 µg/m³. Particulate matter concentrations were low, with $SPM_{2.5}$ = 14–17 µg/m³ and SPM_{10} = 33–36 µg/m³, all below FMEnv limits.

Water Quality:

Three water sources (two boreholes and one surface water body) were assessed. Groundwater pH ranged from 6.9–7.0, while surface water pH was 6.8. Electrical conductivity was 210–220 µS/cm, TDS 135–145 mg/L, dissolved oxygen 7.2–7.5 mg/L, and turbidity 1.0–3.5 NTU. Nitrate levels were low (1.1–2.5 mg/L), with slightly higher values in surface water due to agricultural runoff. Heavy metals were minimal (Pb = 0.001 mg/L; Cd <0.001 mg/L; Fe = 0.05–0.07 mg/L). Total coliforms and E. coli were absent in groundwater and low in surface water (4 and 1 CFU/100 mL, respectively).

Soil Quality:

Soil pH ranged from 6.65–6.75, indicating slightly acidic to neutral soils. Electrical conductivity values were 32.6–35.4 µS/cm, and organic matter content ranged from 2.8–3.3%. Heavy metals were generally low: Pb = 1.7–2.1 mg/kg, Cd = 0.02–0.03 mg/kg, Fe = 0.14–0.17 mg/kg, and Zn = 0.11–0.15 mg/kg. Microbial counts were low but detectable (fecal coliforms 10–15 cfu/100 g; E. coli 1–2 cfu/100 g).

Socio-Economic Conditions:

The surrounding communities are predominantly agrarian, with 48% of respondents in the economically active 26–45 age group and 76% male participation. Household sizes are generally large (57% >7 members), and livelihoods are based on farming, trading, and agro-processing. Waste management practices are informal, relying on open dumping and burning.

ES 5: Potential Impacts

Pre-Construction / Planning Phase

- **High Risks**
  - Land and site preparation risks: Poor site selection or inadequate planning could result in conflicts over land use, existing infrastructure, access routes, or sensitive receptors.
  - Stakeholder and community risks: Inadequate consultation, disclosure, or grievance management may lead to community dissatisfaction and delays.
  - Health, Safety and Security (HSS) risks: Poor planning of construction logistics, traffic management, emergency response, and worker accommodation can create downstream safety risks.
  - Gender and social inclusion risks: Inadequate consideration of women, vulnerable groups, and persons with disabilities in employment and stakeholder engagement may reinforce existing inequalities.
- **Moderate Risks**
  - Vegetation and biodiversity: Site clearing requirements may result in localized loss of vegetation.
  - Soil and erosion: Inadequate drainage and site-layout planning may increase erosion and sedimentation during subsequent construction.
  - Traffic and access: Poor planning of material delivery routes may temporarily affect campus circulation and nearby communities.

- Resource use: Planning for groundwater abstraction for panel cleaning requires appropriate assessment of water availability and sustainable abstraction.
- Waste management: Inadequate planning for construction waste and eventual solar-panel/electrical waste could create longer-term environmental risks.

Construction Phase

- **High Risks**
  - Occupational health and safety: Working at height, electrical installation, lifting operations, excavation, equipment movement, and construction activities present potentially serious injury/fatality risks.
  - Traffic and road safety: Movement of heavy vehicles, construction equipment, and delivery trucks may increase the risk of accidents within and around the campus.
  - Electrical and fire hazards: Installation of solar modules, batteries, inverters, cables, and associated electrical infrastructure presents risks of electric shock, arc flash, short circuits, and fire.
  - Community health and safety: Interaction between construction workers, students, staff, pedestrians, and surrounding communities may create accident and safety risks.
  - Labour and social risks: Workforce influx, inappropriate worker behaviour, sexual harassment/SEA-SH, and conflicts between workers and host communities may occur if labour management is inadequate.
- **Moderate Risks**
  - Air quality: Dust from excavation, earthworks, vehicle movement and material handling, together with exhaust emissions, may temporarily deteriorate local air quality.
  - Noise and vibration: Construction machinery, generators and vehicles may cause temporary noise and vibration impacts, particularly around occupied campus facilities.
  - Soil disturbance and erosion: Excavation, grading and vehicle movement may expose soil and increase erosion and sediment runoff.
  - Vegetation loss: Clearing for the solar plant, access routes, transmission/distribution infrastructure and ancillary facilities may cause localized vegetation loss.
  - Surface-water contamination: Improper handling of fuels, oils, chemicals and construction materials could contaminate soil or drainage channels.

- Construction waste: Generation of excavated materials, packaging, scrap metals, cables, damaged solar components and other solid wastes may increase pressure on waste-management systems.
- Water demand: Construction activities may temporarily increase demand for water.
- Socio-economic disturbance: Temporary disruption to movement, campus activities and access to facilities may occur.
- Gender-related impacts: Unequal access to employment opportunities and risks of harassment or discrimination may affect female workers and community members.

Operation and Maintenance Phase

- **High Risks**
  - Major operational H&S risks are not anticipated under normal conditions, provided that electrical systems, battery systems and maintenance activities are designed, operated and maintained in accordance with applicable safety requirements.
- **Moderate Risks**
  - Occupational health and safety: Electrical maintenance, working at height, battery maintenance/replacement, panel cleaning and other maintenance activities may result in injury if appropriate controls are not implemented.
  - Battery and electrical-system hazards: Battery storage and electrical equipment may present risks associated with overheating, fire, chemical exposure, electrical shock or malfunction.
  - E-waste and hazardous waste: End-of-life solar panels, batteries, inverters, cables and other electronic components require controlled collection, storage, transportation and disposal/recycling.
  - Groundwater abstraction: Regular water abstraction for cleaning solar panels could place localized pressure on groundwater resources if poorly managed.
  - Fire and emergency response: Electrical faults or battery-system failures could result in localized fire risks requiring appropriate detection, isolation and emergency-response arrangements.
  - Gender and social inclusion: Sustaining equitable access to employment, training and skills-development opportunities may remain a moderate social consideration.

Decommissioning / Closure Phase

- **High Risks**
  - Occupational health and safety: Removal of solar panels, batteries, electrical infrastructure and supporting structures may involve working at height, lifting operations, electrical hazards and heavy equipment.
  - Hazardous/e-waste management: Improper dismantling or disposal of batteries, damaged photovoltaic panels and electrical components could result in environmental contamination and occupational exposure.
  - Traffic and community safety: Transportation of dismantled equipment and materials may increase road-safety risks.
- **Moderate Risks**
  - Waste generation: Decommissioning could generate substantial quantities of photovoltaic panels, metals, cables, batteries, structural materials and general construction waste.
  - Soil and vegetation disturbance: Removal of foundations and infrastructure may disturb soil and localized vegetation.
  - Dust and air emissions: Demolition, dismantling and vehicle movement may temporarily increase dust and exhaust emissions.
  - Noise and vibration: Decommissioning equipment may generate temporary noise and vibration.
  - Socio-economic impacts: Temporary employment opportunities may be created, while workers and businesses dependent on the operational facility may experience economic disruption following closure.

ES 6 Mitigation Measures

Pre-Construction / Planning Phase

High Risks and Mitigation Measures

- Land and site preparation risks
  - Confirm land ownership, tenure and approved land-use arrangements before mobilization.
  - Undertake site screening to avoid environmentally and socially sensitive areas.
- Stakeholder and community risks
  - Conduct meaningful consultations with FUTIA management, students, staff, host communities and other affected stakeholders.
  - Disclose project information, anticipated impacts, mitigation measures and implementation arrangements in accessible formats.

    - Establish and publicize an effective **Grievance Redress Mechanism (GRM)** before construction begins.
- Health, safety and security risks
    - Develop emergency preparedness and response procedures covering fire, electrical accidents, injuries and other foreseeable emergencies.
    - Prepare a Traffic Management Plan covering construction vehicles, deliveries, pedestrian movement and campus traffic.
    - Require appropriate PPE, first-aid facilities, emergency contacts and trained safety personnel before work commences.
- Gender and social inclusion risks
    - Develop and implement a Gender and Social Inclusion Plan.
    - Ensure equal opportunity in recruitment, training and employment.
    - Prohibit discrimination, sexual harassment and other forms of workplace misconduct.
    - Provide confidential channels for reporting SEA/SH and harassment.

Moderate Risks and Mitigation Measures

- Vegetation and biodiversity
    - Minimize the project footprint and avoid unnecessary vegetation clearance.
    - Clearly mark vegetation to be retained before clearing.
    - Prohibit indiscriminate tree cutting.
- Soil erosion and disturbance
    - Incorporate erosion-control measures into site design.
    - Minimize unnecessary excavation and soil disturbance.
    - Stockpile topsoil separately for subsequent site rehabilitation.
    - Stabilize exposed surfaces as soon as practicable.
- Traffic and access
    - Prepare and implement a Traffic Management Plan.
    - Identify designated access and delivery routes.
    - Schedule major deliveries to avoid peak campus traffic periods.
- Groundwater/resource use
    - Determine sustainable water requirements before operation.
    - Install appropriate water-metering arrangements.
    - Investigate alternative water sources, including harvested rainwater, where practicable.
- Waste management
    - Provide clearly labelled waste storage areas.
    - Segregate hazardous and non-hazardous wastes.

- Identify licensed waste contractors for hazardous/electronic waste.

Construction Phase

High Risks and Mitigation Measures

- Occupational health and safety
  - Implement a site-specific OHS Management Plan.
  - Conduct induction and regular toolbox talks for all workers.
  - Require appropriate PPE, including helmets, safety boots, gloves, eye protection, high-visibility clothing and fall-arrest systems where necessary.
  - Provide certified scaffolding, ladders and fall-protection systems for work at height.
- Traffic and road safety
  - Use trained flaggers/banksmen during vehicle reversing and deliveries.
  - Provide adequate warning signs and lighting around construction areas.
  - Schedule heavy-material deliveries outside periods of high pedestrian and student movement.
  - Maintain vehicles and prohibit overloading.
- Electrical and fire hazards
  - Ensure all electrical installation works are undertaken by qualified personnel.
  - Apply Lock-Out/Tag-Out (LOTO) procedures during electrical maintenance and installation.
  - Use properly rated cables, switches, distribution boards and protective devices.
  - Develop and regularly test electrical/fire emergency-response procedures.
- Community health and safety
  - Secure construction areas with appropriate fencing/barriers.
  - Prevent unauthorized access to excavations, electrical installations and construction equipment.
  - Control dust, noise and traffic around sensitive campus receptors.
  - Establish a mechanism for receiving and responding promptly to community/campus safety complaints.
- Labour influx and social risks
  - Implement a Labour Management Plan (LMP) and contractor code of conduct.
  - Prioritize qualified local labour where practicable.
  - Provide workers with information on acceptable behaviour and local community norms.

- Prohibit child labour, forced labour, discrimination and harassment.
- Provide confidential reporting mechanisms for SEA/SH and other misconduct.
- Monitor worker accommodation, if provided, to ensure adequate sanitation, water supply, safety and security.

Operation and Maintenance Phase

High Risks and Mitigation Measures

- Major operational OHS risks
  - Develop and implement an Operation and Maintenance OHS Management Plan.
  - Restrict access to the solar plant, battery systems, inverters and electrical installations to authorized personnel.
  - Ensure all maintenance personnel are appropriately trained and competent.

Moderate Risks and Mitigation Measures

- **Occupational health and safety**
  - Conduct task-specific risk assessments before maintenance activities.
  - Use appropriate fall-protection systems for work at height.
- **Battery and electrical-system hazards**
  - Install battery systems in appropriately designed and ventilated areas.
  - Provide suitable fire detection and suppression systems.
- **E-waste and hazardous waste**
  - Develop an end-of-life management system for PV panels, batteries, inverters, cables and electronic components.
  - Maintain an inventory of electrical and electronic equipment.
- **Groundwater abstraction**
  - Monitor groundwater abstraction volumes.
  - Avoid excessive or unnecessary panel-cleaning water use.
  - Maintain the borehole and water system to prevent leakage and contamination.
- **Fire and emergency response**
  - Install and maintain appropriate fire detection and suppression equipment.
  - Establish emergency shutdown/isolation procedures.
- **Gender and social inclusion**
  - Maintain gender-equitable recruitment and promotion practices.
  - Ensure women have access to renewable-energy training and technical positions.

Decommissioning / Closure Phase

High Risks and Mitigation Measures

- **Occupational health and safety**
  - Prepare a Decommissioning OHS Plan before dismantling activities.
  - Conduct task-specific risk assessments and method statements.
- **Hazardous/e-waste management**
  - Prepare an inventory of all PV panels, batteries, electrical equipment and hazardous materials before dismantling.
  - Prioritize reuse and recycling of functional equipment.
- **Traffic and community safety**
  - Implement a decommissioning Traffic Management Plan.
  - Use designated routes for transportation of dismantled equipment.

Moderate Risks and Mitigation Measures

- **Waste generation**
  - Develop a Decommissioning Waste Management Plan.
  - Segregate recyclable, reusable, hazardous and general wastes.
  - Maintain complete waste-transfer and disposal records.
- **Soil and vegetation disturbance**
  - Restrict dismantling activities to the existing project footprint.
  - Minimize removal of vegetation during equipment removal.
- **Dust and air emissions**
  - Avoid unnecessary engine idling.
  - Provide respiratory protection where required.
- **Noise and vibration**
  - Restrict noisy dismantling activities to appropriate daytime hours.
  - Maintain equipment properly.
- **Socio-economic impacts**
  - Provide workers with information on end-of-project arrangements.
  - Where feasible, utilize existing trained personnel for decommissioning activities.
  - Maintain the GRM until all project-related grievances have been resolved.

ES 7: Environmental And Social Management Plan

The ESMP integrates mitigation measures, monitoring programs, capacity building, stakeholder engagement, and grievance mechanisms across all project phases: pre-construction, construction, commissioning, and operation.

Key objectives of the ESMP are to: promote compliance with environmental and social standards, incorporate mitigation into project design and operations, ensure workforce

safety, and provide a framework for continuous monitoring and reporting. Mitigation measures address biodiversity, soil and water management, air quality, noise, traffic, occupational health and safety, and social risks such as displacement, gender-based violence, and community relations. Monitoring programs specify parameters, frequency, responsible parties, and performance indicators to ensure effectiveness of all mitigation actions. Capacity building and training programs enhance understanding of ESMP obligations among PMU staff, contractors, and local communities.

The Rural Electrification Agency (REA-PMU) supervises ESMP implementation, with the EPC contractor responsible during construction and the O&M contractor during operation. Regular reporting to regulators (FMEnv, NESREA, and Akwa Ibom State Ministry of Environment) ensures transparency and compliance.

The total estimated cost for implementing the ESMP is US$51,190, covering mitigation, monitoring, capacity building, and operational management over a 24-month project duration.

S/N	ESMP Activity Category	Key Focus Areas	Cost (USD)
1	Pre-Construction Phase	Land survey, disclosure, and livelihood restoration	$8,000
2	Construction Phase	Dust/noise control, waste management, site safety	$12,990
3	Commissioning Phase	Safety testing and performance verification	$500
4	Operational Phase	Long-term maintenance, welfare, and insurance	$12,600
5	Mitigation & Monitoring	Air, water, soil sampling, and audits	$6,100
6	Capacity Building	Specialized training, GBV prevention, GRM	$11,000
	Grand Total		**$51,190**

This ESMP ensures that all environmental, social, and occupational risks are addressed proactively, residual impacts are minimized to acceptable levels, and project sustainability is achieved.

ES 8 Stakeholder Engagement

Comprehensive stakeholder engagement was undertaken with key institutional stakeholders, the host community, and potentially affected persons to obtain their views, concerns, and expectations regarding the proposed project. Overall, stakeholders expressed strong support for the project, recognizing its potential to improve electricity supply, enhance socio-economic development, strengthen institutional capacity, and create employment opportunities. The University management reaffirmed its commitment to providing the necessary administrative and technical support throughout project implementation and confirmed that the selected project site is free from land disputes and permanent settlements, thereby minimizing the risk of involuntary resettlement.

Discussions with the University community highlighted the anticipated benefits of the project, including improved energy reliability, enhanced campus security through better lighting, and the establishment of a training centre that will promote renewable energy education, certification, and capacity building. The University also confirmed that existing seasonal farming activities within the project site are temporary and that affected users will be relocated to alternative farmland before project commencement, thereby avoiding disruption to livelihoods.

Community consultations revealed broad acceptance of the project while also identifying several expectations and concerns. These included requests for local employment opportunities during project implementation, equitable distribution of project benefits, compensation for affected economic trees, and respect for cultural heritage, including sacred sites and traditional observances. Community members also requested complementary social infrastructure such as a security post, bridge, civic centre, market, secondary school, and health centre. Although several of these requests fall outside the direct scope of the project, they were documented and will be communicated to the relevant government agencies for future consideration.

The Grievance Redress Mechanism (GRM) allows stakeholders to raise issues, including general complaints and GBV/SEA-related concerns. Grievances are received verbally or in writing, logged in a register, acknowledged, investigated, and resolved within defined timelines. The process includes local screening, site inspections, and engagement of relevant project officers. Resolutions may involve corrective actions, compensation, or

mitigation measures, with escalation paths to the PMU and, if necessary, external mediation. The GRM ensures transparency, accountability, and continuous improvement, maintaining records to guide responses to future grievances and safeguard stakeholder interests throughout the project lifecycle.

ES 10: Conclusion And Recommendations

The ESIA for the proposed 2.4MW (AC) and 2.9 MW (DC) solar power plant at the Federal University of Technology, Ikot Abasi (FUTIA), Akwa Ibom State, was conducted in full compliance with Nigerian regulations, African Development Bank (AfDB) safeguards, and international best practices. The assessment integrated environmental and social considerations into project planning and design, providing a foundation for informed decision-making. Baseline data on biophysical and socio-economic conditions were collected in February 2026, supplemented by literature and desktop research, to inform impact identification and evaluation. Stakeholder consultations—including university management, staff, students, and host communities—ensured that concerns were addressed, while mitigation measures were developed to promote sustainable project implementation.

An Environmental and Social Management Plan (ESMP) was prepared to guide mitigation and monitoring throughout the project lifecycle, covering parameters such as air quality, noise, groundwater, and biodiversity. The ESMP supports safe and sustainable operations, regulatory compliance, and acquisition of necessary permits.

Key recommendations include: continuous monitoring of plant performance to ensure efficiency; strict adherence to ethical, social, and environmental guidelines; security oversight of personnel, equipment, and installations; full implementation of the ESMP; and ongoing engagement with stakeholders and host communities to maintain social acceptance. Implementing these measures will ensure that the solar power plant delivers reliable, environmentally responsible energy while supporting local socio-economic development and contributing to national climate goals.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Subproject

The Federal Government of Nigeria (FGN) has secured financing from the African Development Bank for the implementation of the Nigeria Electrification Project (NEP). The FGN, through the Rural Electrification Agency (REA), intends to apply part of the proceeds of this financing towards consultancy services for the preparation of an Environmental and Social Impact Assessment (ESIA) for the Desert to Power (DtP) Phase II Project.

The ESIA is a systematic and proactive process that provides a structured framework for identifying, predicting, evaluating, and mitigating potential adverse environmental and social impacts that may arise from proposed development activities. It also facilitates the integration of environmental and social considerations into project planning, decision-making, and implementation processes.

The Federal University of Technology, Ikot Abasi (FUTIA), Akwa Ibom State, is one of the beneficiary institutions under the Nigeria Electrification Project – Desert to Power Phase II. The proposed intervention at FUTIA includes the development of a 1 MW solar-hybrid power plant, establishment of a renewable energy workshop and training centre, installation and upgrading of campus street lighting, and enhancement of the existing electricity distribution infrastructure.

The objectives of this project component are to:

- Improve the quality and reliability of power supply to tertiary educational institutions through sustainable energy solutions;
- Develop and operate renewable energy workshops and training centres (WTCs) where students can gain hands-on practical experience in renewable energy technologies and innovations; and
- Enhance safety and security within the university campus through the rehabilitation and installation of efficient street lighting systems.

1.1.1 Project Proponent

The Nigerian Rural Electrification Agency (REA) is the implementing agency for the Project. The Agency was established pursuant to Section 88 of the Electric Power Sector Reform Act, 2005, with its Board and Management inaugurated in 2006. REA is mandated to expand access to reliable electricity in rural and unserved communities across Nigeria, irrespective of geographic location or economic activity, in a manner that supports sustainable development and allows for reasonable returns on investment through appropriate tariff structures.

1.2 Objectives of the ESIA

The overall objectives of an ESIA are to:

- minimize or avoid adverse environmental and social impacts before they occur; and

- integrate environmental and social considerations into project planning and decision-making.

The specific objectives of this ESIA are to:

- Establish the existing state of the environment and identify sensitive environmental and social components within the project area and the Area of Potential Project Influence (APPI);
- Identify sensitive receptors within the project site and its surrounding environment;
- Assess the scope of the proposed project and the likely environmental and social impacts associated with its implementation;
- Appraise project activities and determine potential positive and negative impacts on the physical, biological, and socio-economic environment;
- Identify existing and anticipated environmental regulations that may affect the Project and advise on applicable standards, permits, and compliance requirements;
- Provide relevant information to stakeholders, including Project-Affected Persons (PAPs), and ensure their participation in project design and implementation;
- Identify, where applicable, the need for the preparation and implementation of a Resettlement Action Plan (RAP) and/or Livelihood Restoration Plan (LRP);
- Recommend mitigation measures during construction, commissioning, and operation phases to minimize adverse impacts and enhance positive outcomes;
- Propose an environmental management programme covering the entire project life cycle, including monitoring, auditing, compliance, and contingency planning; and
- Provide a basis for cooperation and consultation with regulatory authorities, non-regulatory institutions, and the general public.

1.3 Scope of the ESIA Study

In line with the approved Terms of Reference (ToR), the scope of this ESIA study includes the following:

- Description of all activities to be undertaken during project development, construction, operation, and decommissioning phases;
- Review of applicable national and international laws, regulations, standards, and industry codes relevant to the proposed Project;
- Desktop review of relevant documents, including the Nigeria Electrification Project Environmental and Social Management Framework (ESMF);
- Perimeter survey of the proposed project site, including preparation of survey maps;
- Field data collection covering biophysical and socio-economic components within the Project's area of influence;
- Stakeholder consultations with relevant government institutions, project-affected persons, and university management representatives;
- Laboratory analysis of collected environmental samples and interpretation of results;

- Identification and evaluation of potential environmental and social impacts, and development of appropriate mitigation measures and Environmental Management Plans (EMP); and
- Preparation, disclosure, and submission of the ESIA report to relevant authorities.

1.4 Study Approach and Methodology

The ESIA for the proposed Desert to Power Phase II Project at the Federal University of Technology, Ikot Abasi has been carried out in accordance with the FMEnv-approved EIA process for mini-grid and off-grid renewable energy projects implemented under the Nigeria Electrification Project. The methodology also incorporates relevant international standards and best practices, including the African Development Bank Integrated Safeguards Policies.

The study approach comprised the following key steps:

- Reconnaissance survey to identify site-specific environmental and social issues;
- Desktop review of relevant programme and policy documents;
- Scoping consultations with FUTIA authorities and the Ikot Ukpo Inua community to identify key issues and stakeholder concerns;
- Baseline environmental data collection covering air quality, noise levels, soil, water, ecology, and biodiversity using primary and secondary data sources;
- Laboratory analysis of samples obtained during field investigations;
- Identification of potential environmental and social risks associated with the Project;
- Impact assessment and development of appropriate mitigation measures;
- Preparation of an Environmental and Social Management Plan (ESMP) with defined responsibilities and implementation timelines;
- Compilation of the ESIA report; and
- Regulatory engagement, including report disclosure in line with FMEnv requirements.

The one-season baseline survey was adopted based on the project scope and prevailing environmental conditions; although it provides an adequate baseline for the ESIA, potential seasonal variations will be addressed through ongoing environmental monitoring during project implementation.

The Federal Ministry of Environment has developed procedural guidelines for conducting Environmental Impact Assessments in compliance with the EIA Act. Accordingly, the ESIA process for this Project follows the sequential steps outlined in the FMEnv procedural guidelines, as illustrated in Figure 1.1.

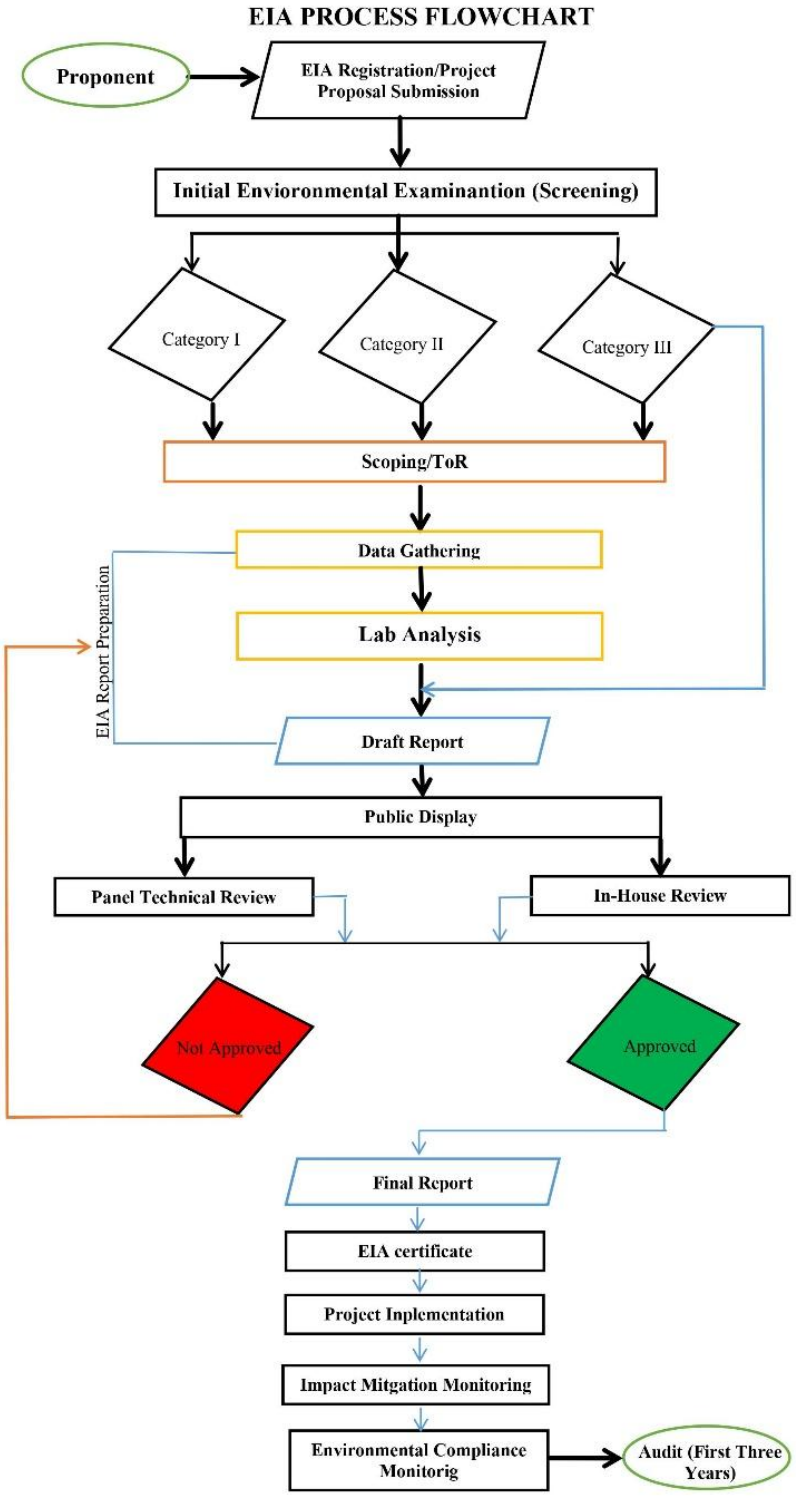


Figure 1: Federal Ministry of Environment Environmental Impact Assessment Process

1.5 Project Location

This subsection highlights the project's location, rationale for the proposed 2,926 kW solar-hybrid power plant and associated infrastructure at the Federal University of Technology, Ikot Abasi (FUTIA), Akwa Ibom State, Nigeria, under the Federal Government of Nigeria (FGN) Desert to Power Project Phase II. It also describes the alternatives and development options considered for the Project.

The project site is located directly opposite the Senate building on the main campus of FUTIA, approximately 100 m from the proposed solar power site. The host community for the project is Ikot Ukpo Inua, with neighboring communities including Ata Udoh Usung, Ikot Etenge Ete, and Ikot Etetuk. The site lies within Latitude 4.600898ºN to 4.600805ºN and Longitude 7.61223ºE to 7.613473ºE, in Zone 32 of the WGS84 datum. The land area for the Project is 1 hectare (100 m × 100 m), currently used for cassava farming and partly consisting of swamp land with secondary vegetation. The Federal University of Technology, Ikot Abasi is situated within Ikot Abasi Local Government Area, Akwa Ibom State, in the Southeastern region of Nigeria. Figure 1.1 presents a map of the project area at FUTIA.

The Project Area of Influence (AoI) extends beyond the immediate project footprint to include the construction corridor, access roads, temporary work areas, utility connections and nearby communities. Adjoining land uses comprise university facilities, academic buildings, seasonal agricultural land (predominantly cassava farms), swampy areas with secondary vegetation, access roads, and scattered residential developments within the host community. Environmentally sensitive receptors within the AoI include seasonal wetlands, secondary vegetation, agricultural lands, surface drainage channels, and nearby educational facilities within the university campus. Nearby communities, particularly Ikot Ukpo Inua, Ata Udoh Usung, Ikot Etenge Ete, and Ikot Etetuk, constitute the primary social receptors that may experience temporary impacts such as increased traffic, dust, noise, and employment opportunities during project implementation.

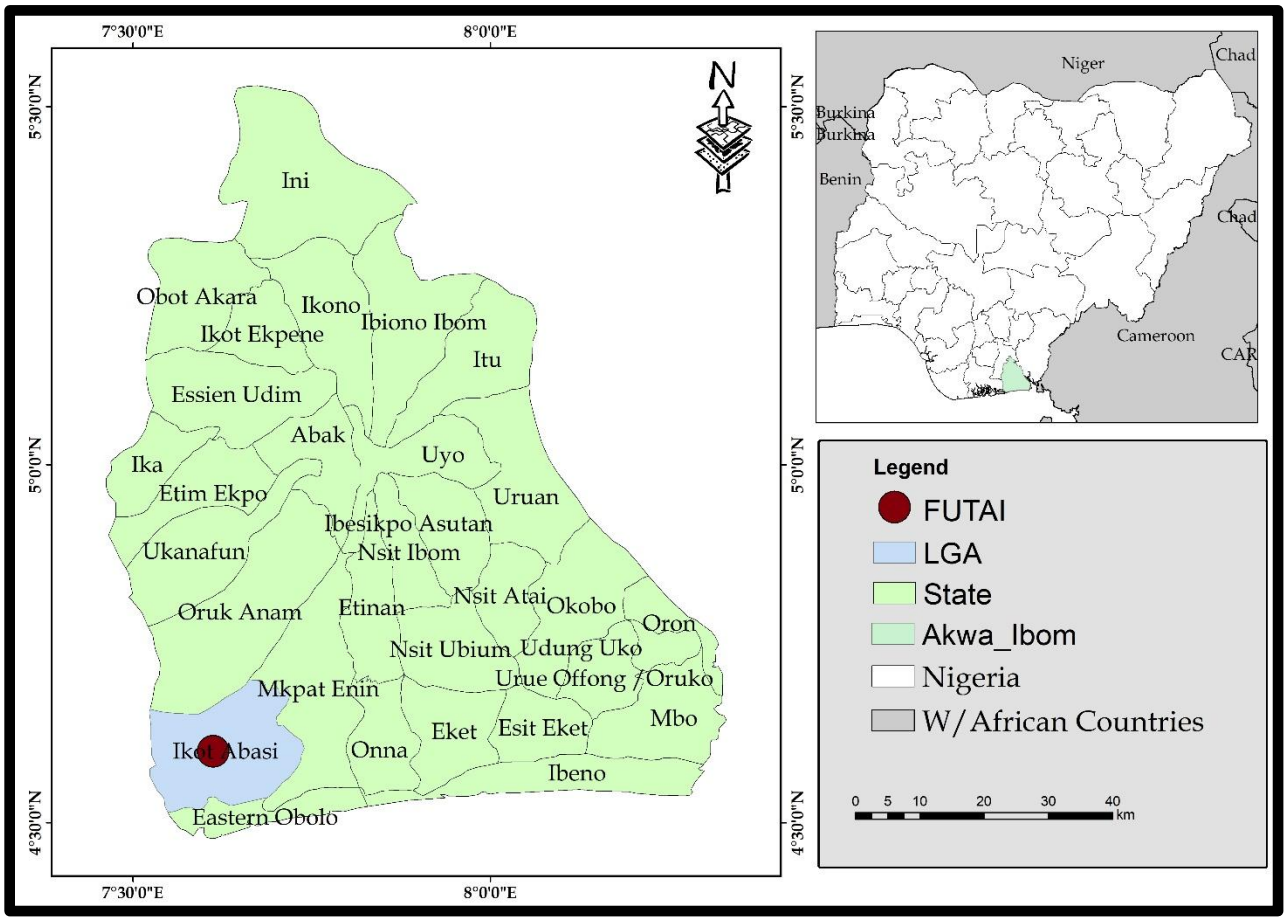


Figure 1: Map showing the location of the Desert to Power (DTP) Project site at Ikot Abasi LGA, Akwa Ibom State Nigeria

Figure 2: Map showing the location of the Desert to Power (DTP) Project site at the Federal University of Technology, Ikot Abasi (FUTIA), Akwa Ibom State.

1.6 Policy, Legal and Administrative Framework

The proposed Project is part of the Federal Government of Nigeria's Desert to Power Project, 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, a number of 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, legislations, and guidelines to the proposed Project and the ESIA study. The project shall ensure compliance with the relevant and applicable local and international regulations, policies, and standards throughout its life cycle.

Table 1: Comparative gap analysis between the applicable Nigerian environmental and social regulatory requirements and the African Development Bank (AfDB) Integrated Safeguards System (ISS).

Issue	Nigerian Regulatory Framework	AfDB Integrated Safeguards System (ISS)	Gap Identified	Proposed Measure to Bridge the Gap
Environmental and Social Assessment	Environmental Impact Assessment (EIA) Act Cap E12 LFN 2004 requires EIAs for projects likely to have significant environmental impacts.	Operational Safeguard (OS) 1 requires integrated environmental and social assessment, risk categorization, stakeholder engagement, and management plans throughout the project lifecycle.	Nigerian EIA legislation focuses primarily on environmental issues, whereas the ISS provides broader coverage of social risks and lifecycle management.	The ESIA has been prepared to satisfy both Nigerian EIA requirements and AfDB OS1 by integrating environmental, social, health, safety, and climate-related considerations.
Stakeholder Engagement	Public consultation is required during the EIA process but provides limited guidance on continuous engagement.	The ISS requires meaningful, inclusive, and continuous stakeholder engagement throughout project preparation, implementation, and operation.	National requirements are less explicit regarding continuous engagement and disclosure.	A Stakeholder Engagement Plan (SEP) will be implemented throughout the project lifecycle, including continuous consultation and operation of a Grievance Redress Mechanism (GRM).
Land Acquisition and Resettlement	The Land Use Act (1978) governs land acquisition and compensation, mainly for legal land rights.	OS2 requires avoidance or minimization of involuntary resettlement, livelihood restoration, and compensation at replacement cost, including assistance to vulnerable persons.	National legislation provides limited provisions for livelihood restoration and informal land users.	A Resettlement Action Plan (RAP), where required, will be prepared and implemented in accordance with AfDB OS2 to ensure fair compensation and livelihood restoration.
Biodiversity Conservation	National laws protect forests, wildlife, and protected areas but provide limited requirements for biodiversity impact mitigation hierarchy.	OS3 requires avoidance, minimization, restoration, and offsetting of impacts on biodiversity and ecosystem services.	Limited emphasis on ecosystem services and biodiversity offsets under national legislation.	The project will apply the mitigation hierarchy and implement biodiversity protection measures consistent with AfDB requirements.
Pollution Prevention and Occupational Health and Safety	NESREA regulations and the Factories Act address pollution control and worker safety.	OS4 requires comprehensive pollution prevention, resource efficiency, occupational health and safety (OHS), and community health and safety measures.	AfDB ISS places greater emphasis on resource efficiency and community health and safety.	The Contractor will implement an Environmental and Social Management Plan (ESMP), Occupational Health and Safety Plan, Waste Management Plan, Emergency

Issue	Nigerian Regulatory Framework	AfDB Integrated Safeguards System (ISS)	Gap Identified	Proposed Measure to Bridge the Gap
				Preparedness and Response Plan, and Community Health and Safety Plan.
Climate Change	National policies promote climate change adaptation and mitigation but are not fully integrated into project-level assessments.	Climate resilience and greenhouse gas considerations are mainstreamed within the ISS.	Climate risk assessment requirements are more comprehensive under the AfDB ISS.	Climate risks have been incorporated into the project design, and appropriate adaptation and resilience measures will be implemented.
Monitoring and Reporting	Compliance monitoring is undertaken by the Federal Ministry of Environment and relevant regulatory agencies.	The ISS requires continuous environmental and social monitoring, adaptive management, and periodic reporting throughout implementation.	AfDB requirements are more comprehensive regarding monitoring and performance reporting.	A monitoring programme with defined indicators, reporting schedules, institutional responsibilities, and corrective action procedures will be implemented throughout the project lifecycle.

1.6.1 FGN Requirements and Relevant Legislation

The Constitution of the Federal Republic of Nigeria (1999), as the national legal order, recognises 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.

1.6.2 Policy, Legal and Institutional Framework

The DtP Phase II seeks to provide off-grid captive power plants for the generation and provision of dedicated and uninterrupted power supply to twenty-four (24) Federal Universities across the six geopolitical zones of Nigeria and as a result, policies laws and regulations instituted by the Nigerian Government pursuant to this constitutional requirement and relevant to the programme will be complied with. These are discussed in the following sections.

1.6.3. Policy Framework

1.6.3.1. 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 ensure 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.

1.6.3.2 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 (NSIFT) 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 organised 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:

a) 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);
b) The health fee waiver for pregnant women and children under five (financed through the debt relief gains (DRG fund); and
c) The community-based health insurance scheme, which 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.

1.6.3.3 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 the 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.

1.6.3.4 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.

1.6.3.5 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.

1.6.3.6 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.

1.6.4 National Legal Framework

1.6.4.1 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 prior to 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 considered to be a minor development, which is expected to have minimum impact on the environment. Hence, the programme is categorised as a Category II (B) EIA. The EIA guidelines (procedural and sectoral) issued by the FMEnv derives from this Act and the programme proponents shall conduct their activities in conformance with these guidelines.

1.6.4.2 Electric Power Sector Reform Act 2005

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

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

1.6.4.4 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 vest every parcel of Land, in every State of the Federation, in 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 to 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 benefits 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 agricultural (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 to be 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 such compensation to the holder or occupier. (Section 6) (7).
Where a right of occupancy is revoked on the ground either that the land is required by the Local, State or Federal Government for public purpose 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 the nature of 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 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 there arises any dispute as to the amount of compensation calculated in accordance with the provisions of section 29, such disputes shall be referred to the appropriate Land Use and Allocation Committee. It is clear from section 47 (2) of the Act that no further appeal will lie 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 shall 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 ground of requirement 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 on the basis of 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 is any building installation or improvement 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.

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

The Urban and Regional Planning Act is aimed at overseeing a 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.

1.6.4.6 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 persons who have suffered injury as a result of his offending act.

1.6.4.7 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 as a result of over exploitation. These sections are noteworthy:

- Section 1 prohibits, except under a valid license, the 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 programme locations are on virgin land that serve as wildlife habitats which will be impacted by the programme. Hence, the programme activities shall be carried out to comply with the relevant provisions.

1.6.4.8 Inland Fisheries Act, Cap I10, LFN 2004

The Inland Fisheries focused on the protection of the water habitat and its species; the following sections 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 the solar hybrid systems is the 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.

1.6.4.9 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; 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 restriction of excavations for the purpose of finding antiquities as well as issuance of permits and 20 deals with accidental discoveries. In case of any accidental find, the Commission shall be notified within seven (7) days.

1.6.4.10 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 to protect 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 the type to be undertaken under the DTP III. Hence, the occupational requirements applicable to construction sites, as well as other work sites to be used by the programme shall be subjected to the provisions of this Act.

1.6.4.11 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.

1.6.4.12. National Minimum Wage Act, 2024

The National Minimum Wage Act, 2024 establishes the national minimum wage applicable to workers in Nigeria and provides the legal framework for the determination, payment and enforcement of minimum wages. The Act replaced the previous minimum-wage framework and provides for a national minimum wage of ₦70,000.00 per month.

Accordingly, all workers, employees and individuals engaged or contracted for activities under the proposed programme shall be remunerated in accordance with the applicable provisions of the National Minimum Wage Act, 2024, and shall not receive wages below the legally prescribed minimum, subject to any applicable exemptions or subsequent statutory revisions.

The Project Proponent and its contractors shall maintain appropriate employment and payroll records to demonstrate compliance with applicable wage requirements. Contractors shall also ensure that workers are informed of their employment conditions, remuneration and applicable labour rights.

1.6.4.13. Employees' Compensation Act, 2010

The Employees' Compensation Act, 2010 provides for an open and fair system of compensation for employees who suffer occupational injuries, disabilities or death arising from or in the course of employment. The Act establishes a framework for compensating employees for work-related injuries and diseases and provides for rehabilitation, retraining and other forms of support where applicable.

The Project Proponent and all contractors shall comply with the applicable provisions of the Act throughout the implementation of the programme. Appropriate measures shall be established to prevent occupational injuries and diseases, and all work-related accidents and incidents shall be promptly recorded, investigated and reported in accordance with applicable requirements.

The programme will engage both skilled and unskilled workers. Contractors shall ensure that workers are adequately informed of their employment rights and compensation arrangements and that appropriate occupational health and safety measures are implemented to minimize the risk of workplace injuries, occupational diseases, permanent disability and fatalities.

1.6.4.14 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 monitory 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.

1.6.4.15 National Environmental Regulations

Section 34 of the NESREA Act, 2007 empowers the Minister of Environment to make regulations for safe and sustainable environment. In exercise of this power, the minster issued the national

environmental regulations covering various environmental components and sectors of development. The regulations relevant to the programme are as follows:

- National Environmental (Battery Control) Regulations, 2024
- National Environmental (Energy Sector) Regulations, 2014. S.I. 63.
- National Environmental (Electrical/Electronic Sector) Regulations, S. I. No 79, 2022
- National Environmental (Wetlands, River Banks 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 Catchments 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.

1.6.4.16. 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, in order to ensure that the programme is implemented with maximum consideration of environmental factors. This ESIA study will be conducted in compliance with this guideline.

1.6.4.17 EIA Sectorial Guidelines (Infrastructures)

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

1.6.4.18. 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 optimise the mini-grid projects EIA timeline and the cost of development.

1.6.4.19 State Legislations

- Akwa Ibom State Environmental Protection and Waste Management Agency Law (2000): The law provides for an agency charged with the responsibility of the protection of the environment and management of waste in Akwa Ibom State.

1.6.5 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 2016
- Convention on Biological Diversity 1992
- 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
- Human and Peoples' Rights on the Rights of Women in Africa 2005
- International Covenant on Civil and Political Rights (ICCPR) 1966
- Vienna Convention for the Protection of the Ozone Layer, 1985
- The Rio Declaration on Environment and Development 1992.
- International Covenant on Economic, Social and Cultural Rights Covenant (ICESCR) 1966
- Convention on the Elimination of All Forms of Violence Against Women (CEDAW) 1979
- Convention on the Rights of the Child (CRC) 1989

1.6.6 Institutional Framework

This section highlights the relevant institutions through which the planning and implementation of the programme will be affected. A number of 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.

1.6.6.1 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.

1.6.6.2 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.

1.6.6.3 The National Environment Standards and Regulations Enforcement Agency (NESREA)

The agency ensures 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.

1.6.6.4 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

1.6.6.5 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), and 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 progammes/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 its supervision

1.6.6.6 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, 2005 was the legislation that led to the establishment of NERC. The Commission is mandated to carry out the following, amongst others:

- Monitor and regulate the activities of the electricity industry in Nigeria;
- Issue licenses to market participants; and
- 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.

1.6.6.7 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 licences on June 10, 2013 for electricity transmission and system operations.

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

1.6.6.9 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 among others:

- Eliminate cultural/ religions gender-based biases and harmful cultural and religious practices which rise to inequalities in gender-role relations in the Nigerian society. A culture which is amendable 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 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 socio-economic development of the nation.

1.6.6.10 State Institutions

Akwa Ibom State Ministry of Environment and Mineral Resources:

The Ministry of Environment and Mineral Resources is responsible for managing environmental services and mineral resources within the state. Its objectives include the formulation, execution, and monitoring of all matters related to environmental protection, solid waste management, and mineral resources development.

Akwa Ibom State Environmental Protection and Waste Management Agency:

This Agency is tasked with protecting the environment and managing waste across Akwa Ibom State. It plays a key role in ensuring sustainable environmental practices and compliance with state environmental regulations.

Akwa Ibom State Ministry of Women Affairs and Social Welfare:

This Ministry empowers and provides social protection to vulnerable members of society, including women, children, persons with disabilities, and the elderly. It promotes gender equality, child rights, and offers free or subsidized services to enable unrestrained development. The Ministry ensures that all citizens benefit from equal opportunities, contributing to a just and equitable society.

Akwa Ibom State Ministry of Land and Water Resources:

This Ministry oversees the management of land and water resources within the state. Its responsibilities include planning, devising, and implementing state policies on land administration and water resource management to ensure sustainable development and equitable access.

1.6.7 Funding Agency Requirements

This programme is funded by the African Development Bank (AfDB). Therefore, the AfDB safeguard systems will be integrated in the project cycle as well as other national and international environmental and social protection requirements, in order to comply with international best

practices. Both main environmental and social requirements that the project needs to comply with are described in the following sections.

1.6.7.1 The African Development Bank's Operational Safeguard

The proposed programme has been assigned Environmental and Social Risk Category 2 by the African Development Bank (AfDB) in accordance with the requirements of the African Development Bank Group's Integrated Safeguards System (ISS, 2023). Although the proposed generating capacity is between 1 MW and 10 MW, the project has the potential to generate site-specific environmental and social risks and impacts during the pre-construction, construction, operation and decommissioning phases, which are expected to be largely reversible and can be effectively managed through the implementation of appropriate mitigation measures and environmental and social management plans.

Based on the preliminary environmental and social assessment, the following Operational Safeguards (OS) of the AfDB ISS 2023 are applicable to the project:

OS1 – Environmental and Social Assessment: Applicable because the project requires an Environmental and Social Impact Assessment (ESIA) to identify, assess and manage environmental and social risks and impacts throughout the project life cycle.

OS2 – Labour and Working Conditions: Applicable: OS2 is applicable because the project will engage direct workers, contracted workers and, where applicable, primary supply workers during construction and operation. The project will therefore need to address terms and conditions of employment, occupational health and safety, workers' rights, non-discrimination, prevention of child and forced labour, worker grievance mechanisms and other applicable labour requirements. The project shall implement appropriate labour-management and occupational health and safety measures throughout the project life cycle.

OS3 – Resource Efficiency and Pollution Prevention and Management: Applicable due to the anticipated use of fuels, construction materials, water and energy resources, as well as the generation of air emissions, wastewater, solid waste and hazardous materials during construction and operation.

OS4 – Community Health, Safety and Security: Applicable because project activities, including transportation of materials, construction works and operation of the facility, may present risks to neighbouring communities and require appropriate health, safety, emergency preparedness and security management measures.

OS5 – Land Acquisition, Restrictions on Land Use and Involuntary Resettlement: Applicable where permanent or temporary land acquisition, restriction of access to land or livelihood impacts may occur. If no land acquisition or displacement is required, this safeguard should be screened out and documented accordingly.

OS6 – Biodiversity Conservation and Sustainable Management of Living Natural Resources: Applicable where project activities may affect natural habitats, ecosystem services, flora, fauna or other biodiversity values within the project's area of influence.

OS7 – Vulnerable Groups: OS7 should be considered applicable because project impacts and access to project benefits may disproportionately affect vulnerable persons or groups. The assessment shall identify potentially vulnerable groups within the project area of influence and ensure that consultation, employment, training, grievance mechanisms and project benefits are accessible to them. The assessment establishes that no distinct vulnerable groups are present and that project impacts will not disproportionately affect such groups, this conclusion has been be documented.

OS8 – Cultural Heritage: Applicable subject to screening: OS8 should be screened because construction activities involving excavation, earthworks and site preparation could potentially encounter archaeological, cultural or historical resources. The ESIA shall identify known cultural heritage resources within the project area and incorporate a chance-find procedure into the ESMP. If there are no known or identified cultural heritage resources and the assessment confirms a low likelihood of impacts, this shall be documented while retaining the chance-find procedure for unexpected discoveries.

OS9 – Financial Intermediaries: Not Applicable OS9 is not applicable because the proposed project is not being implemented through a financial intermediary whose core function involves providing financing to sub-projects. The project is a specific solar-hybrid power-generation investment rather than a financial-intermediary operation.

OS10 – Stakeholder Engagement and Information Disclosure: Applicable. OS10 is applicable because the project will have potentially affected stakeholders, including the project institution, workers, students, staff, neighbouring communities and other interested parties. Meaningful stakeholder consultation, timely information disclosure, accessible communication channels and a functional grievance redress mechanism shall therefore be established and maintained throughout the project life cycle

1.7. Report Structure

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

- Preliminary Sections: containing table of contents, lists of ESIA preparers, Executive Summary, amongst others.
- Chapter One: Introduction containing an overview of the proposed Project, the ESIA objectives and study approach and applicable legal and administrative framework.
- Chapter Two: Project Location and Justification containing a rationale for the proposed Project as well as the analysis of Project alternatives and development options.
- Chapter Three: Project Description containing the technical elements of the Project. It concisely describes the proposed Project and its geographic and temporal context, including the Project's associated infrastructure.
- Chapter Four: Description of the Environment. It details the baseline data that is relevant to decisions about the Project location, design, development and operation.

- Chapter Five: Potential and Associated Impacts. This takes into account all relevant environmental and social risks and impacts of the proposed Project, including cumulative impacts.
- Chapter Six: Mitigation measures for the identified negative environmental and social impacts, as well as the enhancement measures for the identified positive impacts.
- Chapter Seven: is the ESMP. It summarizes the key environmental and social measures and actions and the timeframe including responsibility for the implementation of the recommended measures
- Chapter Eight: presents an overview of remediation / decommissioning plan after Project closure.
- Chapter Nine: describes the stakeholder engagement activities carried out during the ESIA and an overview of the grievance redress mechanism for the Project.
- Chapter Ten: Conclusion and Recommendations

The report also includes references and appendices.

CHAPTER TWO – PROJECT JUSTIFICATION

2.1 Project Justification

2.1.1 Federal University of Technology, Ikot Abasi (FUTIA)

The Federal University of Technology, Ikot Abasi (FUTIA) is a federal government-owned specialized university of technology located in Ikot Abasi Local Government Area, Akwa Ibom State, Nigeria. Ikot Abasi is approximately a 50-minute drive from Uyo, the state capital, providing convenient road access from major regional centers. Established in June 2021 by the Federal Government of Nigeria, FUTIA is part of a strategic effort to expand access to science and technology education nationwide. As one of the newest federal universities of technology in the country, FUTIA operates from its main campus in Ikot Abasi, with ongoing development of academic facilities and infrastructure to support teaching, research, and innovation across its programs.

The university is in an early growth phase, with continual expansion of academic buildings, research facilities, and student services. FUTIA offers degree programs across multiple schools focused on science, technology, engineering, agriculture, computing, management, and environmental sciences.

Table 2: Faculties and Departments at FUTIA

Faculty/School	Departments/Programmes
School of Engineering	Civil Engineering, Electrical Engineering, Mechanical Engineering, Chemical Engineering
School of Science	Physics, Chemistry, Biology, Mathematics
School of Computing	Computer Science, Information Technology, Software Engineering
School of Agriculture	Agricultural Science, Agronomy, Soil Science, Animal Science
School of Management	Business Administration, Accounting, Marketing
School of Environmental Sciences	Environmental Management, Geology, Geography

FUTIA's vision is to be a leading university in the advancement and dissemination of knowledge in Science, Technology, and Engineering, producing first-rate graduates who can transform their environments through innovation and research. Its mission is to equip students with innovative skills through excellent teaching and research, placing the university at the forefront of ground-breaking technological development and societal transformation.

The university's objectives include promoting advanced learning without discrimination, fostering research and technological innovation, evolving responsive academic programmes, expanding access to quality education, and producing graduates who can compete internationally while contributing to national development.

As a young institution, FUTIA has been steadily growing its student population. For instance, over 1,000 students were matriculated in the 2024/2025 academic session, reflecting rising enrolment as infrastructure and academic offerings expand.

2.1.2 Description of the Project Site

The proposed 2,926 kW solar-hybrid power plant will be located on a 1-hectare land parcel (100 m × 100 m) within the main campus of the Federal University of Technology, Ikot Abasi (FUTIA). The site is directly opposite the Senate building, approximately 100 meters away, and is situated within the host community of Ikot Ukpo Inua, with neighboring communities including Ata Udoh Usung, Ikot Etenge Ete, and Ikot Etetuk.

The Project Area of Influence (AoI) extends beyond the immediate project footprint to include the construction corridor, access roads, temporary work areas, utility connections and nearby communities. Adjoining land uses comprise university facilities, academic buildings, seasonal agricultural land (predominantly cassava farms), swampy areas with secondary vegetation, access roads, and scattered residential developments within the host community. Environmentally sensitive receptors within the AoI include seasonal wetlands, secondary vegetation, agricultural lands, surface drainage channels, and nearby educational facilities within the university campus. Nearby communities, particularly Ikot Ukpo Inua, Ata Udoh Usung, Ikot Etenge Ete, and Ikot Etetuk, constitute the primary social receptors that may experience temporary impacts such as increased traffic, dust, noise, and employment opportunities during project implementation. The land is partly under cassava cultivation and consists of swampy areas with secondary vegetation, providing sufficient space for solar panel installation while minimizing disruption to existing infrastructure. Geographically, the site lies between Latitude 4.600898ºN to 4.600805ºN and Longitude 7.61223ºE to 7.613473ºE in Zone 32 of the WGS84 datum, offering optimal solar exposure for the Project.

*Figure 3**: Layout showing the Proposed Site***

*Figure 4**: Proposed Project Site***

The current land use is a fallow ground with some seasonal crops taking about 20% of the land-plate 2.2. The owners of the crops are an estimated number of 7 farmers who are non-academic staff who are aware that the land is only on temporary use for farming. The department of planning have the records of the affected staff if their plants are not harvested before site clearing is required. Some electric poles are sited on the land. Other existing structure by the project area is the power station and the fuel tank of the generator. These will be accommodated within the project and therefore will not relocated.

*Figure 5**: Current land use is a fallow ground composed of shrubs and grasses***

2.2 Need for Project

Public tertiary institutions in Nigeria (especially the Federal Universities) remain the most preferred for a large percentage of students seeking admission in the country. However, majority of these universities are faced with the challenge of inadequate power supply from the national grid. In order to cope with this situation, most of the universities rely on diesel-fuelled generators for the generation of electricity, with significant economic and environmental implications. Part of the FGN's initiatives to address inadequate power supply in the country is the establishment of Nigeria Electrification Project (NEP). NEP is an innovative programme that seeks to provide electricity access to off-grid communities across the country through renewable power sources. It is being implemented by REA and co-financed by the African Development Bank.

One of the components of the NEP is Desert to Power (DtP), with the objective of providing dedicated, clean and reliable power supply to Federal Universities across the country. Also, the DtP is part of measures in ensuring that Nigeria achieves its carbon emission targets (20% carbon emission reduction by the year 2030) as contained in its Nationally Determined Contributions (NDC), under the Paris Agreement.

The proposed Project in Federal University of Technology, Ikot Abasi, Akwa Ibom State, is part of the FGN's DtP Phase II, under NEP. The Project will help to significantly address the challenges of power supply challenges currently faced in the University, which will likely lead to many positive spill-over effects.

2.3 Value of Project

NEP is being co-financed by the African Development Bank through a US$200 million loan facility. The total funding available for the DTP phase II component is US$123 Million. Funding breakdown of the DTP Phase II includes Engineering Procurement Construction (EPC) and Operations & Maintenance (O&M) Contracts this will involve contracts with competitively selected EPC contractors to build, operate and maintain the power plants at each site and also build and equip the training centres for one year.

2.4 Project Benefits

The proposed Project is envisaged to have a range of associated benefits. The potential benefits of the proposed Project include but are not necessarily limited to the following:

- Increased electricity generation - when operational, the project is expected to generate about 3,566 megawatt hours (MWh) of solar energy per year.
- The electricity generated will be sufficient to power approximately 180 additional facilities including student hostels/ staff quarters.
- Stimulation of academic and research activities within the University as a result of access to constant and reliable power supply, thereby promoting educational advancement
- Reduction in fossil fuel consumption by the University thereby leading to reduction in carbon emissions and improvement in eco-balance.

- Significant reduction in the cost of power generation by the University through diesel-fuelled generators. Such savings would be used for other undertakings that will benefit the University.
- Increase in social interactions within the University. There will be enhanced security in the University as a result of more streetlights for illumination which would help kDtP off opportunistic crimes and gender-based violence.
- Enhancement of learning in renewable energy as a result of training centre to be provided as part of the Project.
- Direct and indirect employment opportunities during Project development and operation. The employment opportunities will lead to acquisition of new skills and introduction of all manners of income generating spill-over effects.
- Increase in local and regional economy through award of contracts and purchase of supplies for Project development.
- Increase in financial and technical collaborations between the FGN, the University, REA, AfDB, and other relevant Ministries, Departments and Agencies (MDAs).
- Contributing to the Nigeria's NDC to cut carbon emission by 20% by the year 2030, under the Paris Agreement.

Thus, the socio-economic benefits attached to this rural electrification access intervention, the DTP, are significant and largely impact not only the power, education and healthcare sectors but also provides as a measure to ensure Nigeria achieves its targets as contained in Nigeria's Nationally Determined Contributions (NDCs) under the Paris Agreement 2016. The DTP is a key programme to be developed towards achieving the objectives to the Power Sector Recovery Programme (PSRP) which was approved by the Federal Executive Council (FEC) on 22nd March 2017.

2.5 Envisaged Sustainability

2.5.1 Technical Sustainability

The Project development shall be handled by qualified and experienced EPC contractors (to be selected by REA through a competitive process) according to pre-established standards and procedures. The design and construction phase of the Project shall be overseen by qualified engineers from REA and the Department of Works and Physical Planning in Federal University of Technology, Ikot Abasi (FUTIA). In addition, standard operating manuals and appropriate documentation regarding the operation and maintenance of the Project shall be developed and put in place by the EPC Contractor. These documents will be used as the basis for providing facility-specific training to relevant personnel prior to start-up to further ensure technical sustainability of the Project. In addition, adequate capacity building shall be provided to the University personnel that will be in charge of the day-to-day operation of the Project in the long run.

Upon completion of the construction phase, an O&M contractor will be engaged to operate and maintain the Project, in conjunction with the team from Federal University of Technology, Ikot

Abasi, Works and Physical Planning Department. In addition, adequate capacity building shall be provided to the University personnel that will work with the O&M Contractor for the day-to-day operations of the Project in the long run. Selected students from the STEM Department will also receive hands-on training on the construction, operation and maintenance of the power plant.

2.5.2 Environmental Sustainability

The environmental sustainability measures for the Project include the use of renewable source of energy (solar) for electricity generation (with negligible greenhouse gas emissions compared to fossil fuel-burning power plants). In addition, the establishment of REA-PMU (which includes experienced Environmental and Social Safeguards Specialists) to oversee the implementation of the Project will contribute to environmental sustainability of the Project. More so, this ESIA study undertaken at the early stage of the Project development phase (and the commitment to implement the recommended mitigation measures and the ESMP developed as part of the ESIA) is geared towards ensuring the environmental Sustainability of the Project.

2.5.3 Economic Sustainability

The proposed Project is part of the FGN's DTP initiative, a component of NEP. NEP is being co-financed by the AFDB. The total funding available for the DTP phase III component is US$123 Million. Funding breakdown of the DTP Phase III includes Engineering Procurement Construction (EPC) and Operations & Maintenance (O&M) Contracts – this will involve contracts with competitively selected EPC contractors to build, operate and maintain the power plants at each site and also build and equip the training centres for one year.

Upon completion, the Project will significantly reduce the use of diesel generators in the University thereby saving costs on diesel fuel and generator maintenance, amongst others. Also, the monthly payment to distribution company (Port Harcourt Electricity Distribution Company) for power consumption through the grid would be significantly reduced since most of the energy source will be obtained from the off-grid solar based power plant. Grid connection would still be available for periods of downtime, emergency or facility maintenance, if need be.

Part of such savings will be used for the maintenance of the Project facilities in the long run. A cost-reflective service charge (to be determined based on consultation with University management and users) shall be implemented for all facilities within the University campus. Private business establishments within the University campus shall be allowed to connect to the power Project and metered for billing to generate additional revenue to the University. The generated funds shall be used to sustain the operational costs of the project as well as for the procurement of project components that may be replaced (e.g. spent batteries, panels, etc.) in the future.

2.5.4 Social Sustainability

Stakeholder consultation has been carried out as part of the ESIA process in ensuring that all relevant stakeholders are presented with the opportunity to provide input into the Project at the

early stage. This has also assisted in laying a good foundation for building relationship with the stakeholders. In addition, a Stakeholder Engagement Plan (SEP) was developed as part of the ESIA study to ensure continuous engagement with relevant stakeholders throughout the Project life cycle. Also, a grievance redress mechanism (GRM) has been developed by REA for the Project. The GRM provides the communication channel to receive any complaints from stakeholders on the proposed Project and ensures that they are timely and adequately addressed. Details on stakeholder consultations carried out till date on the proposed Project are provided in Chapter 4 of this report.

Furthermore, REA-PMU will establish a Grievance Redress Mechanism (GRM) that will allow general public in the project area, affected communities or individuals, and PAPs to file complaints and to receive responses in a timely manner. The system will also record and consolidate complaints and their follow-up. This system will, be designed for handling complaints perceived to be generated by the project or its personnel. It may also include disagreements about compensation and other related matters (NEP ESMF, 2018).

2.6 Project Alternatives

2.6.1 Analysis of Project Alternative

The power plant to be provided as part of proposed DtP has been conceptualized to be a renewable energy source, thus eliminating discussions on other possible sources of power generation such as the use of coal fired plant, oil-fuel plant, natural gas fired power plant, etc. Setting up of a solar power project involves selection of environmentally and techno economically suitable site, land characteristics, meteorology, infrastructure, grid availability, water availability, rail and road connectivity, accessibility and shading aspects etc. Before selecting of the solar hybrid system applicable to this location and matching the daily demand and the requisite renewable energy production, the comprehensive review of the measured data for the solar hybrid system for the Federal University of Technology, Ikot Abasi, was carried out duly. Thus, this section specifically focuses on the alternatives considered within the proposed solar-hybrid power plant. Solar power generation is currently one of the fastest growing areas in renewable energy. Beyond panel production, it does not emit any significant GHGs. Compared to alternative renewable generation technologies such as wind turbines or biofuel generators, Solar energy is produced by converting the sun's radiation a process void of any smoke, gas, or other chemical by-product, which makes this technology to meet the clean development mechanism of the Kyoto Protocol. This is the main driving force behind all green energy technology, as nations attempt to meet climate change obligations in curbing emissions.

2.6.2 Site Alternatives

The Project site has been selected based on a number of considerations including: i) accessibility - the Project site can easily be accessed through the existing road network within the campus; ii) security; iii) absence of any physical structure on the site that could be affected by the proposed Project; iv) absence of any rocky outcrops on the site that could pose constraints to the solar panels

to be installed; v) absence of any ecologically sensitive areas and/or cultural resources within and around the Project site. Other candidate sites considered within the University campus for the proposed Project were rejected due to some factors such as: i) presence of physical structure which could trigger relocation; ii) poor accessibility; iii) technical considerations for installation of solar panels, for example, topography.

2.6.3 Solar Power Technology Alternatives

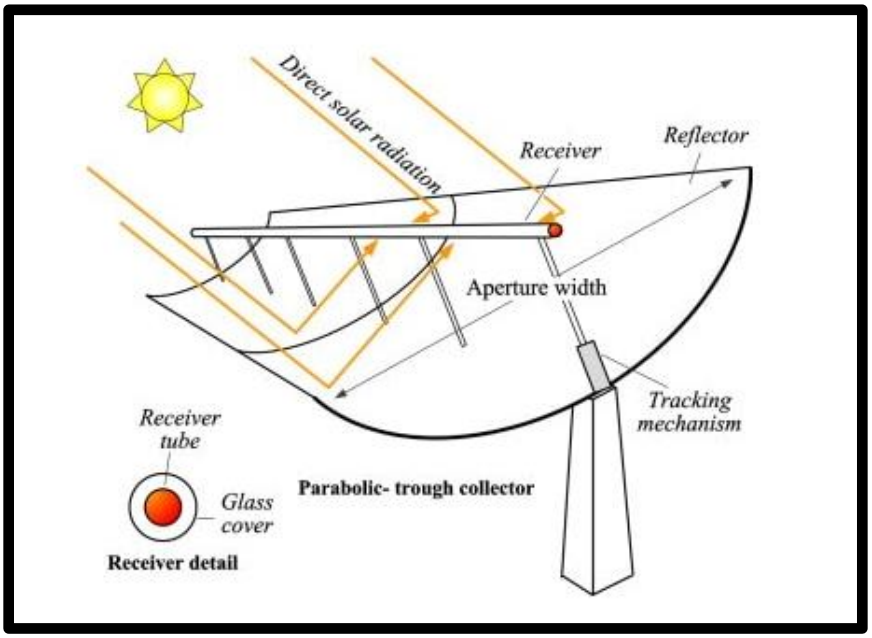
The solar technologies options available for the proposed power plant in the University are:

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

2.6.3.1 Concentrated Solar Power (CSP) Systems

Concentrated solar power (CSP) technologies harness thermal energy from the sun to drive a thermodynamic cycle. Thermal energy storage (TES) is realized through the addition of tanks, which allows CSP systems to generate electricity at times of little or no solar irradiance. This includes operating 24-h a day (baseline generation) or adjusting electricity generation during times of increased demand and high prices.

There are four different types of solar collector designs indicated in figure 2.5 parabolic troughs, heliostats (for power towers), linear Fresnel lenses, and dish receivers.



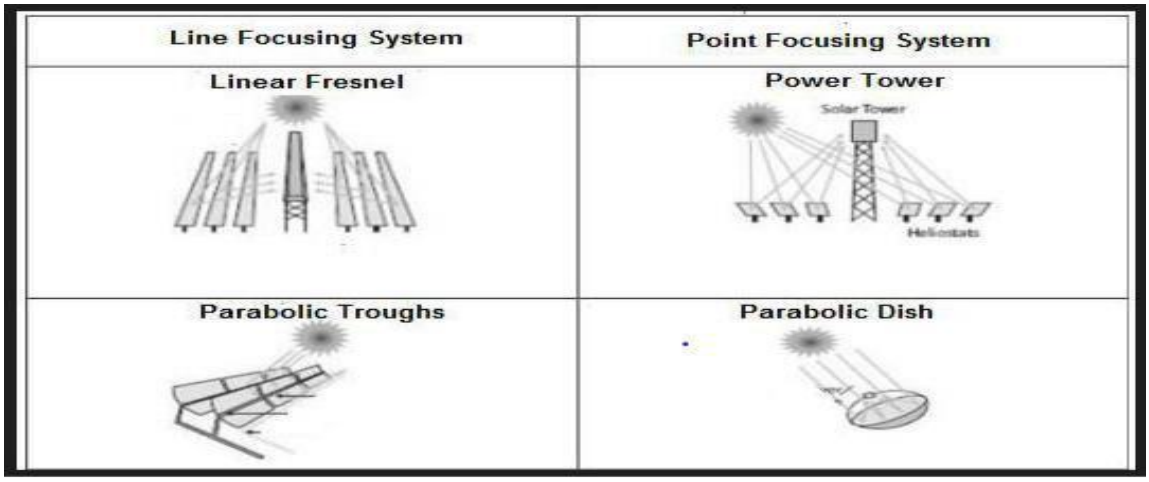


*Figure 6: **Typical Designs of Solar Collector***

2.6.3.2 Solar Photovoltaic Power Systems

SPV systems utilize semiconductor-based materials (solar cells) which directly convert solar energy into electricity. SPV systems have many attractive features, including modularity, no fuel requirements, zero emissions, no noise and no need for grid connection. SPV systems can be classified according to three principal applications.

- Stand-alone solar devices purpose-built for a particular end use, such as solar HF radios, solar home lighting systems, or solar coolers. These dedicated SPV systems can either be configured to include some energy storage capacity or directly power electrical or mechanical loads, such as pumping or refrigeration;
- Stand-alone solar power plants, basically small power plants designed to provide electricity from a centralized SPV power plant to a small locality like village or a building; and
- Grid-connected SPV power plants, which are equivalent to any other generator supplying power to the electricity grid.

The final design preference is for Solar Photovoltaic Power Systems. Table 2. 3 indicates Potential SPV System Configurations and Design Assumptions based on 4.8 daily hours of peak power output.

*Table 3**: Potential SPV System Configurations and Design Assumptions based on 4.8 daily hours of peak power output**.*

Description	***SPV Systems***		***SPV Mini-grid***	***Large Grid-connected***
			Power Plants	*SPV Power Plant*
Module Capacity	50 Wp	300 Wp	25 kW	5 MW
Life Span Modules	20 Years	20 Years	25 Years	25 Years
Life Span Batteries	5 Years	5 Years	5 Years	NA
Capacity Factor	20%	20%	20%	20%

2.6.4 Solar Batteries Alternatives

Solar batteries are mainly categorized by manufacturing material. There are four main types of solar batteries available on the market:

a) Lead-Acid Batteries

Lead-acid batteries are the oldest form of battery with technology dating back more than a century. As a result, lead-acid batteries are a tried-and-true when it comes to storage. Lead-acid batteries are categorized into two types: flooded lead-acid and sealed lead-acid batteries.

The lead-acid variety are considerably more inexpensive than other solar batteries. These batteries come with some challenges: shorter lifespan and lower depth of discharge. Lead-acid battery capacity is also comparatively lower than other batteries. These limitations can complicate the installation process.

b) Lithium-Ion Batteries

Lithium-ion batteries are relatively new. Their advanced technology has updated features. Many portable devices, such as mobile phones and laptops, use lithium-ion batteries. They are efficient, compact and lightweight. If not properly installed, lithium-ion batteries could experience thermal runaway and catch fire.

c) Nickel Cadmium Batteries

Nickle Cadmium (Ni-Cd) batteries are not as common as lead-acid or lithium-ion batteries. These batteries are also a century old. They were popular in the aircraft industry. Because of their sturdiness, Ni-Cd batteries are useful for large-scale applications, such as utility solar energy storage. Known for durability, Ni-Cd batteries can operate at higher temperatures. They also don't need complicated battery management systems and are almost maintenance-free. Ni-Cd batteries' biggest drawback is that they are toxic. Even when recycled, they can become a major environmental concern.

d) Flow Batteries

Flow batteries are still in the development phase, and it may take some time before they are widely available in the market. Knowing about them now is worthwhile because this variety is expected to be a game changer in future solar panel storage methods. Within these batteries, water-based electrolyte liquid circulates between two different chambers. The chemical reaction of the charging process allows the battery to store and release electrical energy.

The biggest advantage of flow batteries is that they offer 100% depth-of-discharge capability. This means you can utilize all the energy stored in the battery without damaging it. The final design option is in preference of lithium battery.

2.7 Project Options

a) No Project Option

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

b) Delayed Option

This option implies that the planned Project will be delayed until a much later date. The implication of delayed project option will mean that all the preliminary work and associated efforts/ costs because of inflationary trends, will result in unanticipated increases in project costs, which may affect the final profit accruable from the Project. The delayed option is considered unviable for the Project.

c) Go Ahead Option

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

CHAPTER THREE: PROJECT DESCRIPTION

3.1. Project Overview

The plan for Federal University of Technology, Ikot Abasi is solar hybrid plant of 2.9 MW. The civil characteristics and general layout of the proposed plant are shown in figure 3.1. The proposed plant would use a renewable method of generating electrical power by converting solar radiation into direct current electricity using silicon panels that exhibit the photovoltaic effect. Photovoltaic (PV) power generation employs solar panels composed of a number of solar cells containing silicone.

The plant would consist of solar panel arrays sufficient to generate the rated power of 2.4 MW AC capacity) and the peak power is 2.9 MW (DC capacity) resulting in a DC/AC ratio of 1.22. The system would include a combination of fixed arrays facing to the south. The arrays would be embedded into the ground with concrete footings. Power produced by the plant would be, converted to AC through inverters. Transformers would be installed to step up voltage so that it is compatible with the national grid. The stepped-up power would then be connected to the grid. The following infrastructure would be established for the project:

- A solar PV plant constructed using poly crystalline PV modules, installed in regular arrays
- An overhead power line to connect the solar plant to national grid
- A system of inverters and step-up transformers
- Aboveground and underground electrical conduits and cabling which connect the arrays to the inverters and transformers
- Marshalling switchgear to collect the power from the PV arrays
- Internal access tracks to allow for maintenance of the site
- Supervisory control centre
- Site office and maintenance building
- Lay down and assembly area

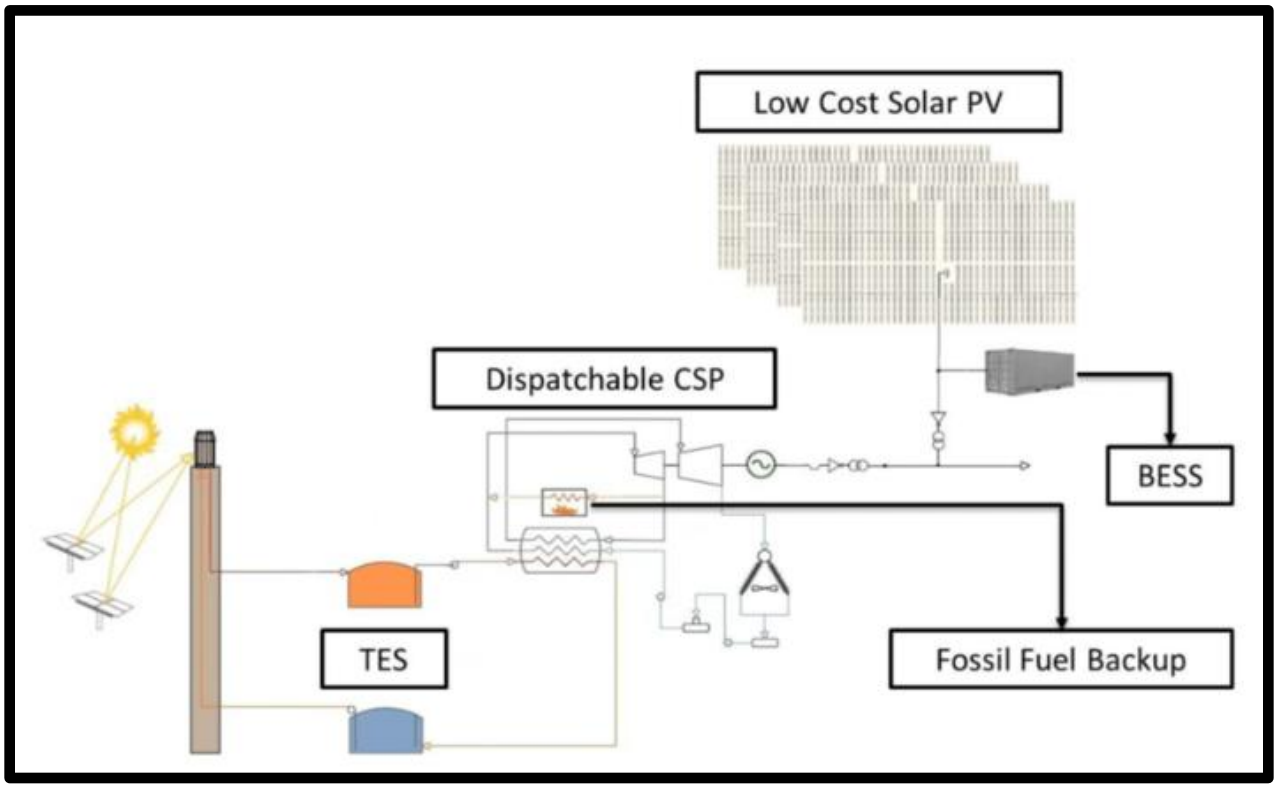


Figure 7: ***FUTIA Hybrid Solar PV Captive Power Plant Overview***

3.2. Project Requirements

Water Use and Supply

Water usage would be minimal and would be mainly for the monthly cleaning of PV panels and domestic use. The use of water for construction activities will be minimal because construction works requiring cement mixing will be few on site. Water is required majorly during the operational phase of the power plant for periodic cleaning of PV panels to prevent dust build-up especially during the dry season), since dust can affect their performance by inhibiting the amount of irradiation that reaches the solar cells. The rate of build-up of dust on the PV panels is dependent on a number of factors including soil type, local wind speed and the mounting structure used for the panels. Manual cleaning of the PV panels with water shall be regulated as much as practicable. A wet day is one with at least 0.04 inches of liquid or liquid-equivalent precipitation. Rain falls throughout the year in Uyo. The month with the most rain in Uyo is September, with an average rainfall of 15.2 inches. The month with the least rain in Uyo is January, with an average rainfall of 0.7 inches. During the periods of rainy season, direct cleaning of the PV panels is estimated to occur not more than twice. However, during the dry season, the frequency of cleaning will depend on the rate of dust accumulation. Based on the review of similar solar power projects, each PV panel would require approximately 5 litres of water per cleaning cycle. The water required for the

cleaning purpose would be obtained from the borehole that will be installed within the Project site. Based on observations noted during the field survey and the estimated quantity of water required for occasional cleaning of the PV panels, water abstraction for the Project is not envisaged to have significant effect on the existing groundwater aquifer of the Project area as well as the local water use. The recharge of the existing boreholes in the study area is largely due to direct precipitation.

During the rainy season, the water reserve of the aquifer in the study area increases; thus, boreholes yield improves significantly. Water requirement would be met by building rain/runoff water harvesting pond and also from groundwater extraction. Reasonable efforts would be taken to conserve water through recycling and reuse during the operational phase. It should be noted that water runoff/discharge from the panel cleaning would be either evaporated or absorbed into the soil below the panels which kDtPs the used water within the water cycle. No drainage canal is required due to the low volume.

Table 4: Quantitative Estimates of Key Project Resource Requirements

Resource	Construction Phase	Operation Phase
Water Demand	Approximately 20–30 m^3/day (for concrete works, dust suppression, equipment cleaning, and domestic use)	Approximately 2–5 m^3/day (mainly for panel cleaning and domestic use)
Electricity Demand	Approximately 80–150 kWh/day, supplied by temporary generators or the existing campus electricity network	The facility will generate 2,926 kW of electricity, with only a small proportion (approximately 20–40 kWh/day) consumed internally for lighting, control systems, security, and auxiliary equipment
Diesel/Fuel Consumption	Approximately 150–300 litres/day for construction equipment, generators, and vehicles	Approximately 10–20 litres/day for standby generators, maintenance vehicles, and emergency operations
Backfill/Lateritic Material	Approximately 1,000–2,000 m^3	Limited quantities for periodic maintenance
Solar PV Modules	Approximately 5,000–6,500 panels (subject to final module capacity)	Installed equipment
Workforce	Approximately 80–120 personnel at peak construction (including	Approximately 10–20 permanent staff for operation, maintenance, administration, and security

Resource	Construction Phase	Operation Phase
	skilled, semi-skilled, and unskilled labour)	

Health and Safety

Engineering, procurement and construction (EPC) contracts are the most common form of contract for the construction of solar PV power plants.

Occupational health and safety (OHS) is an issue that needs to be properly managed during construction in order to minimize the risk of preventable accidents leading to injuries and/or fatalities. Proper OHS risk identification and management measures should be incorporated in every project's management plan and standard EPC contractual clauses.

The EPC contractor shall engage dedicated personnel competent on the basis of appropriate education, training, and experience to manage and oversee the Health, Safety and Environment (HSE) aspects of the Project.

The HSE personnel shall ensure that the Project and subcontractors operate in accordance with the applicable regulatory HSE requirements and plans; and also monitor implementation of environmental and social protection measures. Occupational health and safety (OHS) plans shall be developed and maintained by all contractors involved in the implementation of the proposed Project particularly in the following aspects:

Occupational Health and Safety:

- General Facility design and operation.
- Communication and Training.
- Physical Hazards.
- Chemical Hazards.
- Biological Hazards.
- Personal Protective Equipment (PPE).
- Special Hazard Environments.
- Monitoring.

Community Health and Safety:

- Water Quality and Availability.
- Structural Safety of Project Infrastructure.
- Life and Fire Safety (L&FS).
- Traffic Safety.
- Transport of Hazardous Materials.
- Disease Prevention.

Waste Management

It has been established that RETs are environmentally friendly during their useful life, in terms of obnoxious gaseous emissions as do fossil fuels, however, they are not 100% pollution-free at their end-of-life (EoL) period.

Generally, PV systems have ways of generating primary and secondary wastes streams. the primary wastes streams are direct components used in PV systems, whereas secondary waste streams comprise pollutants from nonrenewable energy resources used in the production and disposal of PV panels and the rest of the balance of system (BOS) components (wires, batteries, inverters, metallic frames). These large quantities of nonrenewable energy generated wastes (pollutants) are of high environmental impacts. A summary of expected waste stream from the project phases is outlined in table 3.2.

*Table 5**: Waste Streams of Project Phases***

Waste Stream	Primary Sources	Pre-Construction (P)	Construction (C)	Operation (O)	Decommissioning (D)
General rubbish, refuse, and domestic (putrescible) waste (food waste)	Food packs, used bottles, packaging materials	✓	✓	✓	✓
Cleared vegetation	Site clearing and preparation activities	✓	✓	✓	✓
Scrap metals	Used tubular casings, iron rods, off-cuts	–	✓	✓	✓
Excavated materials	Foundation and trenching works	✓	✓	–	✓
Damaged / expired PV modules (panels)	Power generation system components	–	–	✓	✓
Expired inverters	Electrical installation and power conversion equipment	–	–	✓	✓
Damaged / expired batteries	Energy storage system components	–	–	✓	✓
Sanitary waste	Training centre and project facilities	✓	✓	✓	✓

Solar PV network installation standards

There are many organizations that develop the standards and codes for PV systems. ASTM mainly known as the American Society of Testing and Materials has developed more than 12,000 international standards to improve the quality of the product and enhance safety. The PV standard developed by ASTM technical committee is E44.09 Photovoltaic electric power conversion. The International Code Council (ICC) is involved mainly with the development of a single set of comprehensive international model construction codes engrossed in building safety and fire prevention. The International Electro-Technical Commission (IEC) has published Technical Specifications IEC 62257, a set of standards covering technical and organisational aspects of mini-grids (design, installation, maintenance, contracting) and a checklist of good practices. The DTP program and system designer have taken cognizance of the national and international standards into consideration for the design and execution of this project.

3.3 Project Components

The project comprises six components:

- A solar PV farm complete with inverters and transformers,
- Power station,
- Transmission line,
- Buildings (control room, site office, renewable energy workshop and training centre (WTC);
- Transmission line; and
- Street lights.

The power plant will use solar panels fitted on fixed structures (mounts). The main characteristics is summarized in Table 3.3. The advantages of solar energy include its non-polluting nature; it is non-depletable, reliable, and free fuel. The disadvantages of solar energy are that the solar energy concentration is very dilute, so collectors with large surface area are needed. In addition, solar radiation is neither constant nor continuous for terrestrial applications (i.e. low-capacity factor). The solar energy received depends on latitude, season, time-of-day, and atmospheric conditions.

Table 6: Main characteristics of the fixed mounting structure

Fixed structure characteristics	
Structure type	1H
Tilt angle	9.0 °
Poles type	Bi pole
Pitch distance	3.04 m
Designed for	MONOFACIAL modules
Minimum ground clearance	0.5 m

Gap between modules in the axis direction	0.0 mm
Gap between modules in the pitch direction	0.0 mm

Table 3.4 gives a summary of the project's characteristics and figure 3.3 shows the electrical configuration of the PV plant.

Table 7: Key Project Characteristics

Parameter Category	**Technical Specification**	**Details / Values**
Project Location	State/Country	Akwa Ibom, Nigeria (FUTIA Campus)
Power Output	Rated Power (AC)	2,400.0 kWac (2.4 MW)
	Peak Power (DC)	2,930.4 kWp
	DC/AC Ratio	1.22
Civil Design	Structure Type	Fixed-tilt Mounting Structure
	Ground Coverage Ratio (GCR)	34.30%
	Pitch Distance	3.04 m
Electrical Components	PV Modules (440.0 Wp)	6,660 Units
	Power Stations (600.0 kW)	4 Units
	String Inverters (100.0 kVA)	24 Units
Environmental Parameters	Gaseous Emissions	Zero (Operational Phase)
	Liquid Discharges	Uncontaminated storm water; diverted via perimeter drainage to natural watercourses.
	Acoustic Impact (Noise)	≤ 15 dB(A) at plant boundary; < 15 dB(A) at the **Senate Building** (nearest sensitive receptor).

	Logistics & Access	Rehabilitation of existing access road within FUTIA; internal traffic restricted to site boundaries.

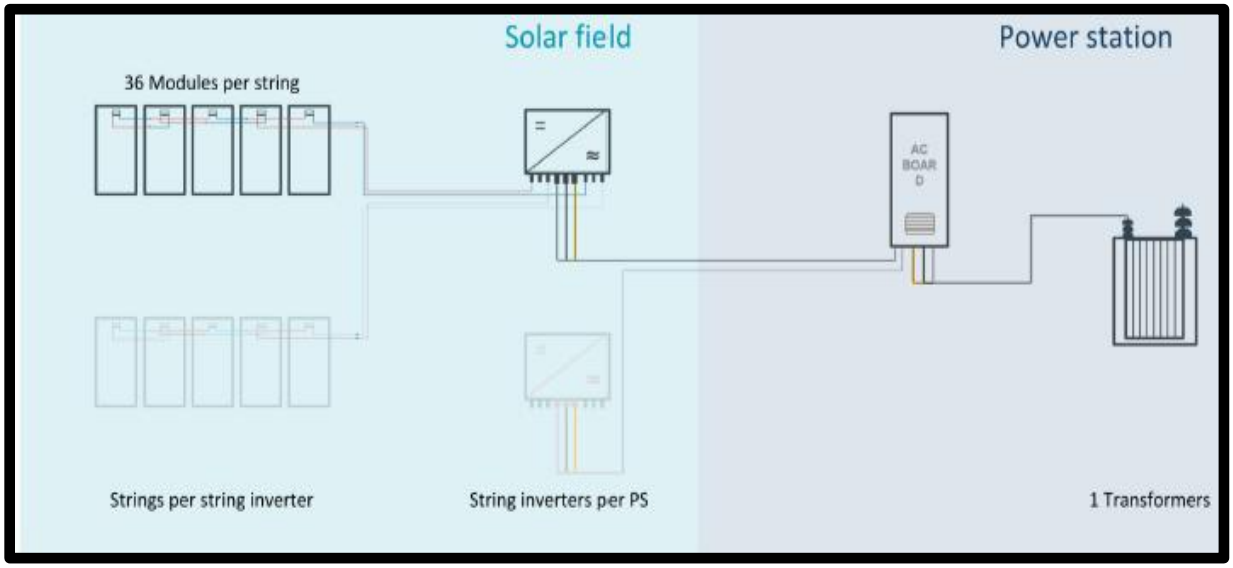


Figure 8: Simplified electrical configuration diagram

Component 1: Solar PV Farm

a) Solar PV Modules

A PV cell is a semiconductor device that converts sunlight into electricity using photovoltaic effect. Multiple cells can be combined to form a PV module. The efficiency of a PV module is measured by its ability to absorb light particles called photons. The more photons that are absorbed, the more efficient the panel is at converting light into electricity. The proposed solar farm would consist of arrays modules, mounted on fixed structures to obtain a total project capability of about 2.9 (MW) of direct current (DC). The feedstock (solar radiation) is readily available as a byproduct from sunlight, and the long-term supply is guaranteed. The panels are generally considered to have a lifetime of upwards of 30 years (Alsema, E.A., de Wild- Scholton, M.J., & Fthenakis, V.M. (2006). The selected minimum reference photovoltaic module has a peak power of 440.0 W, and the technology of the cells is Si-Mono (Figure 3.4). The features of the photovoltaic module are shown in Table 3.5. The general layout is shown in figure 3.5.

Table 8: Photovoltaic module characteristics

Main characteristics	
Technology	Si-Mono
Type of module	Monofacial
Maximum voltage	1500 V
Standard test conditions (STC)	
Peak power	440.0 W
Efficiency	19.93 %
MPP voltage	40.1 V
MPP current	10.98 A
Open circuit voltage	48.3 V
Short circuit current	11.53 A
Temperature coefficients	
Power coefficient	-0.360 %/°C
Voltage coefficient	-0.290 %/°C
Current coefficient	0.050%/°C
Mechanical characteristics	
Length	2108.0 mm
Width	1048.0 mm
Thickness	0.04 mm
Weight	24.9 kg

Figure 9: Example of a Monofacial Si-mono photovoltaic module

b) Inverters

Inverters are installed in the containers or outside on proper mounting solution. Inverter receives DC electrical energy that flows from photovoltaic panels and transforms it into AC electrical energy that is passed to the national grid. The inverter adapts itself to the photovoltaic string to get the maximum electrical energy available and pass it to the grid. This method is called Maximum Power Point Tracking (MPTT). In Figure 3.5, a commonly used photovoltaic inverter for utility-scale PV plants is shown and a detailed characteristic shown in table 3.6. The single line diagram for the inverter is shown in figure 3.6.

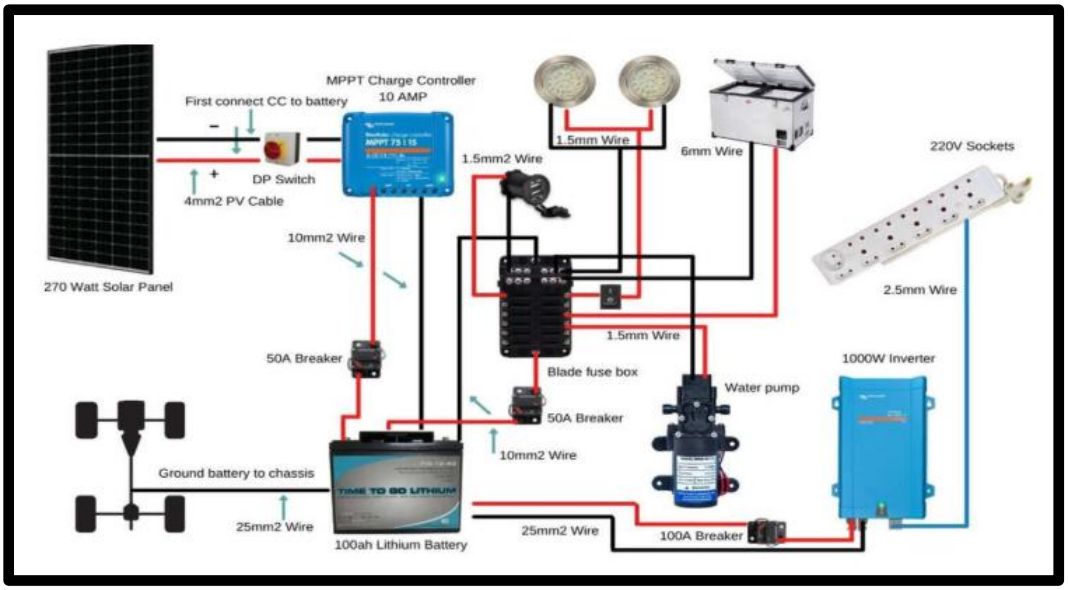


Figure 10: Example of string photovoltaic inverter system

Table 9: Inverter characteristics

Inverter characteristics	
Main characteristics	
Inverter type	STRING
Maximum DC to AC conversion efficiency	99.00 %
Input side (DC)	
MPPT search range	600- 1500 V
Maximum input voltage	1500 V
Output side (AC)	
Rated power	100.0 Kva
Power at 30 C (datasheet)	100.0 Kva
Power at 50 C (datasheet)	90.0 Kva
Output voltage	800 V
Output frequency	50 Hz

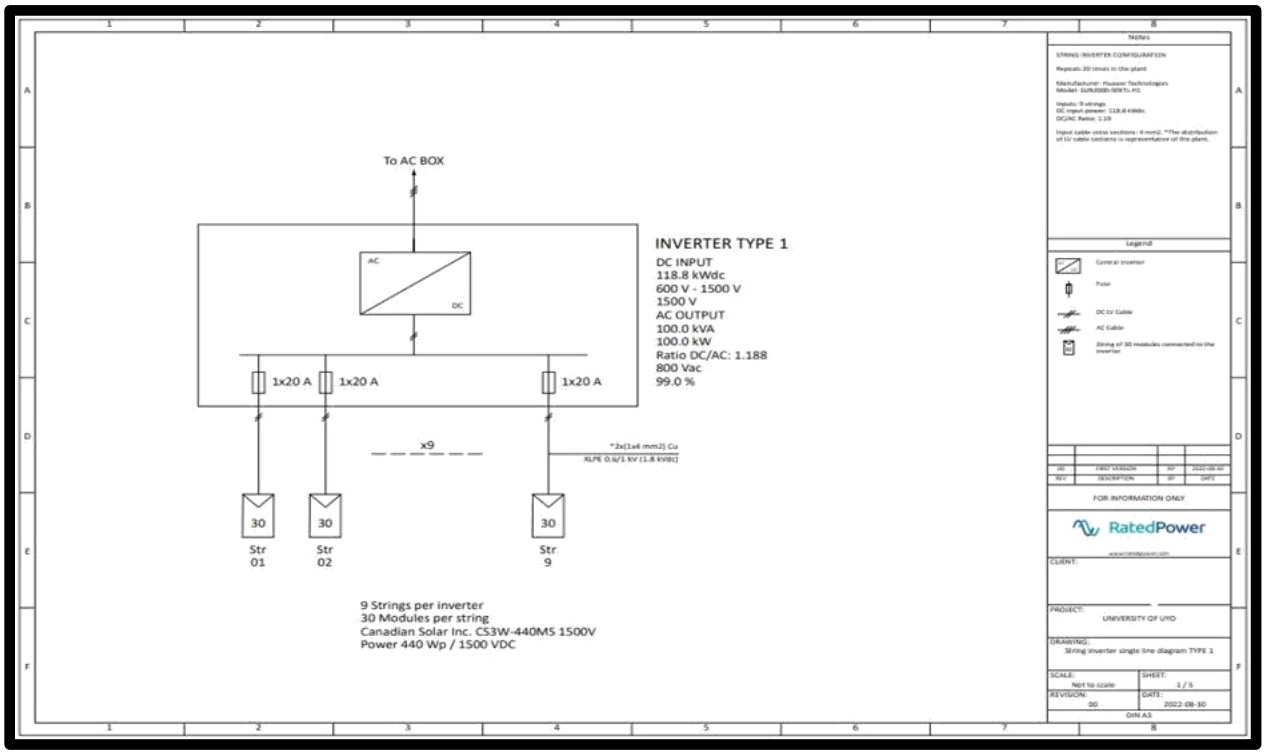


Figure 11: String Inverter Single Line Diagram

c) Transformers

All inverters are connected to a transformer. The role of the transformers is to step-up the voltage from an inverter nominal voltage to a medium voltage of the national grid. Transformers consist of three coils. One coil is connected to the high voltage; two coils are connected to each of the inverter unit's master / slave. The proposed project layout comprising the solar power plant site and transmission line have taken into account the solar radiation, wind direction and evacuation corridor. An example of a power transformer is shown in Figure 3.7 and its characteristics in table 3.7.

Figure 12: Example of Transformer

The main features of the power transformer are shown in Table 3.7.

*Table 10**: Transformer characteristics***

Rated power	600.0 Kva
Voltage ratio	0.8/ 11.0Kv
Cooling system	ONAN
Tap changer	2.5%, 5%, 7.5%, 10%
Short circuit (Xcc)	0.08

d) Weather Station

The Solar Monitoring Weather Station includes common meteorological sensors, mounting accessories, a data logger or the signal translator, power supply, and communications hardware. The equipment can be powered from a solar panel power system. The standard sensor array includes two pyranometers, a combined temperature and relative humidity sensor, wind speed and wind direction sensors, and surface mounted temperature sensors to measure solar panel temperature.

Component 2: Power station

The power stations or transformer stations are indoor buildings or containers. The voltage of the energy collected from the solar field is increased to a higher level to facilitate the evacuation of the generated energy. The power transformers will be housed in the power station.

The power station shall be supplied with medium voltage switchgears that include one transformer protection unit, one direct incoming feeder unit, one direct outcoming feeder unit and electrical boards. Particularly, for the first power station of each MV line, a direct incoming unit will not be installed. The power stations or transformer stations are indoor buildings or containers. The voltage of the energy collected from the solar field is increased to a higher level to facilitate the evacuation of the generated energy. The power transformers will be housed in the power station.

Component 3: Access Roads

Gravel paved earth access roads within the facility will be constructed. The roads will link all project components and be laid out in an efficient manner to ensure easy access for operation and maintenance as well as access from outside the facility. Figure 3. 10 is the Typical Road Cross Section planned for the project.

For the design of the proposed PV plant, roads of 4.0 m have been used. These roads run a total distance of 1802.56 m. Road ditches used for drainage and for channeling water are placed on one side of the roads. A total perimeter of 1132.56 m of chain link fence surrounds the different areas of the PV plant. The fence has at least 2.0 m of height and 3.0 m between posts. For every 50.0 m of fence, a light post of 4.0 m of height and a microwave barrier system are installed. For every 100.0 m of fence, a video camera post of 6.0 m of height is installed.

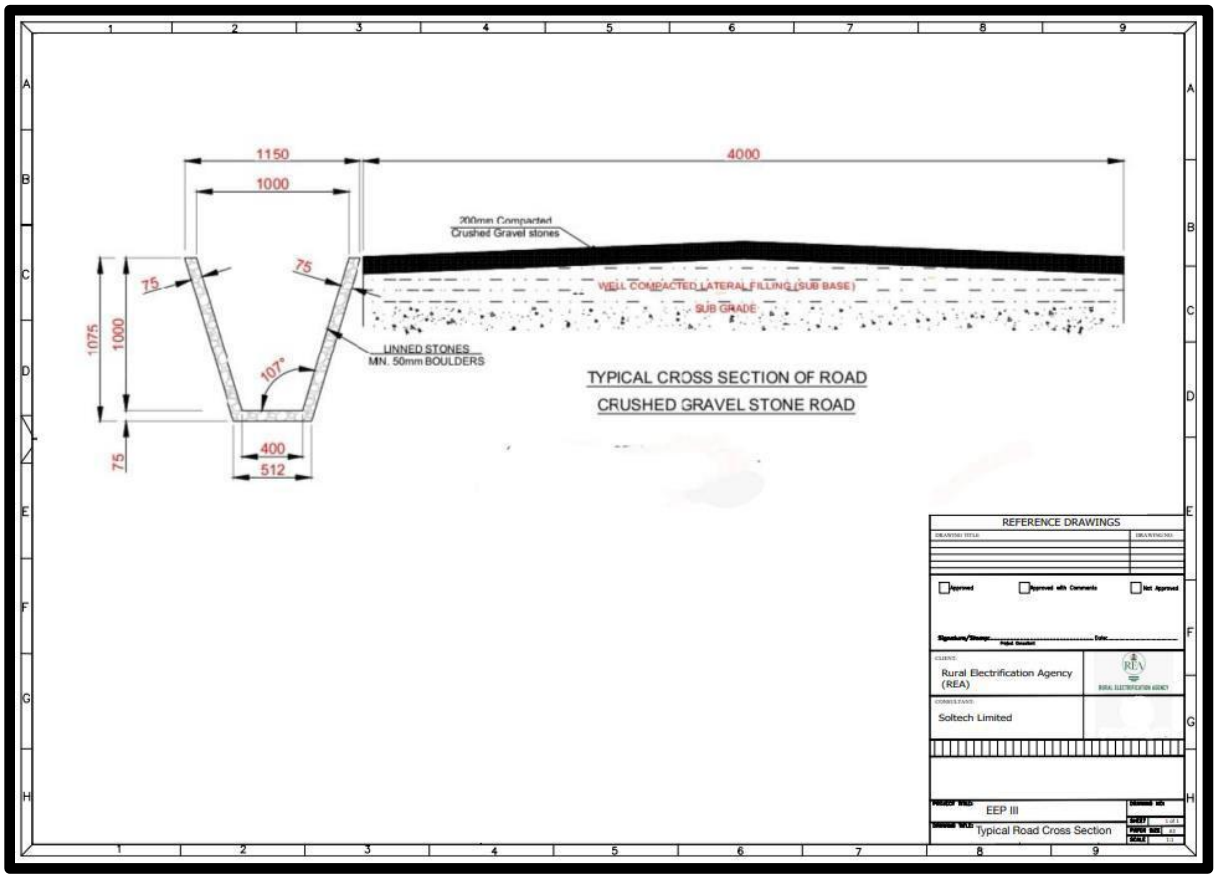


*Figure 13**: Typical Road Cross Section***

Component 4: Buildings

A renewable training/workshop centre will be built and Ancillary facilities include residential quarters for the security, maintenance, and control room staff who will be required full-time, a guard house and an office/control centre. Figure 3. 11 is the Elevation plans of the training Centre.

Control Building

The control building would take up an area of approximately 30m × 15m. The main construction compound would temporarily require an area of approximately 60m × 40m, however, this area would be fully reinstated after construction.

Lay down and Staging Area

A staging area where solar panels would be assembled would be constructed within the project area. The entire area would be enclosed by a chain link fence with a gate. Regular cleaning of the solar panels would be accomplished by either rinsing with water, blowing with compressed air, or a combination of both. Expected waste from this area would include wooden crates, plastics wrappings and Styrofoam.

3.4 Operation and Maintenance

Operation and maintenance of the system would be expected to occur on a limited basis at certain points during the system's estimated 25-year life cycle. To enhance the performance and reliability of the plant, the following types of maintenance will be carried out:

a) Preventive Maintenance - which involves routine inspection and servicing of plant equipment to prevent breakdowns. This includes panel cleaning, vegetation management, wildlife prevention, water drainage, monitoring of electrical components. It also involves retro- commissioning to improve the efficiency of the PV plant by detecting and solving problems in the system.
b) Corrective Maintenance - which involves repair of broken-down equipment. This includes on- site monitoring and mitigation, and critical and non-critical repairs of plant components.
c) Condition-based maintenance - which involves monitoring equipment and plant operations real- time and addressing potential problems early on in order to prevent plant downtime. This includes continuous monitoring via remote and on-site methods, warranty enforcement, and planned and unplanned equipment replacement.
d) Maintenance activities will be carried out by skilled manpower with backgrounds in electrical/electronic engineering and unskilled local labour where applicable. Specific maintenance activities include the following;

PV Modules

- PV modules need to be cleaned weekly in the dry season and monthly in the wet season to prevent accumulation of dust. Also, the cabling around the modules need to be checked regularly for damages.
- Panels need to be checked regularly for cracks and breaks.
- Panel testing needs to be conducted annually to ensure they live up to the manufacturer's warranty.

Electrical System

- Inverter components need to be checked to prevent breakdown which can occur during very hot weather conditions.
- Electrical wiring and earthing protection need to be checked for wear and tear. Also, the underground cabling needs to be monitored regularly for damages from pests. Infra-red technology may be employed to identify spots where there are electricity leaks.

Civil Structures

- Mounting structures need to be checked regularly for bending damage which can affect the PV modules
- Access roads, drainage works, plant foundation and array structures need to be checked by visual inspection for water damage during the rainy season

Vegetation

Growth of shrubs and other vegetation needs to be curtailed to prevent shadowing effect on the solar panels leading to a decrease in the output from the plant. Weeds also need to be eliminated as they present a fire hazard. Vegetation around the transmission line RoW needs to be cleared quarterly to maintain a vegetation height at less than 2 ft (0.61 m).

A stock-pile of spare parts will be kept on-site to facilitate replacement of broken-down or outdated solar panels and inverters. On-site security and inventory management will be implemented to prevent theft of spare parts and installed plant components.

Monitoring of the PV system components needs to be conducted to ensure increased system output and to reduce down-time. Traditional monitoring methods that compare actual energy generation against predicted energy generation will help to track the system's relative health.

3.5 Project Implementation Phase Activities

3.5.1 Preconstruction

Preconstruction works will last for 1-2months. The works at this stage will entail activities such as land identification, completion of engineering design for the Project and receipt of relevant approvals, mobilization of personnel, equipment and materials to site, site preparation and installation of temporary structures for material storage.

3.5.2 Construction

Construction activities would last about 12-18 months. The major activities to be done and facilities to be constructed will include:

- Civil works;
- Towers;
- Transformers;
- Control building;
- Weather station; and
- Transmission lines;

The proposed construction programme would be as follows:

- Construct the site access roads with gates and temporary fencing;
- Excavate the foundations;
- Construct the panel foundations;
- Construct the transformer stations and install the grid connection;
- Lay power and instrumentation cables;
- Construct the control station;
- Erect and connect the panels;
- Erect weather station;
- Commission the panels/ transmission lines; and
- Carry out land reinstatement, remove temporary compounds and clear the site.

The construction activities will normally be completed during daytime hours; however, there will be requirements for extended hours during major concrete pours or other installations that cannot be interrupted. Summary of the implementation activities is indicated in table 3.9 and categories of staff requirement in table 3.10.

3.5.3 Commissioning and Operation

Following the completion of all works at the construction phase, the power plant will be commissioned for operations. The commission phase will involve 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. Standard operating procedures (SOPs) shall be developed by the EPS Contractor for the operation and maintenance of the solar panels, inverters, batteries, and other associated components of the Project.

Upon completion of the commissioning of the power plant and other ancillary infrastructures, the EPC contractor will hand over the power plant to the Operation and Maintenance (O&M) Consultant who will be charged with the responsibility of operating and maintaining the plant for a period of 1 year. At this period, the O&M Consultant will also train the technical unit staff of University for ease of handover at the end of the O&M period. Activities under this phase will include:

- Power generation and distribution to various sections of the University;
- The preventative, corrective and predictive maintenance of the power plant and associated facilities.

Also, the training centre will be utilized in enhancing learning in renewable energy.

3.5.4. Decommissioning

Upon completion of the power plant, the project site area will be cleared out for proper housekeeping. This is different from the decommission of the site which will be undertaken at the end of life of the power plant. The plant has a life cycle of at least 25years, which is expected to be extended with proper and timely maintenance of the plant. Upon the end-of-life of the power plant, the decommissioning activities will include:

- 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).
- Removal of PV panels and equipment, demolition of structures and evacuation as well as site remediation.
- Waste management – recycling, disposal of unusable parts etc.
- Restoring the environment to allowable baseline conditions and monitoring of the process.
- Assessing the residual impacts, if any, that the project has on the environment

Table 11: Project Implementation Phase Activities

Project Phase	Key Activities
Pre-Construction Phase	1. Completion of engineering design for the project.2. Receipt of all relevant regulatory and statutory approvals.3. Site clearing, preparation, and mobilization of equipment, materials, and personnel to site.
Construction Phase	1. Recruitment of workers: • Low-skilled workers (general construction labour). • Semi-skilled workers (drivers, technicians). • Skilled personnel (engineers and expatriates, where required).2. Civil, mechanical, and electrical works.3. Installation of PV panels and associated plant facilities.4. Construction of a training centre.5. Installation of streetlights, batteries, inverters, and other associated components.6. Installation of underground armoured cables for power evacuation.7. Upgrade of existing power distribution infrastructure within the University (where required).
Commissioning Phase	a. Testing and checking of individual equipment and associated infrastructure to ensure proper installation and readiness for use.b. Development of Standard Operating Procedures (SOPs) by the EPC contractor for the operation and maintenance of solar panels, inverters,

	batteries, and associated systems.c. Handover of the completed facilities for operational use.
Operational Phase	1. Power generation and distribution to various sections of the University.2. Preventive, corrective, and predictive maintenance of the power plant and associated facilities.3. Operation of the training centre to enhance learning in renewable energy technologies.4. Monitoring of system performance and environmental and social management measures.5. Assessment of any residual environmental and social impacts during operation.
Decommissioning Phase	1. Dismantling and removal of PV panels and associated infrastructure (mounting structures, power evacuation cables, inverters, transformers, batteries, etc.).2. Removal of any sub-surface installations (e.g. underground cables).3. Waste management, including handling and disposal of hazardous and non-hazardous materials.4. Restoration of the project environment to allowable baseline conditions.5. Post-decommissioning environmental monitoring.

Table 12: Staff requirements

Project Phase	Personnel Category	Estimates	Description / Role
Pre-Construction Stage	Manual Workers	3	Support activities related to site preparation, mobilization, and preliminary works.
	Skilled Labour / Professionals / Managers	4	Engineers, project managers, planners, and technical experts responsible for design finalization, approvals, and project planning.
	Security	3	Site security and access control prior to commencement of construction activities.
Construction Stage	Manual Workers	10	Labour for civil works, equipment handling, installation support, and general construction activities.

Project Phase	Personnel Category	Estimates	Description / Role
	Skilled Labour / Professionals / Managers	4	Engineers, technicians, supervisors, and project managers responsible for civil, electrical, and mechanical works.
	Security	4	Site security, asset protection, and personnel safety throughout construction.
Operational Stage	Cleaners	4	Routine cleaning and housekeeping of project facilities.
	Security	3	Continuous security of installed infrastructure and facilities.
	Heavy Maintenance Personnel	3	Personnel responsible for major repairs, overhauls, and replacement of critical system components.
	Light Electrical Maintenance Personnel	2	Technicians responsible for routine electrical checks, minor repairs, and system troubleshooting.
	Infrastructure Maintenance Personnel	2	Staff responsible for maintenance of physical infrastructure, including mounting structures and associated facilities.
	Parts and Inventory Management Staff	2	Personnel responsible for spare parts management, inventory control, and logistics support.
Decommissioning Stage	Manual Workers	5	Labour for dismantling, material handling, and site clearance activities.
	Skilled Labour / Professionals / Managers	3	Engineers and supervisors responsible for safe dismantling, waste handling, and site restoration.

Project Phase	Personnel Category	Estimates	Description / Role
	Security	2	Security personnel to control access and ensure safety during decommissioning activities.

Photovoltaic (PV) Panels and Battery Energy Storage System Management

Photovoltaic (PV) panels will be carefully dismantled and assessed for potential reuse, refurbishment, or recycling through licensed recycling facilities. Panels that cannot be reused will be managed as electronic waste (e-waste) in accordance with the National Environmental (Electrical/Electronic Sector) Regulations, 2011, and other applicable regulatory requirements.

Battery Energy Storage System (BESS) components, including lithium-ion batteries and associated equipment, will be handled as hazardous waste due to the presence of potentially hazardous materials. End-of-life batteries will be removed by qualified personnel and transferred to licensed manufacturers, recyclers, or hazardous waste management facilities for recovery, recycling, or environmentally sound disposal. Temporary storage, transportation, and handling will comply with applicable health, safety, and environmental standards.

Transformers, switchgear, inverters, cables, and other electrical equipment will be dismantled and inspected for reuse or recycling. Transformer oils and any hazardous substances will be collected, stored, transported, and disposed of by licensed waste management contractors in accordance with national regulations. Scrap metals, copper cables, aluminium frames, and other recyclable materials will be segregated and sent to authorized recycling facilities to maximize resource recovery and minimize waste generation.

Electronic waste generated from control systems, monitoring equipment, communication devices, and other electrical components will be managed through approved e-waste recycling channels. Hazardous materials, including used oils, lubricants, contaminated absorbents, chemicals, and damaged electrical components, will be identified, labelled, stored, transported, and disposed of in accordance with the project's Waste Management Plan and relevant environmental regulations.

Following the removal of all project infrastructure, the site will be restored to a safe and stable condition. Restoration activities will include the removal of foundations where necessary, regrading of disturbed areas, replacement of topsoil where required, revegetation with appropriate native plant species, restoration of drainage patterns, and stabilization of exposed surfaces to prevent erosion. Any temporary construction facilities will also be removed, and all wastes generated during decommissioning will be properly managed.

3.6 Project Interface Management and Schedule

Interface management is of central importance to the delivery of any complex engineering project, and solar PV projects are no exception. The main interfaces to be considered in a solar PV project

are listed in Table 3.11. It may be modified, depending on the final contracting structure for this particular project and design.

Table 13: Solar PV Project Interfaces

Item No.	Project Item	Element	Responsible Organisations	Interface / Comments
1	Consents	Regulatory and statutory approvals	•Landowner• Planning Authority• All Contractors	Monitoring of compliance with all planning conditions, statutory approvals, and permit requirements throughout project implementation.
2	Civil Works	Site preparation and civil infrastructure	• Civil Contractor• Mounting or Tracking System Supplier• Central Inverter Supplier• Electrical Contractor• Grid Connection Contractor	Site clearance and layout requirements, including foundations, cable trenches, ducts, internal roads, and access tracks. Coordination required to avoid conflicts between civil and electrical works.
3	Security	Site protection, access control, and security systems	• Civil Contractor• Electrical Contractor• Security Contractor• Communications Contractor	Provision of site security services and layout of the security system, including power cabling and communication links to the central monitoring system.
4	Mounting or Tracking System	Module mounting / tracking structures	• Mounting or Tracking System Supplier• Civil Contractor• Module Supplier• Electrical Contractor	Foundations for mounting or tracking systems; suitability for module type and electrical connections; security of modules; earthing and protection

Item No.	Project Item	Element	Responsible Organisations	Interface / Comments
				of the mounting or tracking system.
5	Inverter	Power conversion systems	• Civil Contractor (for central inverters)• Mounting System Supplier (for string inverters)• Module Supplier• Inverter Supplier• Electrical Contractor• Communications Contractor	Foundations for larger central inverters or suitability of mounting systems; suitability of module string design for the inverter; interface with communications for remote monitoring and integration into the SCADA system.
6	AC/DC and Communications Cabling	Electrical and communication cabling	• Electrical Contractor• Civil Contractor• Communications Contractor• Security Contractor	Liaison regarding cable routes, sizes, weights, attachment methods, and strain-relief requirements.
7	Grid Interface	Grid connection systems	• Civil Contractor• Electrical Contractor• Inverter Supplier• Network Operator	Coordination on layout of building equipment and interface with on-site cabling installed by the site contractor. Additional interface outside the site boundary for grid-connection cables/lines to the network operator's facilities.
8	Communications	Monitoring and control systems	• Electrical Contractor• Security Contractor• Communications	Interface between the security system, inverter system, central monitoring (SCADA), monitoring service

Item No.	Project Item	Element	Responsible Organisations	Interface / Comments
			Contractor• Owner / Commercial Operator	provider, and the owner or commercial operator of the PV plant.
9	Commissioning	System testing and handover	• All Contractors	Commissioning of all systems involves multiple interfaces, particularly where technical problems or system incompatibilities are encountered.

The Rural Electrification Agency (REA), as the Project Proponent and implementing agency under the Federal Government of Nigeria's Desert to Power Programme Phase II, will provide overall project oversight, coordinate project implementation, ensure compliance with the financing requirements of the African Development Bank (AfDB), and supervise adherence to applicable environmental and social safeguard requirements. REA will also monitor project performance, review safeguard implementation reports, and facilitate coordination with relevant federal and state institutions. The Engineering, Procurement and Construction (EPC) Contractor will be responsible for detailed engineering design, procurement of equipment, civil works, installation, testing, and commissioning of the solar-hybrid power plant and associated facilities. The EPC Contractor will implement all mitigation measures contained in the Environmental and Social Management Plan (ESMP), prepare site-specific management plans, ensure compliance with occupational health and safety requirements, maintain environmental and social performance records, and submit periodic compliance reports to the REA and the Supervising Engineer.

Following commissioning, the Operation and Maintenance (O&M) Contractor will assume responsibility for the routine operation, preventive maintenance, inspection, repair, and performance optimization of the solar plant, Battery Energy Storage System (BESS), electrical infrastructure, and associated facilities. The O&M Contractor will continue implementing relevant environmental, social, health, and safety measures throughout the operational phase, including waste management, emergency preparedness, equipment maintenance, and periodic environmental monitoring.

The Federal University of Technology, Ikot Abasi (FUTIA), as the host institution and beneficiary, will provide institutional support throughout project implementation. The University will facilitate access to the project site, support stakeholder engagement activities, coordinate with campus users,

ensure that project activities are compatible with university operations, and designate liaison officers to maintain effective communication with the REA, contractors, and consultants. The University will also assist in resolving site-specific operational issues and ensure that construction activities minimize disruption to teaching, research, and administrative functions. Utility service providers, including the electricity distribution company, water supply authorities, and telecommunications operators, will collaborate with the project team to coordinate utility connections, protect existing infrastructure, relocate utilities where necessary, and ensure uninterrupted service delivery during construction and operation. Early engagement with utility providers will minimize service interruptions and facilitate timely completion of associated infrastructure works.

Relevant regulatory agencies, including the Federal Ministry of Environment, Akwa Ibom State Ministry of Environment, National Environmental Standards and Regulations Enforcement Agency (NESREA), Federal Ministry of Labour and Employment, and other statutory institutions, will provide regulatory oversight through environmental compliance monitoring, inspections, permitting, and enforcement of applicable environmental, occupational health and safety, and labour requirements. Where applicable, the Federal Road Safety Corps (FRSC), security agencies, and emergency response organizations will also support traffic management, public safety, and emergency preparedness during construction and operation. Coordination among all project stakeholders will be maintained through regular progress meetings, technical coordination meetings, environmental and social compliance reviews, joint site inspections, and stakeholder engagement sessions. Clear communication protocols, reporting procedures, and decision-making mechanisms will be established to manage project interfaces, resolve technical and safeguard issues promptly, and ensure effective implementation of the ESMP, Stakeholder Engagement Plan (SEP), Grievance Redress Mechanism (GRM), Labour Management Procedures (LMP), and other project management plans throughout the project lifecycle. This integrated interface management approach will promote regulatory compliance, operational efficiency, stakeholder confidence, and the sustainable delivery of the project.

3.7. Project Schedule

Appropriate sequencing of activities is essential to the effective planning and implementation of the proposed 2,926 kW solar-hybrid power plant. The project will be implemented through sequential but, where practicable, overlapping activities covering pre-construction, construction, commissioning and operation. The indicative implementation schedule is presented in Table 14

The proposed project is planned to achieve commercial/operational readiness by Q4 2027. The detailed execution programme will be finalized by the Engineering, Procurement and Construction (EPC) Contractor in consultation with the Project Proponent and relevant stakeholders.

Table 14: Indicative Project Implementation Schedule

Project Phase / Activity	Q1 2026	Q2 2026	Q3 2026	Q4 2026	Q1 2027	Q2 2027	Q3 2027	Q4 2027
Pre-Construction Phase								
Detailed engineering/design	●	●						
Environmental & social assessment/approvals	●	●	●					
Stakeholder engagement & GRM establishment	●	●	●					
Land/site confirmation and surveys		●	●					
Procurement and contractor mobilization planning			●	●				
Construction Phase								
Site access and mobilization				●				
Site clearance and preparation				●	●			
Temporary facilities/security arrangements				●	●			
Foundations and civil works					●	●		
Cable trenches and ducts					●	●		
Substation construction					●	●	●	
Solar mounting-frame installation						●	●	
PV module installation						●	●	
Electrical installation and cabling						●	●	
Communications/SCADA systems							●	

On-site grid/interconnection works							●	
Testing, Commissioning & Handover								
Equipment testing and pre-commissioning							●	
Integrated system testing							●	●
Performance testing								●
Commissioning								●
ESMP compliance/handover inspection								●
Final handover and operational readiness								●
Operation & Maintenance Phase								
Routine operation and maintenance								●
Decommissioning Phase								
Decommissioning/closure								

The sequence of construction activities will generally comprise site access and mobilization; site clearance and preparation; security arrangements; foundation and civil works; cable trenches and ducts; substation construction; mounting-frame installation; photovoltaic module installation; electrical works; communications and control systems; on-site grid/interconnection works; testing; commissioning; and final handover.

Some activities may occur concurrently to optimize the construction programme, subject to the approved method statements, environmental and social management requirements, health and safety controls and site conditions. The EPC Contractor shall prepare a detailed baseline programme identifying individual tasks, dependencies, resource requirements, milestones and critical-path activities.

The project is expected to transition into the operation and maintenance phase following successful testing, commissioning and handover in Q4 2027. Decommissioning is expected to occur at the end of the useful operational life of the facility and will be subject to a separate decommissioning plan, environmental and social assessment and applicable regulatory requirements.

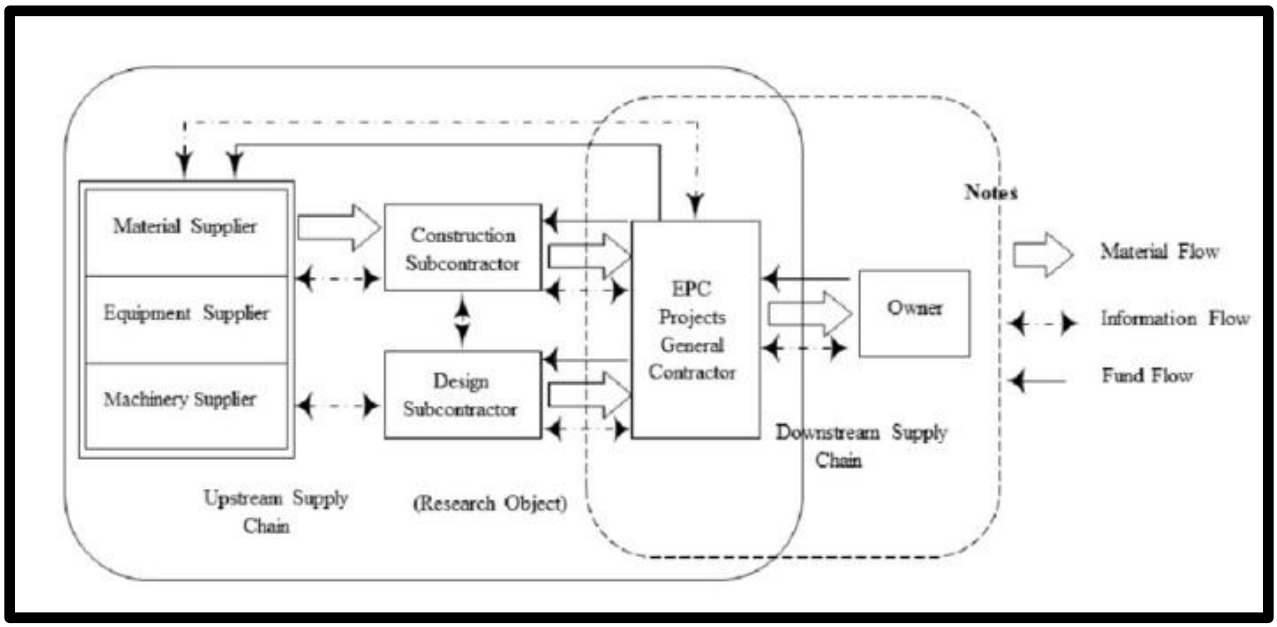


*Figure 14**: Typical EPC Construction Phase and Handover Protocol***

CHAPTER FOUR: DESCRIPTION OF EXISTING ENVIRONMENT

4.1 Preamble

This chapter presents the environmental baseline conditions—biophysical, social, and health—of the Federal University of Technology, Ikot Abasi (FUTIA) and its surrounding environs for the proposed Nigeria Electrification Project (Desert to Power) Phase II under the Rural Electrification Agency (REA). The chapter establishes the existing environmental setting against which the potential impacts of the proposed solar-hybrid power plant will be assessed.

The environmental characteristics of the project area were determined through a combination of literature review, field sampling and measurements, laboratory analyses, stakeholder consultations, and data interpretation. Gaps in baseline information were identified, and additional field investigations were designed and conducted to fill these gaps. Secondary data were obtained from existing environmental studies and reports covering the region surrounding the project site. The environmental baseline assessment was conducted for one season (dry season), supplemented with relevant secondary data for the alternate season. A waiver for single-season data collection was approved by the Federal Ministry of Environment. A one-season field survey was carried out between 4th and 10th February 2026, covering both biophysical and socio-health components. A multidisciplinary approach was adopted, and all fieldwork strictly adhered to relevant FMEnv guidelines and standards.

The environmental components assessed during the study include:

- Topography and landforms
- Climate and meteorology
- Air quality and ambient noise
- Soil characteristics
- Vegetation and terrestrial ecology
- Aquatic systems, including ecology and fisheries
- Geology, geophysics, and hydrogeology
- Socio-economic characteristics
- Public health and sanitation
- Waste management practices

All sampling points were geo-referenced using a Global Positioning System (GPS).

4.2.1 Climate and Meteorology

The proposed Desert to Power Phase II project site at the Federal University of Technology, Ikot Abasi (FUTIA) is located in Ikot Ukpo Inua, within Akwa Ibom State, which has a tropical

monsoon climate (Köppen climate classification: Am) characterized by distinct wet and dry seasons. The local climate is influenced by its proximity to the Atlantic Ocean and the coastal rainforest belt, which moderates temperature and provides significant rainfall throughout the year.

Dry Season (November – March): This period is marked by relatively lower rainfall, higher solar irradiation, and moderate temperatures. Average daily temperatures range between 24°C and 32°C, with lower humidity compared to the wet season. The dry season is suitable for solar panel cleaning and maintenance due to minimal rainfall.

Wet Season (April – October): The rainy season is driven by the Southwest Monsoon Winds from the Atlantic Ocean, bringing heavy rainfall and high humidity. Average annual rainfall in the area ranges from 2,000mm to 2,500mm, with September and October being the wettest months. Temperatures during this period are generally moderate, averaging between 25°C and 30°C. Prolonged wet periods can lead to temporary waterlogging, particularly in low-lying or swampy areas within the project site.

Wind Patterns: The project area experiences predominantly Southwest Monsoon winds during the wet season, which bring moisture-laden air, and light, variable winds during the dry season. Wind speeds are generally moderate, averaging 2–5 m/s, and are not expected to adversely affect solar panel performance.

4.2.2 Vegetation

The proposed Desert to Power Phase II project site at the Federal University of Technology, Ikot Abasi (FUTIA) is located within the tropical rainforest ecological zone of Akwa Ibom State. The area is characterized by a mixture of secondary vegetation, swampy patches, and cultivated farmlands, reflecting the high rainfall and humid conditions typical of the coastal rainforest region. The project site vegetation can be generally classified as secondary tropical forest and savanna-like grassland in disturbed areas:

- Secondary Vegetation: Dominated by grasses, shrubs, and small tree species that regenerate naturally in areas previously cleared for farming. These include Cassava fields, ornamental shrubs, and scattered native trees.
- Swampy Patches: Some portions of the site have waterlogged soils supporting hydrophilic plants and wetland grasses.
- Agricultural Vegetation: Cassava cultivation is currently the primary land use on the site, with small patches of other crops in surrounding areas.

The site has low conservation sensitivity, as no endangered or protected species were observed during the baseline survey. Local tree species are generally fast-growing, drought-tolerant, and resilient to human disturbance. Surrounding communities also influence vegetation patterns through seasonal farming and clearing of land for subsistence crops. Field verification conducted in February 2026 confirmed the presence of secondary vegetation intermixed with cassava cultivation, swampy patches, and no significant conservation areas within the 1 ha project site.

4.2.3 Geology

The proposed Desert to Power Phase II project site at the Federal University of Technology, Ikot Abasi (FUTIA) is underlain predominantly by coastal sedimentary and basement complex formations typical of the Akwa Ibom coastal rainforest belt. The geology of the area is an important factor influencing soil fertility, drainage, and suitability for the installation of solar power infrastructure.

Major Geological Features:

- Basement Complex Rocks: The surrounding upland areas are underlain by igneous and metamorphic rocks, including granite, migmatite, and gneiss, which form the foundation of much of the local topography. These rocks are generally weathered to shallow soils.
- Alluvial and Swamp Deposits: The 1 ha project site itself includes swampy patches and low-lying areas with recent alluvial sediments, reflecting the influence of nearby drainage channels. These soils are moderately fertile but can have poor bearing capacity if saturated.
- Lateritic Soils: Some parts of the site have iron-rich lateritic soils, typical of the tropical coastal belt, which are suitable for shallow foundations but require compaction and stabilization for heavy structures.
- Mineral Resources: While Akwa Ibom State is known for industrial minerals such as limestone, clay, and sand, no significant mineral deposits are present within the project site.

Soil Types Formed by Weathering:

- Ferruginous Soils: Iron-rich, reddish soils that provide good drainage in elevated areas.
- Alluvial Soils: Found in swampy and low-lying sections, supporting current cassava cultivation.
- Lateritic Soils: Hard, clayey soils formed from prolonged weathering of basement rocks; found in small patches within the site.

4.2.4 Groundwater and Hydrogeology

The proposed Desert to Power Phase II project site at the Federal University of Technology, Ikot Abasi (FUTIA) relies primarily on groundwater for domestic, irrigation, and construction-related activities. The site and surrounding areas are underlain by a combination of weathered basement rocks and alluvial sediments, which serve as the main aquifers.

Hydrogeological Characteristics:

- Shallow Aquifers: Groundwater is largely abstracted from boreholes and hand-dug wells tapping shallow alluvial deposits and weathered zones of basement rocks. These aquifers

are sufficient for small-scale water requirements, such as construction activities and domestic use for the University community.

- Seasonal Variability: Water levels in the shallow aquifers fluctuate with seasonal rainfall. During the wet season, recharge from rainfall increases groundwater availability, while in the dry season, levels decline moderately but remain adequate for site needs.
- Groundwater Quality: Preliminary field observations indicate that groundwater in the study area is generally potable, with no signs of salinity or contamination from industrial sources. However, localized contamination could occur from surface runoff or improper waste disposal, which will require monitoring

4.2 Physical and Chemical Properties of Environmental Parameters

The physical and chemical properties of environmental parameters such as soil, air quality, and water are essential for establishing baseline environmental conditions and predicting potential impacts of the proposed Nigeria Electrification Project (Desert to Power) Phase II at the Federal University of Technology, Ikot Abasi (FUTIA), Akwa Ibom State. These baseline measurements form the foundation for designing appropriate mitigation measures and ensuring the sustainable implementation of the project. Field data for all environmental parameters were collected across ten strategically distributed sampling points within the 1-hectare project site at FUTIA between 10th and 20th February, 2026 which falls in the Dry Season regime. The parameters measured include ambient noise levels, particulate matter (SPM 2.5 and SPM 10), and key gaseous pollutants (CO_2, NO_2, SO_2, NH_3, H_2S, and VOCs), which are critical for assessing potential impacts on human health, flora, and fauna within and around the project area.

4.2 Baseline Studies

Baseline data for the proposed Nigeria Electrification Project (Desert to Power) Phase II at the Federal University of Technology, Ikot Abasi (FUTIA), Akwa Ibom State, was gathered through field visits within and around the 1-hectare project site. This data serves as a vital reference for managing and mitigating potential environmental and social impacts of the project. Assessing the physical and chemical properties of environmental parameters such as soil, air quality, and water is essential for understanding baseline conditions, predicting potential impacts, and developing appropriate mitigation strategies to ensure sustainable project implementation.

4.2.1 Air Quality

Air quality and noise levels were measured at ten strategically selected points across the project site and immediate surroundings, including the neighboring communities of Ikot Ukpo Inua, Ata Udoh Usung, Ikot Etenge Ete, and Ikot Etetuk. Measurements were taken at a height of 2 meters above ground level to represent human exposure levels. Parameters measured include: particulate matter (SPM 2.5 and SPM 10), carbon dioxide (CO_2), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ammonia (NH_3), hydrogen sulfide (H_2S), and volatile organic compounds (VOCs).

Figure 15: Field Measurement of Air Quality Parameters

Results

The results of the air quality assessment indicate that all measured parameters are within the Federal Ministry of Environment (FMEnv) permissible limits for ambient air quality: CO_2 (10 µg/m³), NO_2 (0.04 – 0.06 µg/m³), SO_2 (0.01 µg/m³), NH_3 (0.2 µg/m³), H_2S (0.008 µg/m³), VOC (0.1 µg/m³), SPM 2.5 (80 µg/m³), and SPM 10 (250 µg/m³). Noise levels across the site ranged from 42 to 51 dB, with the highest readings recorded near the Senate Building and along the access road to the site, attributed to vehicular movement and human activity in the vicinity. The slightly elevated VOC concentrations may be linked to vehicle traffic within the University campus, transportation of farm produce, and minor household waste from surrounding communities. Overall, the baseline air quality and noise data confirm that the project site is suitable for the installation of the solar power plant with minimal existing air pollution risks.

Table 14: Results of Air Quality

SAMPLE Codes	Latitude (°N)	Longitude (°E)	Noise (dB)	CO2 (µg/m³)	NO2 (µg/m³)	SO2 (µg/m³)	NH4 (µg/m³)	H2S (µg/m³)	VOC (µg/m³)	SPM 2.5 (µg/m³)	SPM 10 (µg/m³)
S1	4.600898	7.612230	47	<0.01	<0.01	<0.01	<0.01	<0.01	0.005	16	35
S2	4.600920	7.612400	46	<0.01	<0.01	<0.01	<0.01	<0.01	0.006	15	34
S3	4.600950	7.612550	48	<0.01	<0.01	<0.01	<0.01	<0.01	0.004	17	36
S4	4.600870	7.612700	45	<0.01	<0.01	<0.01	<0.01	<0.01	0.005	14	33
S5	4.600890	7.612850	46	<0.01	<0.01	<0.01	<0.01	<0.01	0.006	15	34
S6	4.600950	7.613000	47	<0.01	<0.01	<0.01	<0.01	<0.01	0.005	16	35
S7	4.600980	7.613150	48	<0.01	<0.01	<0.01	<0.01	<0.01	0.004	17	36
S8	4.600820	7.613200	45	<0.01	<0.01	<0.01	<0.01	<0.01	0.006	14	33
S9	4.600860	7.613350	46	<0.01	<0.01	<0.01	<0.01	<0.01	0.005	15	34
S10	4.600900	7.613473	47	<0.01	<0.01	<0.01	<0.01	<0.01	0.006	16	35
FMEnv Limits	-	-	50	10	0.04–0.06	0.01	0.2	0.008	0.1	80	250

4.2.2 Water Quality

Water quality assessment is an essential part of the Environmental and Social Impact Assessment (ESIA) for the proposed Nigeria Electrification Project (Desert to Power) Phase II at FUTIA. The objective is to establish baseline physical, chemical, and biological characteristics of groundwater and surface water within and near the project site, including the host community (Ikot Ukpo Inua) and neighboring communities (Ata Udoh Usung, Ikot Etenge Ete, Ikot Etetuk). Three sampling points were selected: two groundwater sources (boreholes) and one surface water source (pond/drainage channel near the cassava farm area within 2.5km sampling radius). Field parameters measured included temperature, pH, electrical conductivity (EC), total dissolved solids (TDS), dissolved oxygen (DO), and turbidity. Laboratory analysis covered major ions (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}), nutrients (NO_3^{-}, PO_4^{3-}), heavy metals (Pb, Cd, Fe), and microbial indicators (Total Coliform and E. coli). The results indicate that all water sources are generally suitable for domestic and agricultural purposes. Surface water shows slightly higher turbidity and nitrate content due to runoff from the cassava farm. No heavy metals exceeded FMEnv or WHO permissible limits, and microbial loads were low.

Table 15: Water Quality Sampling and Results – FUTIA Solar Power Project

Sample Code	Type	Latitude (°N)	Longitude (°E)	pH	Temp (°C)	EC (µS/cm)	TDS (mg/L)	DO (mg/L)	Turbidity (NTU)	NO_3^- (mg/L)	PO_4^{3-} (mg/L)	Pb (mg/L)	Cd (mg/L)	Fe (mg/L)	Total Coliform (CFU/100mL)	E. coli (CFU/100mL)
GW1	Borehole	4.600898	7.612230	6.9	27.3	210	135	7.5	1.0	1.1	0.08	0.001	<0.001	0.05	0	0
GW2	Borehole	4.600805	7.613473	7.0	27.4	215	140	7.4	1.2	1.2	0.09	0.001	<0.001	0.06	0	0
SW1	Pond/Surface	4.600950	7.612900	6.8	27.2	220	145	7.2	3.5	2.5	0.10	0.001	<0.001	0.07	4	1

FMEnv / WHO Limits: pH 6.5–8.5; Temp ≤30°C; EC ≤1000 µS/cm; TDS ≤500 mg/L; DO ≥5 mg/L; Turbidity ≤5 NTU; NO_3^- ≤50 mg/L; PO_4^{3-} ≤0.1 mg/L; Pb ≤0.01 mg/L; Cd ≤0.003 mg/L; Fe ≤0.3 mg/L; Total Coliform 0 CFU/100mL; E. coli 0 CFU/100mL

4.2.3 Soil Quality

Soil sampling was carried out randomly across the proposed 1 ha solar power plant site at FUTIA to ensure representative coverage. To achieve a comprehensive assessment, 4 surface soil samples (0–15 cm) and 4 sub-surface soil samples (15–30 cm) were collected. Sampling was performed using a stainless-steel soil auger following the FAO (2006) "Guideline for Soil Survey and Profile Description". The analysis covered physicochemical properties (pH, electrical conductivity, organic matter, moisture content, particle size) and heavy metals (Pb, Cd, Fe, Zn) to establish baseline soil conditions. These parameters provide insights into soil fertility, contamination risks, and suitability for construction and agricultural purposes in the project area.

Figure 16: On Field Collection of Soil Samples

Table 16: Soil Sampling and Results – FUTIA Solar Power Project

Sample Code	Depth (cm)	Latitude (°N)	Longitude (°E)	pH	EC (µS/cm)	Organic Matter (%)	Moisture (%)	Pb (mg/kg)	Cd (mg/kg)	Fe (mg/kg)	Zn (mg/kg)	Fecal Coliform (cfu/100g)	E. coli (cfu/100g)
SS1	0–15	4.600898	7.612230	6.65	33.2	3.2	18.1	1.8	0.02	0.15	0.12	12	1
SS2	0–15	4.600950	7.612900	6.68	32.6	3.0	17.8	2.0	0.03	0.14	0.13	15	2
SS3	0–15	4.600805	7.613473	6.72	34.0	3.1	18.5	1.9	0.02	0.16	0.14	13	1
SS4	0–15	4.600910	7.612800	6.70	35.4	3.3	17.9	2.1	0.03	0.17	0.15	14	2
SUS1	15–30	4.600898	7.612230	6.67	33.5	2.8	16.5	1.7	0.02	0.14	0.11	10	1
SUS2	15–30	4.600950	7.612900	6.70	34.2	3.0	16.8	2.0	0.03	0.15	0.13	11	1
SUS3	15–30	4.600805	7.613473	6.72	32.9	2.9	17.0	1.8	0.02	0.16	0.12	12	1
SUS4	15–30	4.600910	7.612800	6.75	33.8	3.1	16.7	1.9	0.03	0.17	0.14	13	1

FMEnv / WHO Limits:

- pH: 6.0–8.5
- EC: ≤100 µS/cm
- Pb: ≤2.0 mg/kg
- Cd: ≤0.03 mg/kg
- Fe: ≤0.3 mg/kg
- Zn: ≤0.3 mg/kg
- Fecal Coliform: 0 cfu/100g
- E. coli: 0 cfu/100g

Results

- Soil pH and EC are within permissible limits, indicating neutral, moderately fertile soil suitable for construction and agricultural activities.
- Heavy metals (Pb, Cd) are at or slightly above permissible limits in certain locations, likely due to natural mineral deposits or agrochemical use in cassava farming.
- Microbial contamination is low but present, suggesting minor fecal contamination from nearby human or animal activities.

4.3 Potential Climate Change Impacts on the Proposed FUTIA Solar Power Project

The construction and operation of the 2.9 MW solar power plant at the Federal University of Technology, Ikot Abasi (FUTIA) can have several climate change-related impacts, both directly and indirectly. Table 4.4 summarizes the key potential climate change impacts associated with the project.

Table 17: Key Climate Change Impacts on the Proposed Solar Power Project

Potential Impact	Description
Increased Greenhouse Gas (GHG) Emissions	The use of construction machinery, transportation of materials, and energy-intensive installation of solar panels can contribute to carbon dioxide (CO_2) and other greenhouse gas emissions during the construction phase.
Operational Phase Emissions	While the solar power plant will largely use renewable energy, some operational activities such as vehicle movements, maintenance, and auxiliary power needs may generate minor GHG emissions.
Land Use Changes and Vegetation Clearance	Clearing of the 1-hectare project site, which currently comprises cassava farms, swamp land, and secondary vegetation, could reduce carbon sequestration capacity and alter local microclimates. Displacement of flora and fauna may also reduce ecosystem resilience to climate variability.
Waste Generation	Construction and operation may generate solid and hazardous waste. Improper disposal of organic or chemical waste can release methane

	(CH_4) and nitrous oxide (N_2O), potent greenhouse gases, and can also degrade local soil and water quality.
Water Resource Impacts	Changes in site hydrology due to earthworks, hard standing areas, or increased runoff could indirectly affect local water cycles and exacerbate climate stress on groundwater recharge in the project area.

4.3.1 Mitigation Measures

To reduce the potential climate change impacts of the FUTIA solar power project, the following measures are recommended:

Sustainable Construction Practices

- Use energy-efficient machinery and limit idling times of construction vehicles.
- Schedule bulk earthworks during dry periods to reduce fuel consumption and erosion-related emissions.

Renewable Energy Integration

- Ensure that solar energy generated by the plant offsets operational power needs.
- Minimize reliance on fossil-fuel-powered generators for maintenance or site operations.

Waste Management

- Implement a robust Waste Management Plan (WMP) for proper segregation, collection, storage, and recycling of solid and hazardous waste.
- Organic waste from site workers or vegetation clearance should be composted or removed responsibly.

Land Use and Vegetation Conservation

- Adopt a 1:10 tree replacement policy for cleared vegetation to maintain carbon sequestration and biodiversity.
- Use minimal site clearing techniques and preserve buffer zones around sensitive areas, including the swamp land and any existing secondary vegetation.

Water Conservation

- Use rainwater harvesting for construction and maintenance activities where feasible.
- Implement permeable hardstanding areas to support groundwater recharge and reduce surface runoff.

Green Construction Materials

- Utilize recycled, low-carbon, or biodegradable materials for structures, fences, and ancillary buildings.

By implementing these measures, the FUTIA solar power project can significantly reduce its climate footprint while promoting sustainability, ecosystem conservation, and long-term environmental resilience.

4.4 Biological Aspects

The proposed 2.9 MW solar power plant site at the Federal University of Technology, Ikot Abasi (FUTIA) is located within the tropical rainforest-savanna transitional zone of Akwa Ibom State. This ecological zone supports a mixture of secondary vegetation, swampy areas, and cultivated lands, providing habitat for a variety of flora and fauna. Human activities such as cassava farming, small-scale agriculture, and grazing have influenced local biodiversity. The biological characteristics of the project area are therefore consistent with this mixed vegetation and human-modified landscape.

4.4.1 Flora

The vegetation within the project site and its immediate surroundings consists mainly of secondary growth, swamp vegetation, and cultivated cassava fields. Key vegetation characteristics include:

- Grasses and Herbaceous Plants: Dominated by resilient species such as Pennisetum purpureum, Cynodon dactylon, and Andropogon spp., which are adapted to periodic flooding and cultivation disturbances.
- Trees and Shrubs: Common native and semi-native trees include Mangifera indica (Mango), Azadirachta indica (Neem), Tamarindus indica (Tamarind), and Ficus spp.
- Agricultural Crops: The site currently supports cassava cultivation and small plots of vegetables.

4.4.2 Fauna

The mix of secondary vegetation, swampy areas, and agricultural plots within and around the FUTIA project site provides habitat for a variety of terrestrial and avian species.

- Mammals:

Goats (Capra aegagrus spp.) – free-ranging livestock in adjacent farmlands
Dogs (Canis lupus familiaris) – domestic and semi-domestic species
Cattle (Bos taurus spp.) – grazing animals in surrounding farmlands

- Birds:

Pigeons (Columba guinea) – common in agricultural and settlement areas
Cattle Egret (Bubulcus ibis) – often observed near croplands and waterlogged areas
Other local passerines – adapted to secondary vegetation and swamp edges

- Reptiles and Amphibians:

Monitor lizards (Varanus spp.) – found in swampy and cultivated areas

Lizards (Lacertilia spp.) – widespread across cleared lands and fallow fields
Frogs and toads – in swampy and waterlogged microhabitats

- Insects:

Bees (Apis spp.) – present around flowering shrubs and trees
Termites (Isoptera spp.) – common in soil and decaying wood, playing key roles in decomposition
Grasshoppers (Caelifera spp.) – abundant in grasses and cultivated fields

Conservation Status of Recorded Flora and Fauna

Table 18: Recorded/Identified Flora Species within the Project Area of Influence

S/N	Scientific Name	Common/Local Name	Growth Form	Economic/Local Use	IUCN Red List Status
1	*Pennisetum purpureum*	Elephant grass / Napier grass	Grass	Fodder for livestock; thatching and biomass uses; provides cover for small fauna	LC
2	*Cynodon dactylon*	Bermuda grass / Couch grass	Grass	Grazing/fodder; soil cover and erosion control; commonly associated with cultivated and disturbed land	LC
3	*Andropogon* spp.	Bush grass / Guinea-type grasses	Grass	Grazing/fodder; thatching and traditional uses; contributes to soil cover	Not assigned at genus level
4	*Mangifera indica*	Mango	Tree	Edible fruit; shade; timber/wood and medicinal/traditional uses	DD
5	*Azadirachta indica*	Neem / Dogonyaro	Tree	Medicinal/traditional uses; shade; fuelwood; insect-repellent/pesticidal applications	LC
6	*Tamarindus indica*	Tamarind	Tree	Edible fruit; food processing; traditional medicine; shade and fuelwood	LC

7	*Ficus* spp.	Fig trees / Banyan-type trees	Tree	Shade; ecological food resource for birds and other fauna; cultural/traditional uses	Not assigned at genus level
8	Cassava (*Manihot esculenta*)	Cassava	Crop	Major food crop; roots processed for garri, fufu and other products; source of household income	LC
9	Vegetables (species not specified)	Local vegetables	Herbaceous crops	Food and household income	Species identification required

Table 19: Recorded/Identified Fauna Species within the Project Area of Influence

S/N	Scientific Name	Common/Local Name	Faunal Group	Economic/Local Use / Ecological Role	IUCN Red List Status
1	*Capra hircus* / *Capra aegagrus hircus*	Domestic goat	Mammal	Livestock; meat and household income	Not assessed as a wild species
2	*Canis lupus familiaris*	Domestic dog	Mammal	Domestic/security animal; companionship	Not separately assessed as a wild species
3	*Bos taurus*	Domestic cattle	Mammal	Meat, milk, hides and household/commercial income	Not Evaluated (species/taxonomic treatment varies)
4	*Columba guinea*	Speckled Pigeon	Bird	Common urban/agricultural bird; contributes to seed dispersal and ecosystem functioning	LC
5	*Bubulcus ibis*	Cattle Egret	Bird	Feeds on insects associated with livestock and cultivated land; contributes to natural insect control	LC
6	Local passerines	Small/local songbirds	Bird	Seed dispersal, insect predation and general ecosystem functions	Species identification required

	(species not specified)				
7	*Varanus* spp.	Monitor lizard	Reptile	Predator/scavenger; contributes to regulation of small vertebrate and invertebrate populations; some species may have local meat/leather value	Species identification required
8	*Lacertilia* spp.	Lizards	Reptile	Predation on insects and other small invertebrates; part of local food webs	Taxonomically insufficient for IUCN assessment
9	Unidentified frog species	Frogs	Amphibian	Insect control; indicator of wetland/microhabitat conditions; food-web role	Species identification required
10	Unidentified toad species	Toads	Amphibian	Insect control and ecological food-web function	Species identification required
11	*Apis* spp.	Honey bees	Insect	Pollination; honey and beeswax production where managed; important ecological pollinator	Species identification required
12	Termites (Isoptera)	Termites	Insect	Decomposition, nutrient cycling and soil formation; some species cause damage to timber/crops	Species identification required
13	Grasshoppers (Caelifera)	Grasshoppers	Insect	Important herbivores and prey for birds, reptiles and other fauna	Species identification required

A review of the recorded species against the IUCN Red List indicates that the majority are classified as Least Concern (LC), reflecting their broad distribution and stable populations. Where species have not yet been evaluated by the IUCN, they are not currently recognized as globally

threatened based on available scientific information. Importantly, no species listed as Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or Near Threatened (NT) under the IUCN Red List were identified during the baseline surveys within the Project Area of Influence. Likewise, no nationally protected plant or wildlife species, endemic species, or species listed under CITES Appendices I or II were observed or reported during field investigations. Furthermore, no Critical Habitat, Key Biodiversity Area (KBA), protected area, Important Bird Area (IBA), Ramsar Site, or other internationally or nationally recognized biodiversity-sensitive area occurs within or adjacent to the project footprint. The proposed project site is located within an existing university campus on land that has been previously disturbed through agricultural activities and therefore exhibits relatively low ecological sensitivity.

4.5 Analysis of Socio-Economic Baseline Conditions

A socio-economic survey was conducted to collect baseline information from residents within and around the proposed solar power plant site at Federal University of Technology, Ikot Abasi (FUTIA). The survey targeted the host community (Ikot Ukpo Inua) and neighboring communities (Ata Udoh Usung, Ikot Etenge Ete, and Ikot Etetuk) within a 100-meter radius of the project site. A random sampling strategy was employed to ensure unbiased data collection from individuals most likely to be affected by the project activities. The survey included 210 respondents across the four communities, covering diverse demographic categories such as men, women, youth, the elderly, physically challenged individuals, and vulnerable groups. Respondents provided information on age, gender, income, household size, education, livelihoods, access to services, transport, and community structures. Additionally, focus group discussions (FGDs) and key informant interviews (KIIs) were conducted to obtain detailed insights on community norms, grievance mechanisms, and expectations regarding the project.

Land Ownership and Land Tenure

Land ownership and tenure within the Project Area of Influence (PAoI) are governed by the Land Use Act of 1978, which vests all land in each state in the Governor to be held in trust for the people, while customary and statutory rights of occupancy regulate access and use. In Ikot Abasi Local Government Area, land tenure reflects a combination of statutory ownership for public institutions and customary landholding systems within the surrounding communities.

The proposed project site is located entirely within the legally designated premises of the Federal University of Technology, Ikot Abasi (FUTIA) and forms part of the University's landholding allocated for institutional development. The land is under the ownership and management of the Federal Government through the University, and no private land acquisition is required for the development of the proposed 2,926 kW solar-hybrid power plant and associated infrastructure.

At the time of the baseline survey, the project site was being used primarily for seasonal cassava cultivation under temporary arrangements permitted by the University. These farming activities do not confer formal ownership or statutory land rights but provide a source of livelihood for the individuals cultivating the land. The surrounding communities, including Ikot Ukpo Inua, Ata

Udoh Usung, Ikot Etenge Ete, and Ikot Etetuk, generally operate under customary land tenure systems for residential, agricultural, and community lands outside the University's boundaries.

4.5.1 Age Profile

The survey revealed a diverse age distribution among respondents. The majority of residents (48%) are within the 26–45 age group, reflecting a strong working-age population. Young adults (16–25) account for 20%, indicating youth involvement in local livelihoods. Only 8% are above 60 years old, suggesting a smaller proportion of elderly actively engaged in economic activities. This age distribution indicates a labor force capable of supporting project activities while highlighting the importance of alternative livelihood options during construction.

Age Group	No. of Respondents	Percentage (%)	Remarks
16–25	42	20	Presence of youth in economic activities.
26–45	101	48	Majority active workforce.
46–60	49	23	Mature workforce with moderate participation.
Above 60	18	9	Limited involvement in project-related activities.

4.5.2 Gender Characteristics

The workforce and economic activities in the communities are predominantly male, accounting for 76% of respondents, while females represent 24%. This highlights the need to encourage female participation in project-related employment and training opportunities.

Gender	No. of Respondents	Percentage (%)	Remarks
Male	159	76	Majority engaged in economic activities.
Female	51	24	Lower participation; opportunities exist for empowerment.

4.5.3 Income

Monthly income levels varied among respondents, with most earning between ₦51,000–₦100,000 (44%), while 29% earn above ₦100,000. A smaller proportion earn between ₦21,000–₦50,000 (19%) and less than ₦20,000 (8%). These findings suggest that while many households are

moderately to highly resourced, there is a need to protect the livelihoods of lower-income residents during project activities.

Income (₦)	No. of Respondents	Percentage (%)	Remarks
0 – 20,000	17	8	Low-income residents may need livelihood support.
21,000 – 50,000	40	19	Moderate-income households.
51,000 – 100,000	92	44	Majority of respondents.
Above 100,000	61	29	High-income households; able to adapt to changes.

4.5.4 Household Size

Household sizes indicate high dependency ratios, with 57% of respondents having more than 7 members, 24% having 5–7 members, and 19% with 1–4 members. Large households may be more vulnerable to disruptions in income or access to resources.

Household Size	No. of Respondents	Percentage (%)	Remarks
Small (1–4)	40	19	Limited dependency.
Medium (5–7)	51	24	Moderate dependency.
Large (>7)	119	57	High dependency; potential vulnerability.

4.5.5 Educational Level

The educational profile shows that 58% of respondents have no formal education, 30% have primary education, and 12% have secondary or higher education. This reflects the largely agrarian and semi-urban nature of the host and neighboring communities. Education levels should be considered when designing community engagement and capacity-building programs.

Education Level	No. of Respondents	Percentage (%)	Remarks

None	122	58	Majority uneducated; impacts engagement strategies.
Primary	63	30	Basic literacy present.
Secondary	19	9	Minority with secondary education.
OND/NCE	4	2	Minimal tertiary-level education.
Degree	2	1	Very few respondents with higher education.

4.5.1 Livelihoods

Livelihoods in the project host and neighboring communities are largely based on agriculture, trading, small-scale enterprises, and informal sector activities. Given the rural setting and the socio-economic structure of Ikot Ukpo Inua, Ata Udoh Usung, Ikot Etenge Ete, and Ikot Etetuk, households engage in multiple income-generating activities to sustain their livelihoods. Key activities include:

- Farming: The dominant occupation, with crops such as cassava, yam, maize, plantain, vegetables, and palm produce. Crop farming occupies the bulk of the project site and surrounding lands.
- Livestock Rearing: Many households keep goats, sheep, poultry, and local pigs as additional sources of income and food security.
- Agro-Processing: Women are engaged in processing cassava into garri, fufu, and local flour, as well as palm oil extraction and local fish smoking.
- Petty Trading: Youth and women engage in hawking, retailing household goods, and food vending in local markets and along main access roads.
- Artisanal Activities: Some households participate in carpentry, blacksmithing, and local craft production.

4.5.2 Means of Transport

Field observations and community interactions revealed that the most common means of transport in the project area include:

- Motorcycles (Okadas): Primary mode for intra-community travel and market access.
- Tricycles (Keke Napep): Used for short-distance goods transportation and commuting.
- Cars and Pickups: Mainly for transporting farm produce and construction materials.
- Walking: Still common for short distances within communities.

4.5.3 Administration

The administrative hierarchy in the host and neighboring communities follows traditional and community structures:

- Village Heads: Serve as local authorities and manage day-to-day community affairs.
- Clan or District Heads: Oversee multiple villages and coordinate on social and developmental matters.
- Traditional Rulers: Represent the highest level of traditional authority in the area and are consulted for major community decisions and dispute resolutions.

This structured governance system plays a critical role in coordinating development projects and resolving community concerns.

4.5.4 Existing Conflict Resolution Mechanism

Community grievances are resolved using established local conflict resolution mechanisms, which are widely respected. The hierarchical process typically follows:

- Village Head (Ete Ukpo/): Initial resolution of disputes.
- District/Clan Head: Escalation for more complex issues.
- Traditional Ruler (Obong/Chief): Final arbiter for significant conflicts.

This system is effective for resolving land, agricultural, and social disputes and has been incorporated into the Grievance Redress Mechanism (GRM) for the project to manage conflicts related to project activities.

4.5.5 Waste Management

Waste management in the host and neighboring communities is largely informal and unregulated, with practices such as open dumping, burning, and shallow burying being most common. These practices pose risks to air, soil, and water quality, and contribute to vector-borne diseases. Key observations include:

- Most households and local traders dispose of organic and solid waste in drains, farmlands, or roadside areas.
- There is no formal waste collection system provided by local authorities, and community-led initiatives are limited in coverage and frequency.
- Lack of awareness, inadequate infrastructure, and limited resources exacerbate sanitation challenges, which can indirectly affect project operations.

CHAPTER FIVE: ASSOCIATED AND POTENTIAL IMPACTS

5.1 Introduction

The proposed 2,926 kW solar-hybrid power plant is expected to provide positive socio-economic and environmental benefits by offering a cost-effective, reliable, and pollution-free source of electricity. It will contribute significantly to bridging the gap between power demand and supply in the region. However, the Project may also have potential negative impacts on the environment during site preparation, construction, and operational phases. Impacts during the construction phase are generally temporary or short-term, while long-term impacts are expected primarily during the operational phase.

5.2 Impact Assessment Overview

An Environmental and Social Impact Assessment (ESIA) identifies potential impacts where a project activity has the potential to interact with the biophysical and socio-economic environment. The assessment process for this Project involved:

- Identification of potential impacts using an interaction matrix to illustrate relationships between project activities and environmental components.
- Screening of impacts for each project phase using a Risk Assessment Matrix (RAM) to determine significance and priority.
- Detailed evaluation of individual impact factors, considering their magnitude, duration, and extent. The significance of potential impacts was quantified using both qualitative and quantitative approaches.
- Qualitatively, impacts are ranked on four levels: Major, Moderate, Minor, and Negligible. The assessment covers the entire Project lifecycle, including pre-construction, construction, operation, and decommissioning phases.

5.3 Identification of Environmental and Socio-Economic Aspects and Impacts

Project activities occur in phases, each of which may impact environmental and social components. For the proposed PV-based solar power plant, activities are grouped as follows:

a) Pre-Construction Phase:

Activities include contract award, project design and planning, stakeholder consultation, workforce recruitment, site preparation, and transportation of PV power plant components to the site.

b) Construction Phase:

Activities include mobilization of workforce and equipment, excavation, trenching, grading, bulldozing, soil compaction, and installation of temporary camps and PV plant components. This phase is typically short-term.

c) Commissioning Phase:

This phase involves applying engineering procedures to inspect, test, and verify the functionality of all plant components, from individual instruments to integrated subsystems.

d) Operational Phase:

A long-term phase, beginning post-commissioning, which involves routine operation of plant and equipment, maintenance, and use of natural resources such as water for domestic use and PV panel cleaning.

e) Decommissioning Phase:

Commences when the plant reaches the end of its lifespan, involving safe dismantling and site rehabilitation. It should be noted that impacts may occur in one or multiple phases, depending on the nature of the activity. To identify environmental and social aspects, project activities were assessed for their direct or indirect potential to:

- Interact with the existing biophysical environment (physical and biological components)
- Interact with the existing socio-economic environment
- Contravene policy, legal, or administrative frameworks, including national legislation, international conventions, and corporate environmental policies
- The assessment process referenced FMEnv EIA Procedural Guidelines, African Development Bank Integrated Safeguard Systems Operational Safeguards, and ISO 14001 environmental management principles.

The assessment approach involved matching Project activities to environmental components, identifying potential changes and their magnitude, and developing mitigation measures to reduce, offset, or manage negative impacts. Both adverse and beneficial impacts were identified, providing the basis for the Environmental and Social Management Plan (ESMP). The Risk Assessment Matrix (RAM) was used to determine potential risks, with a "worst-case scenario" approach applied to predict extreme effects. Expert judgment and stakeholder consultations were used to evaluate the significance of affected components.

5.3.1 Potential Impact Characterization

Impacts associated with the Project are characterized as follows:

- Negative: Adverse change from baseline or introduction of an undesirable factor.
- Positive: Improvement from baseline or introduction of a desirable factor.
- Direct: Resulting from direct interaction between a project activity and the environment.
- Indirect: Resulting from secondary activities encouraged by the Project.
- Temporary: Short-duration, reversible, intermittent, or occasional impacts.
- Short-term: Impacts that cease after activity completion or mitigation.
- Long-term: Impacts persisting during the operational life of the Project.
- Permanent: Irreversible impacts causing lasting changes to receptors.
- On-site: Limited to the project site.

- Local: Affecting a single community or administrative area.
- Regional: Affecting environmentally or socio-economically significant areas beyond the immediate site.
- National: Affecting nationally significant resources or policies.
- Reversible: Can return to original state post-mitigation.
- Irreversible: Cannot return to original state (e.g., species extinction).
- Cumulative: Combined incremental impacts from past, present, and foreseeable projects.
- Residual: Impacts remaining after mitigation measures are applied.

5.3.2 Screening and Scoping for Potential Impacts

The first step in impact identification involved developing an interaction matrix showing the relationship between project activities and environmental/social components. A modified Leopold Interaction Matrix was applied to screen and scope potential impacts.

Screening was informed by:

- Knowledge of the project activities and design
- Detailed understanding of the environmental and socio-economic baseline
- Consultations with key stakeholders
- Review of ESIA reports for similar solar power projects

Table 18: Project Activities – Leopold's Environmental and Social Interaction Matrix (Impact Significance Matrix)

Phase / Activity	Air Quality	Ambient Noise	Soil	Groundwater / Aquifer	Landscape / Topography	Terrestrial Flora	Terrestrial Fauna	Land Use	Population	Utilities / Infra	Employment / Income	Gender Issues	Worker H&S	Workplace H&S	General Public
1. PRE-CONSTRUCTION															
Site Selection / Surveying	–	–	–	–	–	–	–	X	–	–	–	–	–	–	–
Final Design & Route Mapping	–	–	–	–	X	–	–	X	–	X	–	–	–	–	–
2. CONSTRUCTION															
Site Clearing & Preparation	X	X	X	–	X	X	X	–	–	–	X	–	X	–	–
Mobilization of Equipment	X	X	–	–	–	–	–	–	–	–	X	–	X	–	X
Civil Works (Excavation/Foundations)	X	X	X	–	X	X	X	–	–	X	X	X	X	X	X
Installation of PV Arrays & BESS	–	–	–	–	X	–	–	–	–	X	X	X	X	X	–
Waste Management (Debris/Packaging)	–	–	X	X	–	–	–	–	–	–	–	–	X	X	–
3. COMMISSIONING															
System Testing & Energization	–	–	–	–	–	–	–	–	–	X	–	–	X	X	X
Demobilization & Site Restoration	X	X	X	–	X	X	–	–	–	–	–	–	X	X	X
4. OPERATIONAL															
Power Generation (Solar Hybrid)	–	–	–	–	X	–	–	–	X	X	–	X	–	X	X
Battery Maintenance / Replacement	–	–	X	X	–	–	–	–	–	–	X	–	X	X	–
Vegetation Control (Panel Cleaning)	–	–	X	X	–	–	–	–	–	–	X	–	X	–	–
Training Centre Operations	–	–	–	–	–	–	–	–	X	X	X	X	–	X	–

Table 19: DTP III Solar Power Plant Impacts Categorisation

Project Phase / Activities	Associated and Potential Impacts	Dir	Ind	Adv	Ben	Rev	Irr	Cum	L-T	S-T
1. PRE-CONSTRUCTION PHASE										
• Permitting & Surveys	Employment opportunities from recruitment	X			X					X
• Stakeholder Engagement	Business opportunities for local contractors		X		X					X
• Recruitment	Skill acquisition for future workforce		X		X				X	
• Land Preparation	Quality of life improvement (compensated persons)		X		X				X	
• Site Clearing	Conflicts over employment quotas/methods	X		X		X				X
• Mobilization	Disputes on MoU with project proponent	X		X		X				X
	Influx of people & pressure on social infra		X	X		X		X		X
	Increase in social vices (theft, etc.)		X	X		X		X		X
	Agitations over land disputes/leadership tussles	X		X		X				X
	Loss of vegetation & forest products	X		X			X	X	X	
	Accidents during mobilization (injury/death)	X		X			X			X
	Risks of armed robbery/hostage taking	X		X			X			X
	Nuisance (noise/vibrations) to workers & wildlife	X		X		X				X
	Dust particles and vehicular emissions	X		X		X		X		X

	Generation of construction/domestic waste	X		X		X		X		X
2. COMMISSIONING & OPS										
• System Testing	Generation of reliable electricity supply	X			X				X	
• Power Generation	Increased business/research opportunities		X		X				X	
• Plant Maintenance	Improved air quality (reduced generator use)		X		X			X	X	
• Servicing	Reduced demand for fossil fuels (petrol/diesel)		X		X			X	X	
	Injuries/fatalities from plant operations	X		X			X			X
	Soil/Groundwater contamination (spills)	X		X		X		X		X
	Workplace accidents (cuts, trips, falls)	X		X		X				X
	Technical skill acquisition for operators	X			X				X	
	Depletion of groundwater (for module washing)	X		X		X		X	X	
3. DECOMMISSIONING PHASE										
• Equipment Removal	Loss of employment and economic activity	X		X		X				X
• Site Restoration	Reduced power generation to the University	X		X		X				X
• Abandonment	Injuries from collision with abandoned structures	X		X			X			X
	Risk of injury/accident during demolition	X		X			X			X
	Dust and vehicular emissions from site closure	X		X		X		X		X
	Traffic obstruction on major roads	X		X		X				X
	Availability of land for alternative uses	X			X				X	
	Loss of site aesthetics (dilapidated structures)	X		X		X		X	X	

Key: Dir – Direct; IndAdv – Indirect; Ben – Beneficial; Rev – Reversible; Irr – Irreversible; Cum – Cumulative; L-T -Longterm; S-T – Short term.

5.4.1 Method for Determining Impact Magnitude

Potential negative impacts were assigned Negligible, Low, Medium, and High labels based on their magnitude while for positive impacts, it sufficed to indicate that the project is expected to result in a particular positive impact without assigning a magnitude to it.

5.4.1.1 Defining Magnitude Levels for Biophysical Impacts

a) A High Magnitude Impact is considered to affect an entire area, physical system or species at sufficient magnitude to cause a significant measurable numerical increase in measured concentrations or levels (when compared with national or international limits and standards specific to the receptors) or a decline in species abundance beyond which natural process would not return that population or species, to its former level within several generations.
b) A Medium Magnitude Impact occurs at sufficient magnitude to cause a measurable numerical increase in measured concentrations or levels and may bring about a change in species abundance, but does not threaten the integrity of that population or any population dependent on it.
c) A Low Magnitude Impact affects a specific area, system, aspect (physical), group of localized individuals within a population (biological) and at sufficient magnitude to result in a small increase in measured concentrations or levels over a short time period, but does not affect other trophic levels or the population itself, and localized area.
d) A Negligible Magnitude Impact results in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation.

5.4.1.2 Defining Magnitude Levels for Socio-economic Impacts

For socio-economic impacts, the magnitude is based on the perspective of those who would be affected by the impact; this considers the likely perceived importance of the impact, the ability of people to manage and adapt to change caused by the impact and the extent to which a human receptor gains or loses access to, or control over socio-economic resources resulting in a positive or negative effect on their well-being. The event magnitude rankings are shown in Table 5.3.

Table 20: Event Magnitude Rankings

Importance	Environmental & Ecological Attributes	Socio-Economic & Livelihood Attributes	Public Health, Safety & Infrastructure Attributes
High	• Highly undesirable outcome (e.g., impairment of endangered/protected species or habitats). • Detrimental, extended behavioral changes in	• Negative change in livelihood, income, or assets affecting a high proportion of people.	• Increased risk to public health leading to a **fatality or serious injury**. • Damage to public infrastructure (sewers, water pipelines)

	flora/fauna (breeding, spawning). • Major reduction in resource function/service. • Impact occurs during environmentally sensitive periods.	• Resultant economic loss and public protests against the project • Reputational damage or revenue drop threatening future business viability. • Continuous non-compliance with international best practices.	leading to severe secondary impacts on other users.
Medium	• Negative outcome with measurable reduction or disruption in the value/function of the resource. • Potential for non-compliance with international best practices.	• Negative change in livelihood status, household assets, or living conditions. • Temporary disruption to businesses resulting in a small, manageable drop in revenue.	• Increased risk to public health that can be controlled using detailed mitigation measures. • Disruption to public infrastructure (e.g., road closures) resulting in significant inconvenience to users.
Low	• Imperceptible outcome with insignificant alteration in the value or function of the resource. • Fully within compliance; no additional controls required.	• Minor disruption to livelihoods/living conditions resulting in a localized, reversible, and temporary nuisance. • Temporary business disruption that does not result in revenue loss or reputational damage.	• No change in the health status of local communities. • Temporary disruption to public infrastructure resulting in only minor inconvenience to the affected community.

Importance Attributes

High

- Highly undesirable outcome (e.g., impairment of endangered, protected habitat, species)
- Detrimental, extended flora and fauna behavioural change (breeding, spawning, moulting)
- Major reduction or disruption in value, function or service of impacted resource

- Impact during environmentally sensitive period
- Continuous non-compliance with international best practices
- Negative change in livelihood status, household income/assets or living conditions affecting a high proportion of people resulting in economic loss and protests against the project.
- Reputational damage and/or drop in business revenue that threatens the future viability of the economic activity.
- Increased risk to public health leading to a fatality or injury.
- Damage to public infrastructure (such as a sewer, water pipeline, etc.) leading to environmental or socio-economic impacts to other users.

Medium

- Measurable reduction or disruption in value, function or service of impacted resource
- Potential for non-compliance with international best practices
- Negative change in livelihood status, household assets/income or living conditions.
- Temporary disruption to businesses resulting in a small drop in business revenue.
- Increased risk to public health that can be controlled using detailed mitigation measures.
- Disruption to public infrastructure (such as a road closure) that results in an inconvenience to other users.

Low

- Imperceptible outcome
- Insignificant alteration in value, function or service of impacted resource
- Within compliance, no controls required
- Minor disruption to livelihoods or living conditions resulting in a localised, reversible and temporary nuisance.
- Temporary disruption to businesses that does not result in a loss of revenue or any reputational damage.
- No change in the health status of local communities.
- Temporary disruption to public infrastructure (such as a road closure) that results in minor inconveniences to affected communities.

5.4.2 Determining Receptor Sensitivity

Receptor sensitivity refers to the socio-economic and environmental importance of the receptor, including human dependence on the receptor for food and income. It basically considers the type of receptor (namely, biological/ecological, human and physical receptor) and impacts that directly affect people. Vital natural resources are considered more important than indirect impacts. Where the receptor is physical (for example, soil environment) its current quality, sensitivity to change, and importance (on a local, national and international scale) are considered. Where the receptor is biological (for example, the aquatic environment), its local, regional, national or international importance and its sensitivity to the specific type of impact are considered. Where the receptor is

human, the vulnerability of the individual, community or wider societal group is considered. The receptors' sensitivity is categorized as Low, Medium and High and the criteria for ranking the receptor sensitivity are defined in Table 5.4.

Table 21: Receptor Sensitivity Ranking

Sensitivity	Definition / Capacity to Adapt	Examples of Receptors
High	Receptors with **little to no capacity** or means to adapt to change or maintain their quality of life. Often includes marginalized or legally unprotected groups.	• Individuals with marginal livelihoods, low income, or poor-quality living conditions. • Vulnerable groups: the elderly, persons with disabilities, or those requiring special assistance. • People with low access to recourse (e.g., no land titles, migrants, or seasonal herders). • Businesses with a marginal economic existence that cannot withstand any disruption.
Medium	Receptors with **limited capacity** and means to adapt to a given change. They can survive the change but with noticeable difficulty or restricted resources.	• Individuals who rely heavily on a specific livelihood to maintain their socio-economic status but have few alternatives. • Businesses that are sensitive to any reduction in revenue or reputation and have limited flexibility to pivot their operations.
Low	Receptors with a **moderate to high capacity** to adapt. They possess the means to adjust to disruptions while maintaining or even improving their quality of life.	• Individuals able to quickly adapt to temporary disruptions in living conditions or infrastructure (e.g., temporary road closures). • Businesses with robust economic models that can easily absorb restrictions or may even gain economically from the project changes.

5.4.3 Significance

For both Environmental and Socio-Economic Impacts, impact significance, as a function of impact magnitude and receptor sensitivity, is ranked as Negligible, Minor, Moderate or Major as presented in Table 5.5.

Table 22: Impact Significance

		Receptor Sensitivity		
		Low	**Medium**	**High**
Impact Magnitude	**High**	Minor	Moderate	Major
	Medium	Minor	Moderate	Major
	Low	Negligible	Minor	Moderate
	Negligible	Negligible	Negligible	Minor

Negligible Significant impacts are where a resource or receptor will not be affected in any way by a particular activity or the predicted effect is deemed to be 'negligible' or 'imperceptible' or is indistinguishable from natural background variations. An impact of minor significance is one where an effect will be experienced, but the impact severity is sufficiently low (with or without mitigation) and well within accepted standards, and/or the receptor is of low sensitivity/value. An impact of moderate significance is one within accepted limits and standards. Moderate impacts range from a threshold below which the impact is minor, up to a level that might be just short of breaching a permissible limit. Thus, impacts of Negligible, Minor or Moderate significance are considered as being mitigated as far as practicable and necessary, and therefore, do not require further mitigation.

An impact of major significance is one where an acceptable limit or standards may be exceeded, or high magnitude impact occurs to highly valued/sensitive receptors/resources and for such negative impacts, additional mitigation is required.

5.4.3.1 Determining the Significance of Potentials Impacts of the Project

To assist in calculating the overall significance of each of the identified potential impacts, expert discussions were organized, which employed extensive use of screening matrices and predefined criteria for impact magnitude and receptor sensitivity. The significance was then developed as seen in Table 5.6.

Table 23: Leopold's Activity-Receptor Interaction Matrix (Impact Significance Matrix)

Project Phases & Activities	Air Quality	Ambient Noise	Soil	Ground water / Aquifer	Landscape / Topography	Terrestrial Flora	Terrestrial Fauna	Land Use	Population	Utilities / Infra	Employ. / Income	Gender Issues	Worker H&S	Workplace H&S	General Public
PRE-CONSTRUCTION															
Site Selection	–	–	–	–	–	–	–	2(2)	–	–	–	–	–	–	–
Site Clearing & Prep	2(2)	2(2)	2(2)	–	2(1)	3(1)	3(1)	–	–	–	+	–	2(2)	–	–
Mobilization	2(2)	2(2)	–	–	–	–	–	–	2(2)	–	+	–	–	–	2(2)
CONSTRUCTION															
Civil Works (Excavation)	2(2)	2(2)	3(1)	–	2(2)	–	–	–	–	3(2)	++	–	2(2)	2(3)	2(3)
Facility Installation	2(2)	2(2)	3(1)	–	–	–	–	–	–	–	–	–	2(2)	2(3)	–
Waste Generation	–	–	2(2)	2(2)	–	–	–	–	2(1)	–	+	–	2(2)	–	2(2)
COMMISSIONING															
Testing & Energization	2(1)	–	–	–	–	–	1(1)	–	1(1)	–	–	–	2(3)	–	2(2)
OPERATIONAL															
Power Gen & Training	2(1)	–	–	–	–	–	–	–	–	++	2(3)	–	–	2(3)	2(3)
Routine Maintenance	2(2)	–	2(2)	2(2)	2(2)	–	–	–	2(1)	1(2)	+	–	2(1)	2(2)	2(2)

The value assigned to each cell in the matrix above is in the form "x (y)": where "x" denotes the impact magnitude and "y" the sensitivity of receptor.
Impact magnitude ranking: 1 = Negligible; 2 = Low; 3 = Medium; 4 = High.
Receptor sensitivity ranking: 1 = Low; 2 = Medium; 3 = High.

5.5 Impacts Discussion

5.5.1 Potential Positive Impacts

The proposed 2,926 kW solar-hybrid power plant aims to provide independent and reliable electricity to FUTIA, enhancing educational and institutional services by extending available hours and improving illumination for academic and administrative activities. The Project will contribute to Nigeria's carbon emission reduction targets (20% reduction by 2030) in line with the nation's Nationally Determined Contributions (NDCs) under the Paris Agreement. Within the Project area, reliance on diesel generators will be reduced, resulting in lower noise and air pollution, thus protecting natural habitats and human health from fossil-fuel-related emissions. The construction of a renewable energy training center as part of the Project will provide capacity building, enabling students and staff to acquire practical skills in renewable energy technologies, with opportunities for certification.

Additional benefits include:

- Installation of streetlights improving safety and security on campus.
- Promotion of social cohesion and community development through engagement of local labor and small businesses.
- Creation of employment opportunities for skilled, semi-skilled, and unskilled labor, particularly during the construction phase, supporting overall socioeconomic development.

5.5.2 Potential Negative Impacts

Potential adverse impacts are grouped according to environmental and social aspects and are discussed in relation to each project phase:

- Land use changes
- Impacts from equipment, personnel, and material movement
- Traffic disruptions
- Air quality deterioration
- Noise and vibration
- Impacts on terrestrial flora and fauna
- Impacts on water resources
- Waste generation
- Soil quality changes
- Visual and aesthetic impacts
- Socio-economic impacts
- Health impacts
- Workplace hazards

5.5.2.1 Pre-Construction / Mobilization Phase

The pre-construction phase includes site selection, site clearing and preparation, and mobilization of equipment, materials, and personnel to the Project site.

Site Selection

The Project site occupies 1 hectare within FUTIA, allocated by University management for the solar-hybrid power plant and training center. No additional land outside the campus is required. The site is partly used for cassava farming and contains secondary vegetation and swampy areas. Field observations indicate no physical structures on the site, and current farming is seasonal. While farming activities will cease on the site, this will not significantly affect staff income or food supply. The impact significance of site selection on existing land use is therefore moderate.

Site Clearing and Preparation

Vegetation on the site will be cleared using light earth-moving equipment. Potential impacts include:

Terrestrial Flora and Fauna:

Clearing will result in loss of grasses, shrubs, and a few non-threatened trees. The impact is negative, direct, site-specific, and largely irreversible, but minor in significance due to the modified nature of the habitat and absence of endangered species. Fauna are generally mobile and able to relocate to surrounding areas.

Soil:

Soil may experience compaction and exposure, potentially leading to minor erosion, particularly if clearing occurs during wet conditions. Laboratory analysis indicates the site is not highly prone to erosion, so the impact is minor.

Air Quality and Ambient Noise:

Dust and emissions (particulate matter, NOx, CO, TSP, SOx) from clearing equipment, and intermittent noise, may temporarily reduce air quality. Activities are short-term (<1 week), localized, and reversible, with the overall impact significance rated minor.

Worker Safety:

Minor accidents could occur, particularly if unskilled labor is involved. The number of workers is expected to be fewer than 10, and the duration is short, so impacts are minor.

Mobilization of Equipment, Materials, and Personnel

Transportation of materials and workforce to the Project site may affect air quality, ambient noise, and road infrastructure:

Air Quality and Noise:

Vehicular emissions and dust generation are anticipated to be similar to those during site clearing. The capacity of the environment to absorb these emissions is high, and the impact significance is minor.

Traffic and Infrastructure:

Increased vehicle movement could temporarily raise accident risk, cause congestion, and cause minor inconvenience. The magnitude is low, receptor sensitivity is medium, and significance is minor.

Worker Safety:

Handling of heavy construction materials could cause injuries similar to site clearing, and is considered minor in significance.

Table 24 summarizes the potential impacts associated with the pre-construction phase of the proposed Project.

Activity	Receptor	Associated Impact	Significance
Site Selection	Existing Land Use	• Loss of land for farming activities due to land take for the Project.	**Moderate**
Site Clearing & Preparation	Terrestrial Flora & Fauna	• Loss of vegetation cover. • Direct impacts on vegetation and soil-dwelling organisms. • Indirect impacts on fauna in the immediate surroundings.	**Minor**
	Soil	• Loss of topsoil. • Soil compaction and degradation. • Increased erosion potential. • Reduction in structural stability and percolative ability.	**Minor**
	Air Quality & Noise	• Air quality impacts due to emissions from clearing equipment. • Increase in ambient noise levels.	**Minor**
	Worker Safety	• Injuries and accidents to workers during site clearing and preparation activities.	**Minor**
Mobilization	Air Quality & Noise	• Air quality impacts from vehicular emissions (TSP, NO_x, CO, SO_x). • Increase in ambient noise levels from heavy-duty vehicles.	**Minor**

	Infrastructure (Roads)	• Increase in vehicular movement and traffic congestion. • Potential for road traffic accidents.	**Minor**
	Worker Safety	• Injuries and accidents to workers during the loading and offloading of construction materials.	**Minor**

5.5.2.2 Construction Phase

The construction phase of the proposed Project will involve civil and electrical works, including excavation, trenching, concrete mixing, installation of PV panels and associated components, construction of the renewable energy training center, installation of streetlights, and upgrades to existing electricity distribution infrastructure. Waste generation and disposal are also anticipated. The potential environmental and social impacts associated with this phase are assessed below.

Equipment, Personnel, and Plant Material Movement

During construction, personnel and materials will be transported to the Project site as needed. Vehicles will include saloons, SUVs, and heavy-duty trucks for equipment and materials. Potential impacts from vehicle movement include:

- Emission of pollutant gases (CO, SO_2, NO_2) from vehicle exhaust.
- Contribution to greenhouse gas emissions and ozone depletion.
- Increased traffic along access roads to the Project site.
- Potential accidents involving personnel or property.
- Dust generation from construction activities.

These impacts are considered moderate in significance prior to mitigation. Mitigation measures, such as traffic management plans and vehicle maintenance, will minimize effects.

Assessment of Labour-Related Impacts

Labour Influx

The project is expected to recruit labour from both local communities and external sources. Given the relatively small project footprint (1 hectare), short construction duration, and proximity to existing urban centres and accommodation facilities, labour influx is anticipated to be low to moderate. Priority will be given to recruiting qualified workers from Ikot Abasi and neighbouring communities for positions where the required skills are available locally, thereby reducing the need for imported labour and maximizing local economic benefits. Nevertheless, the temporary presence of non-local workers could result in risks such as:

- Increased demand for local goods, housing, and public services;
- Community-worker conflicts arising from cultural differences or perceived inequitable employment opportunities;
- Increased traffic and road safety risks;

- Gender-based violence (GBV), sexual exploitation and abuse (SEA), and sexual harassment (SH);
- Communicable disease transmission, including sexually transmitted infections (STIs).

To minimize these risks, the EPC Contractor will prepare and implement a Labour Management Plan (LMP) and a Labour Influx Management Plan. These plans will include local recruitment targets, worker orientation programmes, a Code of Conduct addressing respectful behaviour and GBV/SEA/SH prevention, community engagement, security management, and monitoring of labour-related impacts throughout project implementation.

Workers' Accommodation

The project is not expected to require the establishment of dedicated workers' camps because construction personnel will primarily be recruited locally or accommodated in existing hotels, guesthouses, and rental facilities within Ikot Abasi and nearby communities. Consequently, significant impacts associated with large workers' camps such as pressure on land resources, sanitation, waste management, and community health are not anticipated. Should temporary accommodation become necessary for specialist personnel, the Contractor will ensure that all accommodation facilities comply with applicable Nigerian occupational health and safety requirements and international good practice, including the IFC/EBRD Guidance Note on Workers'.

Workers' Grievance Mechanism

A dedicated Workers' Grievance Mechanism (WGM) will be established before commencement of construction to provide all project workers including direct workers, contracted workers, subcontractors, and primary supply workers with a safe, confidential, transparent, and accessible process for raising workplace concerns. The mechanism will:

- Be available free of charge and accessible throughout employment;
- Allow workers to submit grievances anonymously where desired;
- Protect complainants from retaliation or discrimination;
- Establish clear procedures and timelines for grievance registration, investigation, resolution, and feedback;
- Include a structured appeals process where grievances remain unresolved; and
- Maintain grievance records for monitoring, reporting, and continuous improvement.

Assessment of Community-Related Social Risks

Gender-Based Violence (GBV) and Sexual Exploitation and Abuse/Sexual Harassment (SEA/SH)

Construction projects may increase the risk of Gender-Based Violence (GBV), including Sexual Exploitation and Abuse (SEA) and Sexual Harassment (SH), particularly where there is a significant influx of non-local workers or prolonged interaction between workers and surrounding communities. For this project, the overall GBV/SEA/SH risk is assessed as Low based on the following considerations:

- The project occupies a relatively small footprint (approximately 1 hectare).
- Construction is expected to be of relatively short duration.
- The workforce will be limited in size.
- Preference will be given to recruiting workers from Ikot Abasi and neighbouring communities, thereby minimizing labour influx.
- Dedicated workers' camps are not anticipated, as workers will reside in existing accommodation within the locality.
- The project is located within a controlled university environment with existing security arrangements and institutional oversight.

Despite the low risk, the project adopts a zero-tolerance approach to GBV, SEA, and SH. Accordingly, the EPC Contractor will implement the following measures:

- Mandatory Code of Conduct signed by all workers, subcontractors, and security personnel;
- Induction and periodic training on respectful behaviour, prevention of GBV/SEA/SH, and sanctions for misconduct;
- Confidential, survivor-centred reporting and referral procedures;
- Public awareness and sensitization activities for workers and nearby communities;
- Integration of GBV requirements into contractor contracts and supervision;
- Immediate investigation and disciplinary action for substantiated violations

Violence Against Children (VAC)

The risk of Violence Against Children (VAC), including child abuse, exploitation, neglect, and inappropriate contact with workers, is assessed as Low because:

- Construction activities are confined within the university premises.
- The project does not involve residential worker camps.
- The workforce will be relatively small.
- The site will be secured and access controlled.

Nevertheless, preventive measures will include:

- Strict prohibition of child labour and child exploitation.
- Mandatory worker Code of Conduct prohibiting inappropriate interactions with children.
- Site fencing, warning signage, and controlled site access.
- Traffic management measures around areas used by students and community members.
- Community awareness programmes for parents, schools, and local stakeholders where necessary.

Mitigation measures

- Inclusive stakeholder engagement using culturally appropriate communication methods;
- Transparent and non-discriminatory recruitment procedures that promote equal employment opportunities;
- Identification and support for vulnerable Project Affected Persons (PAPs) through the project's livelihood restoration measures, where applicable;
- Universal access considerations during construction activities where feasible;

- Accessible and confidential Project Grievance Redress Mechanism (GRM), including channels suitable for women, persons with disabilities, and vulnerable individuals;
- Regular monitoring to ensure vulnerable groups benefit equitably from project interventions.

Civil and Electrical Works, and Installation of Plant Facilities

Potential Impact on Air Quality

Dust and emissions (PM, NOx, CO, SOx) will arise from excavation, material handling, transportation, and equipment operation. These emissions are localized and short-term. The construction phase is projected to last up to 12 months. Considering the small site area (1 ha) and low baseline air pollution, the overall impact is minor.

Potential Impact on Noise Levels

Noise and vibration from construction equipment, civil works, and vehicle movement may disturb fauna, particularly birds and mammals. However, noise will be intermittent, localized, and short-term, with no expected increase of more than 3 dB(A) at nearby receptors (e.g., Senate building, 100 m from site). The impact magnitude is low, and significance is minor.

Potential Impact on Soil

Excavation, filling, and compaction can degrade soil quality by:

- Removing topsoil and soil compaction.
- Reducing structural stability and percolation.
- Disturbing soil-dwelling organisms.
- Increasing erosion and siltation of nearby drainage channels.

Given the site's partially swampy terrain and susceptibility to erosion during the rainy season, the impact magnitude is medium, with an overall moderate significance. Buffer zones and proper excavation management will reduce risks.

Potential Impact on Terrestrial Flora and Fauna

Vegetation clearing and human activity may temporarily reduce flora diversity and disturb fauna, including birds, snakes, and rodents. None of the species present are threatened or endangered. The impact is direct, minor, and localized, with fauna likely to relocate to surrounding areas. Overall significance is minor.

Potential Impact on Groundwater

Construction activities may lead to minor infiltration of fuels, oils, or lubricants, and slight changes in runoff patterns. A borehole will be installed onsite for water supply, while existing University boreholes provide additional water. Groundwater quality is currently good, and abstraction for construction activities is minimal. The potential impact on groundwater is rated minor, with negligible effect on the underlying aquifer.

Potential Impact on Gender

Women may face limited access to employment or training during construction, reinforcing gender stereotypes. To mitigate this, select female students will participate in on-the-job training across construction activities. The potential for gender-based violence (GBV) exists but is considered minor, given the local workforce composition and community engagement plans.

Potential Impact on Socio-Economic and Health

The influx of construction workers may temporarily strain local infrastructure and social services. Worker behavior could increase risks of minor crime, alcohol/drug use, and sexual health issues. Local unskilled labor will be prioritized, reducing impacts. The displacement of seasonal farmers is possible, but the University has records and alternative land options, mitigating adverse effects. Overall significance is moderate.

Potential Impact on Infrastructure (Road)

Increased vehicle movement along access roads may temporarily raise the risk of traffic accidents and congestion. Given the small scale of construction traffic, the impact is low, with overall significance minor.

Potential Impact on Worker Safety

Construction sites pose occupational hazards, including:

- Noise and air pollution exposure.
- Electrical shocks and equipment accidents.
- Handling of heavy materials.

The impact magnitude is moderate, requiring enforcement of occupational health and safety measures.

Waste Generation and Disposal

Wastes during construction include:

- Solid: wood, metals, electrical cables, packaging, sand, gravel.
- Liquid: wastewater and minor oil spills.
- Air: dust and vehicle emissions.

Impact on Soil

Improper disposal of solid or liquid waste could increase pathogen loads and contaminate soils. With proper handling and designated collection areas, the impact is minor.

Impact on Groundwater

Waste infiltration could affect groundwater, particularly from spent oils. The potential impact is minor, given the low volume and controlled management.

Impact on Waste Management Facilities

Construction and e-waste (scrap panels, cables, batteries) cannot enter standard University waste systems. A take-back/recycling scheme will be implemented, resulting in negligible impacts on existing waste management infrastructure.

Table 25: Summary of Potential Negative Impacts Associated with the Construction Phase of the proposed Project

Activity	Receptor	Associated Impact	Significance
Equipment & Personnel Movement	Air Quality	• Emissions (CO, SO_2, NO_2) from vehicle exhaust. • Contribution to global warming and ozone depletion. • Dust/particulate matter from construction traffic.	**Minor**
	Social System (Road)	• Increased traffic movement of heavy-duty trucks on local routes.	**Minor**
	Health & Safety	• Potential accidents involving personnel and assets due to vehicle movement.	**Minor**
Civil & Electrical Installation	Air Quality	• Emissions from construction equipment (SPM, NO_x, CO, SO_x). • Increase in windblown dust from stockpiles and cleared land.	**Minor**
	Ambient Noise	• Elevated noise levels resulting from construction and installation activities.	**Minor**
	Soil	• Increased erosion potential from excavation. • Reduced structural stability and percolation due to soil compaction.	**Moderate**
	Terrestrial Flora & Fauna	• Introduction of alien plant species preventing natural recovery. • Loss of fauna due to human activity and noise disturbance.	**Minor**
	Groundwater	• Depletion of aquifers due to water abstraction (mixing, washing). • Increased sediment load in nearby streams due to runoff. • Creation of new drainage lines from hard standing areas.	**Minor**
	Gender / GBV	• **Discrimination against women during employment.** • **Risks of Gender-Based Violence (GBV).**	**Moderate**
	Socio-economic & Health	• **Population influx leading to increased risk of STIs/HIV.**	**Moderate**
	Infrastructure (Road)	• Physical damage to roads and traffic safety impacts.	**Minor**

Activity	Receptor	Associated Impact	Significance
	Construction Worker Safety	**• Occupational injuries and accidents during construction activities.**	**Moderate**
Waste Generation & Disposal	Soil & Groundwater	• Contamination from improper disposal of solid and liquid construction waste.	**Minor**
	Waste Infrastructure	• Pressure on existing waste management facilities in the project area.	**Negligible**

5.5.2.3 Commissioning Phase

Once the construction phase of the Solar Power Plant is completed, the Plant will be tested to ensure that it has been installed according to the pre-design and operational requirements.

Potential Impact on Noise

During the Plant commissioning, there could be increase in noise level due to humming noise emission from the Plant components (inverters and batteries), vehicular movement (transportation of commissioning officials), public address system, crowd noise, and other ceremonial activities. The impact significance is however rated minor.

Potential Impact on Safety

Also, there is potential for occupational hazards during the Plant testing as a result of any wrong electrical connection. The impact significance is considered to be moderate on the workers' health and safety. However, the potential hazard of to the public during the commissioning activities could be electrical shocks from exposure to wrong electrical connections. This is considered to have a minor impact on the general public.

Potential Impact on infrastructure (road)

The commissioning phase will lead to an influx of guest and officials which will have an impact on the population and infrastructure (road). Due to the short duration of the commissioning phase (1 day), the impacts are considered to be negligible.

Table 26 summarizes the potential negative impacts associated with the commissioning phase of the proposed Project.

Activity	Receptor	Associated Impact	Significance
Plant Testing	Ambient Noise	• Temporary increase in ambient noise levels during equipment startup and load testing.	**Minor**
	Worker Health & Safety	**• High-risk occupational hazards including injuries and electrocution resulting from incorrect electrical connections or insulation failure.**	**Moderate**

	Campus Occupants' Safety	• Risk of electrocution or fire hazards to the university community due to faulty connections to the campus grid.	**Minor**
	Population Influx	• Minor increase in onsite personnel (specialized engineers/inspectors) during the commissioning period.	**Negligible**
	Infrastructure (Road)	• Residual road traffic from the final demobilization of heavy machinery; low risk of accidents.	**Negligible**

5.5.2.4 Operational Phase

Power Generation and Distribution

Potential Impact on Noise

The potential sources of noise during the Power Plant operations are inverters and batteries. Typically, the designed noise level from an inverter is approximately 30- 35 dB(A) while that of a battery is 15-20 dB(A). The associated noise levels from the inverters and batteries are not envisaged to result in a maximum increase in background levels of 3 dB(A) at the nearest receptor location offsite. The impact significance is considered to be negligible.

Potential Impact on Gender

Women have conventionally been under-represented in the energy sector; they are often marginalized from many power sector employment and training opportunities. There is a potential that this situation may come to play during the operations phase of the Project as women experience discrimination may be denied training and employment opportunities. Male and female staff will be trained on the management and maintenance of the facility. Although the number of personnel working at the Project site would reduce, the likelihood of impacts predicted during the construction phase may exist. Therefore, the impact significance is regarded as minor.

Potential Impact on Socio-economic and Health

The potential negative impacts on the socio-economic environment (community health and safety) during the operational phase of the Project are related to visual impact and the generation of electromagnetic field (EMF) radiation.

For visual impact, the Project site is not known to be a tourist route or to have any special scenic characteristics, hence it has a limited potential for visual impacts on the receiving environment. However, the facility (primarily the PV panels) will be visible during operation. The impact significance is considered negligible.

Regarding EMF radiations, Solar PV panels, inverters, batteries, and other components that make up solar PV arrays produce extremely low frequency EMF when generating and transmitting

electricity. Thus, the potential impact of EMF radiation from the proposed Solar Power Plant on community health and safety is considered to be negligible.

Community Health and Safety (Emergency Response and Operational Safety)

Electrical Faults and Electrocution Risks

The project will include photovoltaic arrays, inverters, transformers, switchgear, underground and overhead electrical cables, and a Battery Energy Storage System (BESS), all of which operate with high-voltage electrical equipment. Potential hazards include electric shock, arc flash, equipment malfunction, and accidental contact with energized components.

To minimize these risks, the project will incorporate:

- Electrical system designs compliant with applicable Nigerian regulations and relevant international standards (e.g., IEC standards);
- Proper grounding (earthing) and lightning protection systems;
- Protective relays, circuit breakers, surge protection devices, and automatic isolation systems;
- Clearly marked danger signs and restricted access to energized equipment;
- Routine inspection, preventive maintenance, and testing of electrical installations;
- Lock-out/Tag-out (LOTO) procedures during maintenance activities; and
- Training of operational personnel in electrical safety and emergency response.

These measures will significantly reduce the likelihood of electrical incidents affecting workers or surrounding communities.

Fire Outbreaks

Potential sources of fire include electrical faults, inverter failures, transformer malfunctions, overheating of electrical equipment, cable faults, or battery system failures. Although the probability of a major fire is considered low due to the project's modern design and built-in protection systems, the consequences could include equipment damage, service interruption, smoke generation, and localized safety risks.

The facility will therefore be equipped with:

- Automatic fire detection and alarm systems;
- Portable and fixed fire suppression equipment appropriate for electrical and battery fires;
- Fire-resistant construction materials where appropriate;
- Clearly designated emergency exits and assembly points;
- Firewater supply or other suitable firefighting arrangements where required;
- Routine inspection and maintenance of fire protection systems; and
- Regular emergency drills involving plant personnel.

Battery Energy Storage System (BESS) Failures

The Battery Energy Storage System is a critical component of the solar-hybrid facility and may present hazards such as thermal runaway, overheating, fire, release of hazardous gases, or electrolyte leakage under abnormal operating conditions.

To manage these risks, the project will:

- Install battery systems certified to recognized international safety standards;
- Provide dedicated battery housing with adequate ventilation and temperature control;
- Install Battery Management Systems (BMS) for continuous monitoring of battery performance;
- Include automatic shutdown and fault isolation mechanisms;
- Install gas detection, smoke detection, and fire suppression systems specifically designed for battery installations;
- Maintain emergency spill response materials where applicable; and
- Develop detailed operating and maintenance procedures for battery safety.

Operational staff will receive specialized training in battery safety, emergency isolation procedures, and incident response.

Emergency Preparedness and Response Arrangements

A comprehensive Emergency Preparedness and Response Plan (EPRP) will be developed prior to commissioning of the facility. The plan will define procedures for preventing, responding to, and recovering from emergency situations, while minimizing risks to workers, the university community, and surrounding residents.

The Emergency Preparedness and Response Plan will include:

- Identification of credible emergency scenarios;
- Clearly defined roles and responsibilities;
- Emergency communication and notification procedures;
- Coordination with the University Management, local emergency services, hospitals, the Fire Service, and relevant government agencies;
- Incident command structure and decision-making procedures;
- Evacuation routes, assembly points, and accountability procedures;
- First aid and medical response arrangements;
- Emergency shutdown procedures for electrical systems;
- Periodic emergency drills and simulation exercises; and
- Incident investigation and corrective action procedures.

Protection of Surrounding Communities

Although the project is located within the University campus and is separated from nearby residential areas, several measures will be implemented to ensure the safety of surrounding communities throughout the operational life of the project. These include:

- Maintaining appropriate buffer distances between electrical equipment and public access areas;
- Restricting access to hazardous installations through fencing and security controls;
- Providing adequate warning signage in English and local languages where appropriate;
- Implementing routine inspection and preventive maintenance programmes to reduce equipment failure;

- Maintaining an operational Community Grievance Redress Mechanism (GRM) for reporting safety concerns;
- Conducting periodic community awareness programmes on emergency procedures and electrical safety; and
- Coordinating emergency response activities with the University authorities, host communities, and relevant emergency response agencies.

Potential Impact on Occupational Health, Safety and Welfare of Workers

During the Plant operation, workers may be exposed to occupational health and safety issues (e.g. electrical and field exposure, shock hazards and mechanical injuries) including work related issues such as discrimination, denial of rights, unfair treatment, poor working conditions etc. The impact significance is considered to be moderate primarily due to the low number of staff (approximately 10) required for operation.

Routine Maintenance, Waste Generation and Disposal

Potential Impact on Soil

Routine maintenance of the Plant will lead to the generation of wastes which can contaminate the soil within the Project site and AoI. The major waste stream will be e-waste generated from spent/damaged components of the Project such as batteries, inverters and PV panels. These wastes will be stored within the Project site according to the manufacturer's instructions. All components to be used for the Project will have buy back agreements with the manufacturers as specified in the Extended Producer Responsibility Program (EPRP). The impact significance is considered to be minor.

Potential Impact on Groundwater

Potential impacts may include decrease in amount of groundwater reservoir as a result of water abstraction for cleaning of the PV panels. Cleaning of the PV panels is envisaged to be carried more during the dry season than in the rainy season. Based on previous experience, each MW of panels would require approximately 5 litres of water per cleaning cycle. The water required for the cleaning purpose would be obtained from the boreholes proposed to be dug at the project site. Based on observations noted during the field survey and the estimated quantity of water required for occasional cleaning of the PV panels, water abstraction for the Project is not envisaged to have serious effect on the existing groundwater aquifer of the Project area as well as the local water use. Thus, the impact significance is considered minor.

Potential Impact on Occupational Health, and Safety of Workers

During routine maintenance, workers may be exposed to occupational health and safety issues (e.g. electrical and field exposure, shock hazards and mechanical injuries). The impact significance is considered to be minor primarily due to the low number of staff (approximately) required for maintenance activities and low frequency of maintenance.

Table 27 summarizes the potential negative impacts associated with the operational phase of the proposed Project.

Activity	Receptor	Associated Impact	Significance
Power Generation & Distribution	Noise	• Noise from batteries and inverters during power generation and evacuation.	**Negligible**
	Gender	• Discrimination against women during O&M employment. • Gender-Based Violence (GBV) including harassment and poor working conditions.	**Minor**
	Socio-economic (Visual)	• Landscape alterations causing unpleasant changes in the visual prominence/character of the area.	**Negligible**
	Socio-economic (Health)	• Community health and safety impacts due to Electromagnetic Field (EMF) radiation.	**Negligible**
	Health & Safety of Staff	• **Electric shock and physical injuries to personnel during plant operations.** • Work-related issues (discrimination, denial of rights, unfair treatment).	**Moderate**
Routine Maintenance & Waste	Soil	• Soil contamination from spent/leaking batteries and inverter components.	**Minor**
	Groundwater	• Water abstraction for cleaning PV panels (potential aquifer depletion).	**Minor**
	Soil & Ground Water	• General contamination from liquid or solid waste streams.	**Negligible**
	Health & Safety of Staff	• Electric shock and injuries to personnel during active maintenance tasks.	**Minor**

5.5.2.5 Potential Cumulative Impacts

Cumulative impacts are those impacts resulting from the combined effects of past, present or reasonably foreseeable actions owing to the project aspects and activities outside the project (GSI, 2003). The concept of cumulative effects is an important one. It holds that, while impacts may be small individually, the overall impact of all environmental changes affecting the receptors taken

together can be significant. When a resource is nearing its tolerance threshold, a small change can push it over. The major existing activities around the Project area are seasonal farmlands, residential and commercial activities. The nature of the activities associated with the proposed Project and the existing activities around the project area, the potential cumulative impacts of the Project on road traffic, ambient noise levels and groundwater availability is negligible and considered low.

5.6 Risk and Hazard Assessment

Risk assessment refers to the determination of the quantitative or qualitative estimate of risk(s) associated with recognized threats/hazards posed by the project's activities. The assessment of the risks and hazards associated with the proposed project involves:

- Identification of hazards/risks
- Assessing their likelihood of occurrence
- Estimating the consequence/severity of the hazards

Table 28: Severity and Risk Level Definitions

Risk Score	Risk Category	Severity Description (Injury / Property / Process)
0 – 5	**Low Risk**	Insignificant/Minor injury; Non-reportable damage to property or equipment.
6 – 10	**Moderate Risk**	Reportable injury; Minor loss of process; Slight damage to property.
11 – 15	**High Risk**	Major injury; Moderate loss of process or limited damage to property.
16 – 25	**Extremely High / Unacceptable**	Single or Multiple Fatalities; Critical/Catastrophic loss of business, process, or property.

Table 29: Risk Calculation Matrix

Likelihood ↓ / Severity →	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Catastrophic (5)
Almost Certain (5)	5	10	15	20	25
Probable (4)	4	8	12	16	20
Possible (3)	3	6	9	12	15
Remote Possibility (2)	2	4	6	8	10

Extremely Unlikely (1)	1	2	3	4	5

5.6.1 Project Specific Risks and Hazards

The potential risks and hazards associated with the proposed project are:

5.6.1.1 Fire and Explosion

The major risk associated with the operation of the plant is fire and explosion because PV systems are subject to electrical faults like other electrical installations such as short circuits, ground faults and reverse currents. Failures within the plant system could cause hotspots that can ignite nearby combustible materials. Faulty installations or failure with DC/AC inverters can also cause photovoltaic fires. Overcharging, high temperatures and physical stress to Lithium-ion battery cells can cause thermal escape, which commonly leads to the destruction of the battery, fire and even explosions. In addition, dDtP discharging can also cause battery fires. Any outbreak of uncontrolled fire in the area can escalate to dangerous dimensions which could be critical. Thus, this hazard is classified as high risk.

5.6.1.2 Electrocution

Electrocution from direct contact with high-voltage electricity or tools, vehicles, ladders, and other devices that are in contact with high-voltage electricity could occur during the plant operation. This hazard is hardly likely to occur and it is of minimally severe consequence and is thus classified as moderate risk.

5.6.1.3 Occupational Hazards

During construction, workers carrying out activities at heights could be exposed to occupational hazards. Electrical accidents may also result in shocks and/or burns, muscle contractions, and traumatic injuries associated with falls after the shock. This hazard is fairly probable although, its severity is considered minimal thus it is classified as moderate risk.

5.7 Summary of Anticipated Impacts

These includes significant risks such as electric shock and injuries of workers during the construction phase as well as GBV risks and soil degradation. The execution of suitable mitigation measures presented in the next chapter will abate the effect of identified negative impacts/risks to the most minimal level possible and heighten the effects of the identified positive impacts.

Table 5.12 is a summary of the general potential site specific environmental and social impacts on the project.

Table 30 Potential site specific environmental and social impacts on the project

Impact Type	Environmental / Physical Impacts	Social & Socio-economic Impacts
Direct Impacts	• Reduced noise and odors from decommissioned diesel generators. • Protection of natural habitats against deforestation for fuel. • Reduced annual fuel consumption and associated CO_2 emissions. • **Negative:** Localized air, water, and soil pollution during construction. • **Negative:** Battery waste pollution and flood/erosion hazards.	• **Longer study hours** and better illumination for students. • Improved social cohesion and equitable development. • Improved access to information (ICT, Radio, TV, Internet). • Enhanced safety and lighting for women on campus. • **Negative:** Temporary access restrictions to properties/land.
Indirect Impacts	• Improved safety by reducing hazards associated with flammable fuels. • Reduced indoor air pollution for consumers. • Impacts related to material production (solar panel manufacturing) and fuel source lifecycles.	• Reduced expenditures on fossil fuels (petrol, kerosene), increasing savings by **10–15%**. • Freeing up financial resources for more profitable business investments. • Generation of new income and stimulation of economic activities via "day lengthening." • Job creation and increased state/local income.
Cumulative Impacts	• Improved quality of regional educational and healthcare services. • Significant contribution to Greenhouse Gas (GHG) emissions reduction. • **Negative:** Population-level effects on threatened biodiversity due to land-use changes.	• Proper addressing of local/host population needs to avoid social conflicts regarding land use and agriculture. • Facilitation of overall sustainable socioeconomic development in the region.

CHAPTER SIX: MITIGATION MEASURES

6.0 INTRODUCTION

This chapter presents the mitigation measures proposed for the potential environmental and social impacts of the 2.9 MW solar-based power plant at the Federal University of Technology, Ikot Abasi (FUTIA), Akwa Ibom State. The measures are designed to prevent, minimize, or offset negative impacts and enhance the benefits of the Project. A comprehensive Risk Assessment Matrix (Figure 6.1) was applied to determine the appropriate mitigation requirements for each identified impact. In this assessment, the following factors were considered:

- Frequency and severity of potential impacts
- Sensitivity of environmental and socio-economic receptors
- Spatial scale and temporal duration (longevity) of impacts
- Political, economic, and legal considerations
- Reputation, image, and communication/complaints management

The mitigation measures are organized according to the different phases of the project—pre-construction, construction, operation, and decommissioning—ensuring that potential impacts are addressed throughout the Project lifecycle.

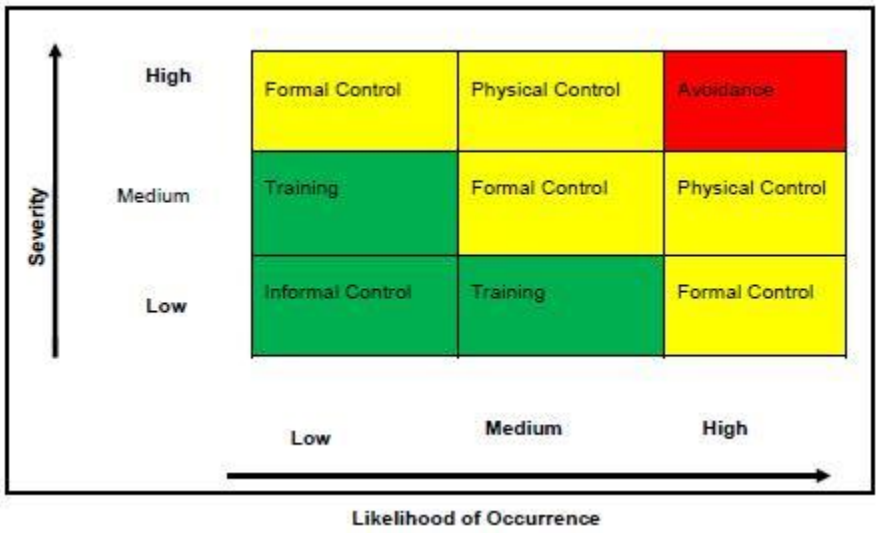


Figure 17: Matrix for Determination of Mitigation Measures

Mitigation measures designed to prevent, reduce or control the adverse impacts of the environmental and social aspects of the proposed project to as low as reasonably practicable were considered and documented in this chapter of the report. Subsequently, the specific mitigation measures satisfying the mitigation requirement were established putting the following into consideration:

- Available resources and competencies;
- on-site conditions; and
- Public concerns and technology.

6.2 Mitigation measures and approach

Mitigation refers to measures or interventions necessary to avoid, minimize, reduce or offset adverse impacts. Approach as indicated in table 6.1 for selecting appropriate mitigation measures include:

- Anticipate and avoid risks and impacts;
- Where avoidance is not possible, minimize or reduce risks and impacts to acceptable levels;
- Once risks and impacts have been minimized or reduced, mitigate;
- Where significant residual impacts remain, compensate or offset them, where technically and financially feasible.

Table 31: Summary of mitigation approaches for the University Solar Hybrid Power Project

Project Phase	Mitigation Hierarchy	Approach & Key Actions
Project Design	Avoidance & Minimization	• **Micro-siting:** Adjusting layout to bypass sensitive ecological or cultural zones. • **Safety Engineering:** Re-routing or burying powerlines to prevent bird collisions and barrier effects.
Construction	Avoidance	• **Scheduling:** Timing activities to avoid sensitive biological periods (e.g., nesting seasons).
	Minimization	• **Abatement:** Noise, erosion, and waste controls to limit construction pollutants. • **Operational Controls:** Using exclusion fencing, designated lay-down areas, and minimizing vegetation clearing.
	Restoration & Rehabilitation	• **Repair:** Revegetating temporary-use areas and lay-down sites immediately after construction to restore ecosystem services.
Operational	Minimization	• **Infrastructure Modification:** Optimizing solar tech foundations and security fencing to reduce footprint. • **Resource Management:** Wastewater management and water conservation measures for panel cleaning. • **Vegetation Maintenance:** Managing intervals for vegetation control around the solar array.

End-of-Life	Avoidance	• **Decommissioning Schedule:** Coordinating timing to protect local biodiversity from disturbance during removal activities.
	Minimization	• **Pollution Control:** Managing noise and waste during the dismantling or repowering phase. • **Contractor Regulation:** Enforcing exclusion zones even during the final phase.
	Restoration & Rehabilitation	• **Final Reinstatement:** Returning the site to its original vegetative state as far as feasible after all equipment is removed.

In proffering mitigation measures for the various negative impacts identified in the previous chapter, preference was given to avoidance or prevention of adverse impacts and where not feasible, measures which are practicable and cost-effective using best available technology were suggested to reduce and/or minimize the impacts while rehabilitation, restoration or compensation was considered as the last resort. The implementation of the proffered mitigation measures highlighted in Table 6.2, are of negligible to minor significance. There are no potential long-term impacts associated with the Project that cannot be mitigated to acceptable levels of residual impact.

Table 32: Mitigation Measures for the Potential Negative Impacts of the proposed Project

Project Phase / Activity	Sensitive Receptor	Potential Impact Summary	Pre-Mitigation Significance	Mitigation Measures	Residual Impact
PRE-CONSTRUCTION					
Site Selection & Land Take	Local Farmers / Land Users	Loss of existing farmlands and standing crops.	**Moderate**	• Notify affected persons in time to harvest crops before work starts. • Provide alternative farming land within the University campus. • Secure a formal commitment letter signed by the Vice Chancellor.	**Minor**
Site Clearing & Preparation	Flora & Fauna (Biodiversity)	Habitat loss; destruction of dwelling	**Minor**	• Limit clearing strictly to the project footprint; demarcate boundaries.	**Negligible**

		organisms; soil exposure.		• Prohibit bush burning and chemical herbicides. • Implement a **1:10 tree replacement ratio** (replant 10 trees for every 1 felled) using native species. • Sensitize workers on ecological protection.	
Site Clearing & Preparation	Soil Resources	Removal of topsoil; increased erosion; soil compaction.	**Minor**	• Stockpile topsoil for future landscape remediation. • Implement soil conservation measures and install **silt traps**. • Rehabilitate disturbed areas immediately after clearing to prevent runoff.	**Negligible**
Site Clearing & Preparation	Air Quality & Noise	Dust generation and noise from heavy clearing equipment.	**Minor**	• Use fuel-efficient, well-maintained machinery with noise suppressors. • Turn off equipment when not in use. • Limit clearing to daytime hours only.	**Negligible**
CONSTRUCTION					
Mobilization (Personnel & Equipment)	Air Quality & Noise	Vehicle emissions; dust on unpaved roads; noise pollution.	**Minor**	• Select vehicles with high engine performance; service regularly. • **Cover all materials** prone to dust during transit. • Enforce onsite speed limits (**15–20 km/h**) to minimize dust.	**Negligible**

Mobilization (Personnel & Equipment)	Transport Infrastructure	Traffic congestion; increased risk of road accidents.	**Minor**	• Implement a **Traffic Management Plan (TMP)**. • Install safety signage and formalized crossing points. • Assess and use alternative access routes with lower traffic volumes. • Record and analyze all traffic incidents for corrective action.	**Negligible**
Civil & Electrical Works	Soil & Hydrology	Severe erosion; sediment loading in nearby streams; soil compaction.	**Moderate**	• Suspend excavation during aggressive weather (heavy rain). • Cover stockpiles; use native plants for immediate erosion control. • Establish a **buffer/green zone** around existing gullies/natural drains. • Install palisade fencing to act as a physical barrier against sediment runoff.	**Minor**
Installation Activities	Community & Workers	Noise disturbance; workplace injuries; lack of sanitation.	**Minor**	• Limit work to standard hours: Weekdays (08:00–17:00), Weekends (09:00–13:00). • Notify neighboring receptors in advance of unavoidable noisy tasks. • Provide mandatory **PPE** (Hard hats, gloves, masks) and sanitary amenities.	**Negligible**

				• Prohibit the use of unregistered or casual "touts" for off-loading.	

Table 33: comprehensive Mitigation Measures for the Potential Negative Impacts of the proposed Project

Project Phase / Activity	Sensitive Receptor	Potential Impact & Context	Pre-Mitigation Significance	Comprehensive Mitigation Measures (Actions)	Responsibility	Residual Impact
PRE-CONSTRUCTION						
Land Acquisition & Site Selection	Local Farmers, Students & Staff	Displacement of livelihoods; loss of active crops and farmlands.	**Moderate**	• Conduct a census of Project Affected Persons (PAPs). • Issue formal VC-signed guarantee letters for alternative plots.	University Mgmt / Lands Dept	**Minor**
Site Clearing & Earthworks	Terrestrial Biodiversity	Destruction of micro-habitats; loss of native flora; displacement of fauna.	**Minor**	• Use "Soft Felling" techniques to allow mobile fauna to escape. • Prohibit bush burning to protect soil nutrients and air quality. • Implement a **1:10 Reforestation Policy** (10 native trees for every 1 removed). • Restrict clearing to daylight hours (08:00 - 17:00).	EPC Contractor / HSE Officer	**Negligible**
Topsoil Management	Soil Health & Structure	Soil compaction; loss of fertile top layer;	**Minor**	• Strip and **stockpile topsoil** (top 15–30cm) separately for site closure.	Site Engineer	**Negligible**

		nutrient leaching.		• Limit heavy machinery movement to designated "haul routes" to prevent widespread compaction. • Apply mulch to stockpiles to prevent wind erosion.		
CONSTRUCTION						
Civil & Electrical Works	Hydrology & Local Drainage	Increased runoff; siltation of nearby streams; exacerbation of existing gullies.	**Moderate**	• Install **Silt Fences** and **Sediment Basins** to trap runoff before it enters the stream. • Construct **Palisade Fencing** and stone pitching around gully heads. • Design "permeable" hardstanding areas to allow groundwater recharge. • Schedule bulk earthworks for the dry season.	EPC Contractor	**Minor**
Mobilization & Logistics	Air Quality & Community Health	PM10 (Dust) and NO_x emissions; noise nuisance; traffic congestion.	**Minor**	• Deploy water bowsers for **dust suppression** on unpaved roads (twice daily). • Cover all trucks carrying sand or cement with tarpaulins. • Enforce a strict **20 km/h speed limit** on-site.	Logistics Mgr / HSE Officer	**Negligible**

				• Implement a **Traffic Management Plan (TMP)** with flagmen at campus entry points.		
Waste Generation	Soil & Water Quality	Hazardous waste (oil leaks); construction debris; sanitary waste.	**Moderate**	• Establish a "Bunded" area (110% capacity) for fuel and chemical storage. • Use drip trays for stationary equipment. • Provide portable chemical toilets (ratio 1:15 workers) with regular evacuation. • Implement a **Waste Manifest System** for all off-site disposal.	Environmental Consultant	**Minor**
Installation & Labor	Occupational Health & Safety (OHS)	Work-at-height risks; electrical shocks; heat stress; accidents.	**Moderate**	• Conduct daily **Toolbox Talks** on safety protocols. • Mandatory use of PPE (High-viz, steel-toe boots, hard hats, gloves). • Prohibit unauthorized "casual labor"; maintain a verified workers' register. • Establish an on-site First Aid post and emergency evacuation plan.	HSE Manager	**Negligible**

Discussions on the Mitigation Measures for the Potential Negative Impacts

During the pre-construction phase, key concerns include land acquisition and site clearing, which could displace local farmers and affect biodiversity. Mitigation strategies such as soft-felling techniques for vegetation ensure minimal disruption. Soil conservation measures, including topsoil

stockpiling and restricted machinery movement, preserve soil health. These measures reduce the significance of initial impacts from moderate/minor to negligible/minor residual impacts.

In the construction phase, activities like civil works, mobilization, and waste generation pose risks to hydrology, air quality, community health, and occupational safety. Implementing silt fences, sediment basins, dust suppression, traffic management, proper waste handling, and strict safety protocols effectively mitigates these risks. Residual impacts after mitigation are considered minor to negligible, reflecting a strong alignment of project execution with environmental and social best practices.

Mitigation Measures for Hazardous Waste Management

Temporary Storage: Designated, impermeable, and covered storage areas will be established onsite, located away from watercourses and sensitive receptors. These secured zones will feature secondary containment (bunds or trays) to capture any leaks, segregated compartments to prevent incompatible materials from mixing (e.g., batteries isolated from flammable materials), and clear hazard signage. Storage duration will be strictly limited to the regulatory maximum (typically ≤ 90 days) to minimize onsite accumulation risks.

Transportation: All hazardous waste movement will be executed exclusively by licensed and registered waste haulers using specialized, leak-proof vehicles. Each shipment will be accompanied by a duly completed waste manifest (tracking document) detailing the waste type, quantity, origin, and destination. Transport routes will be pre-approved to avoid densely populated areas, schools, and water bodies, and will be scheduled during off-peak hours to reduce accident exposure. Emergency response kits and trained personnel will accompany each transport consignment.

Recycling and Final Disposal: In alignment with the Extended Producer Responsibility (EPR) principle, the project will contract directly with the original equipment manufacturers (OEMs) or their authorized local representatives to establish a take-back and recycling program. End-of-life PV panels and lithium-ion batteries will be returned to OEM-operated or certified regional recycling facilities, where valuable materials (glass, aluminum, copper, lithium, cobalt) will be recovered and reintroduced into the supply chain. Only non-recoverable, inert residues will be directed to a government-licensed, engineered hazardous waste landfill. All final disposal activities will be documented with certificates of disposal issued by the receiving facility and submitted to regulatory authorities for compliance verification. This closed-loop approach ensures environmental responsibility, resource efficiency, and full lifecycle accountability for all hazardous components

CHAPTER SEVEN: ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

7.1 Introduction

This section deals with the set of mitigation management measures to be taken to avoid, reduce, mitigate or compensate for adverse environmental, occupational and social impacts with the institutional arrangement, monitoring schedule, parameters to be monitored and soon including tentative monitoring budget. It includes the following aspects:

- Types of impacts and their mitigations
- Mitigation measures
- Environmental Code of Conduct/ Practices (to be attached to bidding documents and/ or contracts)
- Monitoring Plan
- Communication and documentation
- Cost of ESMP
- Integration with Project (contract clauses, others)
- Grievance resolution process

Plan for stakeholder/ community engagement during pre-construction, construction, and operation phases; the plan should include community mobilization approach from both social and commercial perspectives.

Further to the impacts assessed in the previous chapter, this section presents more detailed mitigation measures and monitoring requirements that correspond to the impacts examined in the previous section, thus exploring them in more detail. Mitigation measures aim to offset any negative impacts that may result from the project, and monitoring is the process of measuring the success of mitigation measures in order to assess their effectiveness.

7.2 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 ESIA 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 Environmental and social management and communicate the aims and goals of the ESMP;
- Ensure that all workers, subcontractors and others involved in the Project meet legal and regulatory requirements with regard to environmental management including financial implications
- Incorporate environmental and social management into Project design and operating procedures;
- Serve as an action plan for environmental and social management for the Project;
- Provide a framework for implementing Project environmental and social commitments (i.e. mitigation measures identified in the ESIA).

7.3 Environmental and Social Management Measures

The recommended environmental and social management measures required to mitigate the identified impacts of the proposed project activities during pre-construction, construction, commissioning and operation phase are presented in tables 7.1 to 7.8.

*Table 34: **Environmental Management Plan for Pre-Construction Phase of the proposed Project***

Impact Category	Summary of Potential Impact	Mitigation Action	Monitoring Requirements & Frequency	Performance Indicator	Responsible (Implementation)	Responsible (Monitoring)	Cost (USD)
Site Clearing & Preparation	**Biodiversity Loss:** Habitat destruction & direct impact on flora/fauna.	• Limit clearing to project footprint. • Replant cleared trees elsewhere (1:10 ratio) per university physical planning. • No bush burning or herbicides. • Prohibit hunting/killing of fauna.	**Daily Inspection:** Visual check of clearing boundaries and worker activities. **Monthly:** Tree survival audit.	100% adherence to demarcated boundaries; Zero herbicide use; Tree survival rate.	EPC Contractor	REA (PMU) & POE (Site Engineer)	$1,000
Site Clearing & Preparation	**Soil Degradation:** Topsoil loss, erosion, and compaction.	• Restrict soil cover removal to essential areas. • Stockpile topsoil for future remediation. • Install and maintain silt traps to prevent runoff.	**Daily:** Visual inspection of stockpiles. **Monthly:** Inspection of silt traps and erosion controls.	Integrity of silt traps; Topsoil stockpiles properly maintained and covered.	EPC Contractor	REA (PMU) & POE (Site Engineer)	Included above
Site Clearing & Preparation	**Air & Noise:** Emissions and noise nuisance from heavy	• Operate machinery under fuel-efficient conditions. • Limit activities to daytime (08:00-17:00	**Daily:** Maintenance records check and fuel consumption monitoring.	Maintenance logs up-to-date; Zero noise complaints from	EPC Contractor	REA (PMU)	Included above

	machinery.	weekdays; 09:00-13:00 weekends).	**Daily:** Adherence to noise-restricted hours.	surrounding campus.			
Mobilization	**Vehicular Emissions:** Air & Noise pollution from transport.	• Use vehicles with high-performance engines. • Enforce regular servicing and maintenance of the fleet.	**Pre-Commencement:** Vehicle certification check. **Ongoing:** Maintenance log audits.	Low smoke opacity from exhausts; valid service records for all vehicles.	EPC Contractor	REA (PMU) & POE (Site Engineer)	$300
Mobilization	**Dust Entrainment:** Airborne particulates during material transit.	• Cover all dust-prone materials during transport. • Enforce speed limits (15–20 km/h) on unpaved roads. • Implement water sprinkling/suppression on access roads.	**Daily:** Inspection of truck covers and road moisture levels. **Daily:** Random speed checks of project vehicles.	Zero visible dust plumes on site roads; 100% of trucks properly covered.	EPC Contractor	REA (PMU)	Included above
TOTAL							**$1,300**

*Table 35: **Social Management Plan for Pre-Construction Phase of the proposed Project***

Potential Impact	Mitigation Measures	Monitoring Parameters	Frequency	Performance Indicator	Implementation Responsibility	Monitoring Responsibility	Cost (USD)
Loss of Farmlands & Livelihood	• Complete ARAP/RAP before mobilization. • Allow farmers to harvest standing crops before clearing. • Provide alternative farm demonstration plots within FUTIA campus. • Secure formal commitment letter signed by the Vice Chancellor.	• Involuntary Resettlement records. • Signed VC Commitment letters. • Farmer census data.	Once, prior to site mobilization	100% of affected farmers compensated or relocated; Signed land-guarantee letters issued.	FUTIA Management	REA (PMU)	$1,200

Infectious Diseases (HIV/AIDS, COVID-19)	• Implement NCDC Safety Guidelines. • Provide functional hygiene stations (handwashing, sanitizers). • Mandatory use of face masks in crowded work areas. • Conduct health sensitization for all workers.	• Implementation of NCDC protocols. • Presence of functional hygiene facilities.	Daily	Zero outbreaks of preventable diseases; 100% compliance with hygiene protocols.	EPC Contractor	REA (PMU)	$2,000
Occupational Injuries & Accidents	• Mandatory provision and use of PPE (Gloves, steel-toe boots, hard hats). • Limit clearing	• PPE inventory and usage logs. • Employment/ Staff register. • Daily safety time logs.	Daily	Zero "Lost Time Injuries" (LTI); 100% PPE compliance; All workers verified on register.	EPC Contractor	REA (PMU) & POE	$3,500

	and heavy lifting to daylight hours. • Prohibit "unregistered labor/touts"; use only verified, trained personnel.						
Traffic & Road Safety	• Develop and implement a Traffic Management Plan (TMP). • Install safety signage and barriers at crossing points. • Mandatory driver competency tests and valid licensing. • Strict disciplinar	• Traffic Management Plan (TMP). • Incident/Accident forms. • Driver licenses and training certificates.	Daily (Monitoring) Once (Pre-Mobilization)	Zero road traffic accidents; Adherence to on-site speed limits; Completed incident logs.	EPC Contractor	REA (PMU)	*Included in OHS cost*

	y action for speed limit violations.						
TOTAL							**$6,700 **

*Table 36: **Environmental Management Plan for Construction Phase of the proposed Project***

Potential Impact	Mitigation Measures	Monitoring Parameters	Frequency	Performance Indicator	Responsibility (Imp / Mon)	Cost (USD)
Air Quality & Dust	• Maintain/service machinery monthly. • Daily water sprinkling on cleared land. • Cover all windblown stockpiles.	Maintenance logs; Visual site inspection.	Daily / Monthly	No visible dust plumes; Exhaust emissions within FMEnv limits.	EPC / REA-PMU	$580
Noise & Vibration	• Limit work to 08:00–17:00 (weekdays) and 09:00–13:00 (weekends). • Turn off idling engines. • Maintain noise-attenuation equipment on machinery.	Noise monitoring records; Complaint logs.	Weekly / Monthly	Noise levels below FMEnv limits (70 dB day/ 60 dB night).	EPC / REA-PMU	$760

Soil Erosion & Stability	• No excavation during aggressive weather/storms. • Cover stockpiles to prevent runoff. • Implement proper soil compacting after backfilling.	Excavation and site inspection logs.	Daily during civil works	No visible soil loss or siltation of drainage; Stable trenching.	EPC / REA-PMU	$300
Ecological & Biodiversity Loss	• Train workers on ecological awareness. • Clean machinery mud/soil before site entry to prevent alien plant invasion. • Monitor/clear stored heaps for weed germination.	Training records; Vegetation monitoring logs.	Monthly / Daily	No introduction of invasive species; Zero illegal poaching/tree cutting.	EPC / REA-PMU	$300
Road Damage & Traffic Safety	• Enforce strict speed limits. • Install safety barriers and signage around active zones. • Implement a Traffic Management Plan (TMP). • Promptly repair any damage to	TMP Implementation records; Incident forms; Driver licenses.	Daily during construction	Zero traffic accidents; 100% repair of infrastructure damage.	EPC / REA-PMU	$1,500

	public/private infrastructure.					
Waste & E-Waste Management	• Implement the Waste Management Plan (WMP). • Store e-waste in secure, labeled receptacles. • Conduct worker training on hazardous waste handling.	Waste consignment notes; Training certificates.	Weekly	100% of waste sorted/logged; Zero illegal dumping on site.	EPC / REA-PMU	$450
Soil & Water Contamination	• Store hazardous substances (fuel/oil) on impervious hardstanding with secondary containment. • Maintain portable spill kits on site. • Mandatory spill response training for crew.	Spill kit inventory; Secondary containment inspection.	Daily	Zero leaks/spills to ground or water; 100% containment of hazardous fluids.	EPC / REA-PMU	$2,400
TOTAL						**$6,290**

Table 37: Social Management Measures for Construction Phase of the proposed Project

Potential Impact	Mitigation & Management Measures	Monitoring Parameters	Frequency	Performance Indicator	Responsibility (Imp / Mon)	Cost (USD)
Discrimination & Child Labour	• Implement fair, open recruitment. • Strict prohibition of workers under age 18.	Employment records; ID verification logs.	Once before start	100% compliance with age and fair-hire laws.	EPC / REA-PMU	—
Land Use Displacement	• Manage temporary displacement of ad-hoc users via University physical planning.	Reallocation records; Consultation logs.	Once before start	100% successful relocation of temporary users.	University / REA-PMU	(In-house)
Gender-Based Violence (GBV/SEA)	• Hire a dedicated Gender/GBV Officer. • Mandatory Code of Conduct (CoC) signed by all workers. • Establish GBV-sensitive reporting channels (GRM).	Signed CoC forms; Monthly training logs; GRM records.	Monthly refreshers	Zero reported GBV/SEA incidents; 100% of staff trained.	EPC / REA-PMU	$700
Labour Influx & Community Relations	• Prioritize local hiring for unskilled/semi-skilled roles. • Induction on local norms and customs. • Develop/implement a Labour Management Plan.	Local hiring %; Community consultation records.	Ongoing	>70% local labor for unskilled roles; Zero community unrest.	EPC / REA-PMU	$1,500
Occupational Health & Safety (OHS)	• Mandatory PPE (boots, helmets, vests).	PPE compliance audits; Toolbox	Daily	Zero Lost Time Injuries (LTI); 100%	EPC / REA-PMU	$4,000

	• Daily toolbox talks before work. • Engage an onsite Safety Officer. • First aid and fire-fighting training.	talk logs; Incident reports.		PPE compliance.		
Infectious Diseases (HIV/COVID-19)	• Implement NCDC/Public Health guidelines. • Provide functional hygiene/wash facilities. • Conduct infectious disease risk assessments.	Hygiene facility inspection; Health policy implementation.	Continuous	Zero site-related disease outbreaks; Adequate hygiene supply.	EPC / REA-PMU	$500
TOTAL						**$6,700**

Table 38: Environmental management for Commissioning phase

Potential Impact	Mitigation & Management Measures	Monitoring Parameters	Frequency	Performance Indicator	Responsibility (Imp / Mon)	Cost (USD)
Increased Ambient Noise Levels	• Ensure strict compliance with Standard Operating Procedures (SOPs) during testing. • Install power plant components strictly according to manufacturer specifications to minimize vibration/noise.	Noise level measurements; SOP compliance logs.	Once before/during commissioning	Noise levels within NESREA/WHO regulatory limits.	EPC Contractor / REA-PMU	(Included in EPC Contract)

Operational Technical Risks	• EPC Contractor must develop comprehensive SOPs for the operational phase before handover. • Verify installation against pre-established engineering standards.	Final SOP documentation; Installation audit reports.	Once before commissioning	Approved SOPs on-site; 100% verification of installation standards.	EPC Contractor / REA-PMU (POE)	—

Table 39: Social Management Measures for Commissioning Phase

Potential Impact	Mitigation & Management Measures	Monitoring Parameters	Frequency	Performance Indicator	Responsibility (Imp / Mon)	Cost (USD)
OHS Hazards (Electrocution, Injuries)	• Testing must be performed only by qualified, senior engineers. • Mandatory use of specialized electrical PPE (e.g., insulated gloves/tools).	Staff qualifications; PPE inspection logs.	Once before commissioning	Zero electrical accidents or injuries.	EPC Contractor / REA-PMU	$500
Equipment Failure / Fire / Explosion	• Double-verify all electrical connections against schematics before energizing. • Deploy emergency response	Connection checklists; Emergency equipment availability.	Once before commissioning	100% of connections verified; Fire suppression on standby.	EPC Contractor / REA-PMU (POE)	(In-house)

	equipment (CO2 extinguishers, etc.) at the test site.					
TOTAL						**$500**

*Table 40**: Environmental Management Measures for Operational Phase***

Potential Impact	Mitigation & Management Measures	Monitoring Parameters	Frequency	Performance Indicator	Responsibility (Imp / Mon)	Cost (USD)
Power Gen: Air & Noise Emissions	• Strict compliance with Generator SOPs. • Monthly maintenance of diesel generators. • Use soundproof covers and ear muffs (PPE).	Maintenance & Inspection logs	Monthly	Emissions and Noise within EHS limits	O&M Contractor / REA-PMU	$1,200
Dust on PV Panels	• Implement a cleaning schedule to maintain efficiency. • Inspect for rain/weather damage.	Visual Inspection	Monthly	Clean panels; Optimal power output	O&M Contractor / University	(O&M Budget)
Visual/Landscape Alterations	• Minimize lighting to safety essentials.	Night-time inspection	Monthly	Minimal light spillage beyond site	O&M Contractor / REA-PMU	(In-house)

	• Use downward-shielded, low-level lighting to reduce light pollution.					
E-Waste Generation (Batteries/Inverters)	• Provide staff training on hazardous waste. • Store waste in secured, designated areas. • Use "Take-Back" / EPR policies for recycling batteries via manufacturers.	Waste consignment notes; Training records	Continuous / Annual	100% recycling of hazardous e-waste	O&M Contractor / REA-PMU	$2,000
Soil & Water Contamination	• Store fuel/oil on impervious hard surfaces with secondary containment. • Maintain spill clean-up kits on-site. • Implement the Waste Management Plan (WMP).	Inspection of storage areas; spill kit check	Quarterly	Zero leaks or uncontained spills	O&M Contractor / FMEnv	$1,200
OHS: Electric Shock/Injury	• Provide specialized electrical PPE. • Strict adherence to safety SOPs.	PPE availability; Incident reports	Quarterly	Zero occupational injuries	O&M Contractor / REA-PMU	$500
Groundwater Depletion	• Implement a water conservation plan for panel cleaning.	Water usage records	Quarterly	Water consumption within benchmarks	O&M Contractor / FMEnv	$500
TOTAL						**$5,400**

*Table 41: **Social Management Measures for Operational Phase***

Potential Impact	Mitigation & Management Measures	Monitoring Parameters	Frequency	Performance Indicator	Responsibility (Imp / Mon)	Cost (USD)
Gender-Based Violence (GBV/SEA)	• Implement DTP Gender Action Plan. • Mandatory training and refreshers on GBV/Sexual Harassment. • Sign-off on Code of Conduct (CoC) by all staff. • Establish sensitive Grievance Redress Mechanism (GRM) channels. • Provide separate facilities/conveniences for men and women.	Training records; Signed CoCs; GRM logs; Facility inspection.	Monthly / Continuous	100% CoC sign-off; Zero reported/unresolved GBV incidents.	O&M Contractor / REA-PMU (University)	$2,200
Staff Welfare & Safety	• Provide medical insurance schemes for all employees. • Strategic placement of safety signage. • Implement a labor-specific Grievance Redress Mechanism.	Insurance enrollment forms; Safety signs; Grievance forms.	Quarterly / Monthly	100% insurance coverage; Active GRM usage.	O&M Contractor / REA-PMU (POE)	$3,000
Infectious Diseases (HIV, COVID-19, etc.)	• Adhere to NCDC safety guidelines. • Conduct risk assessments for infectious disease exposure.	Hygiene facility checks; Risk assessment reports.	Continuous	Zero workplace outbreaks; Compliance with NCDC protocols.	O&M Contractor / REA-PMU (POE)	(Included in welfare)

	• Provide hygiene facilities and PPE (masks, sanitizers). • Establish isolation procedures for symptomatic individuals.					
Maintenance Hazards (Shock/Injury)	• Provide appropriate electrical PPE. • Strict adherence to Standard Operating Procedures (SOPs).	PPE availability logs; SOP compliance audits.	Quarterly	Zero occupational injuries during maintenance.	O&M Contractor / REA-PMU	$2,000
TOTAL						**$7,200**

7.4 Environmental Monitoring Programme

Monitoring shall be conducted to ensure compliance with regulatory requirements as well as to evaluate the effectiveness of operational controls and other measures intended to mitigate potential impacts. Table 7.9 summarizes the environmental monitoring programme for the Project.

*Table 42: **Environmental Monitoring Programme for the proposed Project***

Environmental/Social Component	Sampling Locations	Parameters Monitored	Frequency	Responsibility	Phase	Est. Cost (USD)
Air Quality & Noise	Project Site & Evacuation Route	TSP, CO, NO_x, SO_x, Noise Levels (dBA)	Monthly	EPC Contractor	Construction	$500
Groundwater Quality	University Boreholes	pH, Salinity, TDS, Heavy Metals, Microbiology	Quarterly	EPC / O&M Contractor	Construction & Operations	$500
Soil Quality	Unpaved Plant Sections	pH, TOC, THC, TPH, Heavy Metals	Quarterly	EPC / O&M Contractor	Construction & Operations	$700
Solid Waste	Operational Areas	Waste Tracking, Disposal Documentation	Monthly / Quarterly	EPC / O&M Contractor	Construction & Operations	$500
Health and Safety	Worker Areas	PPE Compliance, Unsafe Conditions	Daily / Quarterly	EPC / O&M Contractor	Construction & Operations	$1,200
Staff Training	Project Office	Training Plan records & Attendance	Quarterly	EPC / O&M Contractor	Construction & Operations	$1,000
General Housekeeping	Plant Site	Cleanliness and Aesthetics	Daily / Quarterly	EPC / O&M Contractor	Construction & Operations	$500
Stakeholder Engagement	Local Community / Agencies	Evidence of Consultations, Grievance Logs	Quarterly	EPC / O&M Contractor	Construction & Operations	$1,200
TOTAL						**$6,100**

7.5 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. Table 7.10 indicates the Roles and Responsibilities of the Stakeholders in the Implementation, Monitoring and Review of the ESMP.

*Table 43**: The Roles and Responsibilities of the Stakeholders in the Implementation, Monitoring and Review of the ESMP***

S/N	Stakeholder	Key Phase	Primary Roles & Responsibilities
1	FUTIA Director of Physical Planning	All Phases	Earmark land; Appoint Site Engineer; Ensure University commitment to ESMP; Implement livelihood restoration for affected persons.
2	REA-PMU (Project Management Unit)	All Phases	Provide technical land selection support; Appoint/Supervise EPC & O&M contractors; Review ESMP compliance; Manage non-compliance issues.
3	FUTIA Site Engineer	All Phases	Undergo ESMP training; Supervise daily EPC/Plant activities; Report compliance/non-compliance to the Director of Physical Planning.
4	EPC Contractor	Construction	Implement management measures; Hire a Gender/GBV Officer; Ensure all staff are aware of safety/environmental protocols.
5	O&M Contractor	Operations	Execute day-to-day ESMP requirements; Maintain a Gender/GBV officer; Report on long-term environmental compliance.
6	Regulators (FMEnv & NESREA)	All Phases	Monitor impact mitigation; Conduct environmental compliance audits; Discuss improvements with REA and the University.
7	Min. of Women Affairs / Social Dev.	Operations	Monitor Gender mitigation measures; Oversee GBV/SEA service providers; Liaise with the project Gender Officer.
8	State Min. of Environment (Akwa Ibom)	All Phases	State-level monitoring of impact mitigation and environmental compliance; Address upcoming local environmental issues.
9	Safeguards Unit	Implementation	Analyze community impacts; Implement the Grievance Redress Mechanism (GRM); Establish partnerships with CBOs and CSOs.
10	Works Management Contractor	Construction	Oversight of BOQ specifications; Ensure EHS procedures are followed; Hault construction if PMU instructions are ignored.

7.6 Additional Management Plans

During the progression of the project, management plans will be expanded to include specific procedures to guide implementation by the relevant project personnel and institutions including contractors and subcontractors. Such documents will be prepared strictly in line with the requirements set out in the relevant international standards and guidelines and other applicable national and local regulations and guidelines. These additional management plans include the following:

- The Stakeholder Engagement Plan will be prepared prior to construction by the Project's Community Liaison Officer in collaboration with the ESIA Consultant. It will be approved by the Project Manager in consultation with the Federal Government of Nigeria (FGN) Desk Officer. Implementation will be led by the Community Liaison Officer throughout the construction and operational phases. The plan will be reviewed quarterly, and following any major community incident or significant project phase change, to ensure ongoing meaningful engagement and effective grievance redress.
- The Emergency Preparedness and Response Plan will be developed by the Project Health, Safety, and Environment (HSE) Manager, with input from a certified fire safety consultant. Approval will be sought from the State Fire Service, the National Environmental Standards and Regulations Enforcement Agency (NESREA), and the Project Director. Implementation will be the responsibility of the site HSE Team and the dedicated Emergency Response Unit. While the plan must be finalized and approved prior to commissioning, emergency drills will commence during late construction to test readiness. The plan will undergo bi-annual reviews with full-scale drills, and will be revised immediately following any actual emergency event.
- The Traffic Management Plan will be prepared prior to construction by the Civil Works Contractor and a transport consultant, to manage the safe haulage of materials and equipment to the site. It requires approval from the Local Government Authority and the Project Engineer. During construction, implementation will be overseen by the Civil Contractor, while during operations and maintenance (O&M), the Project Logistics Team will assume responsibility. The plan will be reviewed monthly during construction, and quarterly during O&M, or whenever road conditions or haulage routes change.
- The Waste Management Plan will be prepared prior to construction by the ESIA Consultant and an environmental specialist, and submitted to NESREA and the State Ministry of Environment for approval. Implementation will be led by the Site Environmental Officer, working in conjunction with licensed waste haulers. This plan covers all waste streams, including hazardous materials such as end-of-life photovoltaic panels and lithium-ion batteries. It will be

reviewed annually, or whenever the composition or volume of waste generated changes significantly.

- The Occupational Health and Safety Plan will be prepared prior to construction by the Project HSE Manager, with approval from the Project Director and NESREA for reference. All site personnel will be responsible for implementation, under the supervision of the HSE Team. This includes the provision of personal protective equipment, site safety inductions, and daily toolbox talks. The plan will be reviewed monthly during site safety meetings, with a comprehensive annual review, and additionally after any lost-time injury or near-miss incident.
- The Local Content and Employment Management Plan will be prepared prior to construction by the Human Resources Manager in conjunction with the Community Liaison Officer. Approval will be granted by the Project Director and the FGN Desk Officer, ensuring alignment with national local content policies. Implementation will be carried out by the HR Team and line supervisors, guiding recruitment, skills training, and subcontracting opportunities for local community members. The plan will be reviewed quarterly and at each major project phase transition from construction to O&M.
- The Erosion and Sediment Control Management Plan will be developed prior to construction by a civil or environmental engineer, and approved by the Project Engineer and the State Environmental Agency. During the construction phase, implementation will be the responsibility of the Civil Contractor, with installation of silt fences, sediment basins, and drainage channels. During operations, the O&M Team will maintain these measures. The plan will be reviewed weekly during the rainy season, monthly during drier periods, and after any major storm event that may compromise control structures.
- The Water Conservation Plan will be prepared prior to construction by an environmental specialist or hydrologist, and approved by the Project Director in consultation with the State Water Resources Ministry. Implementation will be managed by the Site Operations Team, focusing on efficient water use for panel cleaning, dust suppression, and domestic purposes. The plan will be reviewed annually, or more frequently if water consumption patterns change or seasonal water scarcity becomes a concern.
- Livelihood Restoration Plan will be prepared prior to construction by a resettlement specialist and the ESIA Consultant, with approval required from the Project Director, the FGN Desk Officer, and relevant financing institutions such as the AFDB, if applicable. Implementation will be coordinated by the Community Liaison Officer and a Compensation Committee, ensuring that any affected persons are fairly compensated and supported in restoring their incomes before physical or economic displacement occurs. The plan will be reviewed quarterly during active resettlement activities, and then annually until all affected livelihoods are fully restored and monitored.

7.7 Environmental Monitoring Program

Monitoring shall be conducted to ensure compliance with regulatory requirements as well as to evaluate the effectiveness of operational controls and other measures intended to mitigate potential impacts. The key components of the environmental monitoring program that will be developed for this project include:

- Comprehensive identification of high-level issues, risks, opportunities and gaps in system and operating practices that can impact ability to achieve the required level of performance;
- Establishment of clear metrics to measure statistically significant performance improvement areas towards goals and targets;
- Establishment of processes to ensure documents and records that are critical to operational excellence are current, controlled and accessible;
- Establishment and maintenance of appropriate processes for regularly monitoring of HSE performance as well as conducting regular environmental audits and evaluations to ensure that the system is implemented and maintained and remains effective.

7.8 Training, Awareness and Capacity Building for Zonal Offices

REA shall identify, plan, monitor, and record training needs for personnel whose work may have a significant adverse impact upon the environmental or social conditions. It is important that employees at each relevant phase of the project are 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 appointment;
- Specialist training (as required for specific job role); and
- Refresher training as required.

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

7.8.1 ESMP Capacity Building Plan

The various actors involved in the ESMP implementation will need capacity enhancement to ensure adequate understanding of ESMP/ OHS/ Waste Management/ Code of Conduct requirements amongst other areas identified. Proposed topics and target audience is outlined in table 7.11.

*Table 44: **ESMP Capacity building plan***

S/N	Training Content	Participants	Delivery Lead	Cost (USD)
1	Core E&S Management: Deep dive into specific Environmental & Social Management techniques.	PMU & Safeguard Officers	E&S Consultant	$4,000
2	ESMP Implementation: Mitigation strategies, institutional roles, and reporting responsibilities.	Project Team	PMU Consultant	$1,000
3	Contractor Safeguards: Mitigation measures, worker Code of Conduct (CoC), and OHS requirements.	Contractor Management & Workers	PMU Consultant	$1,000
4	Traffic & Fleet Safety: Defensive driving, fleet management, and traffic control within FUTIA.	Drivers, HSE Officers, Security Team	FUTIA School of Transport	$1,000
5	GBV/SEA/SH: Prevention, reporting, and response mechanisms for Gender-Based Violence.	Project Team & Safeguard Officers	PMU Consultant	$2,000
6	Grievance Redress (GRM): Management of project-level and management-level committees (GRCs).	Grievance Redress Committees	PMU Consultant	$2,000
TOTAL				$11,000

7.9 Implementation Schedule and Reporting

The project has an estimated completion period of 12-18months as outlined in table 7.12. Activities related to the ESMP Matrix as seen above should to be integrated into the overall construction schedule.

*Table 45: **ESMP Implementation Schedule***

S/No	Activity / Training Content	Target Participants	Primary Responsibility	Timeline	Cost (USD)
1	ESMP Disclosure	Community/Public	Project Team	Month 1	(In-house)
2	E&S Bidding Requirements	Bidders/Legal	Project Team	Month 2	(In-house)
3	Core E&S Management Training	PMU/Safeguards	Consultant	Month 3	$4,000
4	ESMP Roles & Responsibilities	Project Team	PMU/Consultant	Month 3	$1,000
5	Contractor Mitigation & OHS	Contractors	PMU/Consultant	Month 3	$1,000
6	Traffic & Fleet Management	Drivers/Security	FUTIA Transport	Month 4	$1,000
7	GBV/SEA/SH Prevention	All Staff	PMU/Consultant	Continuous	$2,000
8	Grievance Redress (GRM)	GRC Committees	PMU/Consultant	Continuous	$2,000
9	Environmental Monitoring	Site Staff	EPC/O&M	Months 4-18	$6,100*
TOTAL					$17,100

Implementation will be in line with the finalized overall project schedule, as all activities are integrated into the project design. This will take place from the planning stages to ensure quality equipment and support services are sourced, through construction, commissioning, operation to decommissioning phases. Once monitoring begins, any observation of an environmental problem, such as non-compliance or adverse impacts will be reported immediately by the officers responsible to respective authorities in REA and corrective/ remedial actions will be taken without delay to ensure optimal performance of the project while promoting environmental sustainability. Also, REA shall kDtP the regulatory authorities (FMEnv, NESREA, Akwa Ibom State Ministry of Environment and Mineral Resource) informed of the project performance through reports that will be made available to the regulators when required. REA will provide appropriate documentation of HSE related activities, including internal inspection records, training records, and reports to the relevant authorities. These periodic HSE reports summarizing the status of the environment in the plant will be submitted to FMEnv. Any values exceeding regulatory limits will be specifically identified, together with an explanation of the circumstances involved and corrective measures to ensure compliance in the future.

7.10 ESMP Costing

Table 7.11 provides the summary of the cost estimate required to effective and efficiently implement the recommended mitigation measures and management plans required to address the potential and associated impacts of the proposed project. The total cost of implementing the ESMP is estimated at US$ **51,190** with the current Naira value of N1,329 to 1 dollar.

*Table 46**: Cost of ESMP***

S/N	ESMP Activity Category	Key Focus Areas	Cost (USD)
1	Pre-Construction Phase	Land survey, disclosure, and livelihood restoration.	$8,000
2	Construction Phase	Dust/Noise control, waste management, and site safety.	$12,990
3	Commissioning Phase	Safety testing and performance verification.	$500
4	Operational Phase	Long-term maintenance, welfare, and insurance.	$12,600
5	Mitigation & Monitoring	Scientific sampling (Air, Water, Soil) and audits.	$6,100
6	Capacity Building	Specialized training, GBV prevention, and GRM.	$11,000
	GRAND TOTAL		$51,190

The duration of this estimate is expected to be 24 months, (based on EPC Construction Phase and Handover Protocol).

CHAPTER EIGHT: REMEDIATION PLAN AFTER DECOMMISIONING/ CLOSURE

8.1 Introduction

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 centre can last for 40 years or more. Even after the 25 years, the PV panels can still generate up to 90% of the design capacity. 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 FUTIA, 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:

a) Description of the site and components to be decommissioned.
b) Description of the decommiss
c) ioning scope, objectives, end state and strategy; o Activities to be performed during the decommissioning;
d) Schedule of decommissioning activities; o Estimate of the decommissioning cost;
e) Estimated inventory of waste streams to be generated during the decommissioning and handling techniques;
f) Decommissioning team (qualifications, roles and responsibilities)

- To ensure that due consideration is given to all options a detailed evaluation of facility decommissioning options shall be carried out. The options will include facility mothballing, partial facility decommissioning or complete site decommissioning. The evaluation will consider environmental issues in conjunction with technical, safety and cost implications to establish the best practicable environment friendly options for the Project decommissioning.
- A risk assessment shall be conducted to ensure that nothing, which could be constituted as a hazard for other users of the site or for the environment in general, will be left at the site. The Project site shall be left in a safe and environmentally acceptable condition.
- Hazard identification and analysis shall be conducted to determine special safety concerns to be addressed.
- An appropriate Health, Safety and Environment (HSE) plan shall be implemented to ensure that the decommissioning activities are carried out in an environmentally sound manner and in conformity with relevant laws and regulations guiding such operations
- Third party notifications shall be carried out before any demolition and shall be conducted in a phased sequence.
- Socio-economic considerations of facility decommissioning shall be carried out. These will include assessment of potential effects associated with termination of employment (at the end of operational phase) and the measures to minimize the effects by:
- Ensuring that employees are fully informed about the decommissioning and how it will affect them before the project finally closes.
- Building community capacity to manage opportunities and impacts arising from the decommissioning and post-decommissioning phase of the Project.
- Providing training to build local skills tailored to project decommissioning and post-decommissioning activities (e.g. equipment dismantling, rehabilitation activities, monitoring, etc.).
- Providing training to transfer project-learned skills to alternative and secondary industries tailored to respond to market economy.
- An effective waste management plan shall be developed for the decommissioning activities. The decommissioning options for redundant structures and equipment will include: the complete dismantling of structures and equipment and the return of all components to the equipment manufacturer for recycling. A detailed record of all suitable recycling materials shall be maintained.

8.4 Abandonment Plan

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

- Identification of the components of the power plant that will be abandoned and/or removed;
- The proposed methods for abandonment or re-use of the plant equipment/material applicable;
- Processes put in place to mitigate potential environmental impacts associated with the abandonment process; and
- Appropriate site rehabilitation programs (including re-vegetation of the site with native plant species) to return the Project site to its original status (as much as possible).

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 REA-Project Management Unit, the Department of Works and Physical Planning in FUTIA, the Akwa Ibom State Ministry of Environment and Mineral Resource. 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.

8.5 Roles, Responsibilities and Accountabilities

The key personnel and institutions with major roles in the implementation and monitoring of environmental and social measures for the Project decommissioning/closure are as follows:

A. Contractor(s) Engaged for Decommissioning Activities
- Implement environmental and social measures and management actions put in place for the decommissioning activities.

B. REA-PMU
- Supervise the activities of the contractor(s) engaged for decommissioning purpose by ensuring that the recommended environmental and social and management actions are implemented.
- Discuss environmental and social management plan improvements with the Director of Works and Physical Planning Department in FUTIA to address non-compliance and upcoming issues.

C. Federal University of Technology, Ikot Abasi, Akwa Ibom Plant Manager
- Directly monitor the activities of the contractor(s) engaged for decommissioning and ensure compliance to the implementation of environmental and social measures and management actions put in place to address potential impacts and risks associated with the decommissioning activities.
- Report to the Director of Works and Physical Planning Department in FUTIA on contractor's performance regarding the implementation of environmental and social measures.

D. Director of Works and Physical Planning Department in FUTIA
- Jointly supervise the activities of the contractor(s) engaged for decommissioning
- Suggest environmental and social management plan improvements to REA-PMU to address non-compliance issues and upcoming issues.

E. FMEnv/ Akwa Ibom State Ministry of Environment and Mineral Resource
- Approve the decommissioning plan for the Project

- Monitor the implementation of environmental and social measures and management actions documented in the decommissioning plan.
- Discuss environmental and social management plan improvements to REA-PMU to address non-compliance issues and upcoming issues.

CHAPTER NINE: STAKEHOLDER ENGAGEMENT AND GRIEVANCE REDRESS MECHANISM

Consultations are an important tool in identifying the major environmental and social issues that form a vital aspect of the preparation of this ESIA. A Stakeholder Engagement Plan (SEP) which aims at facilitating the development and sustainable implementation of various stages of the Project's life cycle from (pre-construction to, construction, operations, and decommissioning) was done during preparation of this ESIA document. It describes the process by which stakeholders were identified; the means by which they were consulted; and the outcomes of the consultations to date. It also describes the actions that the Project took to disclose pertinent information to stakeholders.

9.1 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 interest.it is very important to plan these activities well so that they appraise the contribution of stakeholders on projects, manage their expectations also achieve project objectives.

Stakeholder engagement process focusing on free, prior and informed consultation (FPIC) shall be conducted with the community and other stakeholders, and take into account modalities of vulnerable and marginalized communities may be involved. The consultation shall include prior disclosure of information in a manner accessible and understandable to communities, key informant interviews, focus group discussion (male& female, youth) and public consultation. The consultation shall be documented with required facts, figures and evidence including participant list with contact details, photographs. Information shall be disclosed as per the requirement of National Regulations EIA Act No. 86 of 1992 (as amended by the EIA Cap E12 LFN 2004) and the African Development Bank's Integrated Safeguards System.

9.2 Objectives of Stakeholder Engagement

The objectives of public participation in an ESIA are to provide sufficient and accessible information to potentially interested and affected parties/stakeholders in an objective manner to assist them identify issues of concern, and provide suggestions for enhanced benefits and alternatives. The stakeholder engagement process was designed to conform to the Nigerian EIA Act and international standards. For this Project, the key objectives for stakeholder engagement are:

- 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.

9.3 Disclosure and Participation Plan

Information disclosure is an important activity not just as a form of engagement but for also enabling the other engagement activities to be undertaken in an informed and participatory manner. This section outlines the process to be followed for the disclosure and participation as part of the DTP implementation.

It is required under the AfDB operational Safeguards that the Proponent will maintain and disclose as part of the environmental and social assessment, a documented record of stakeholder engagement, including a description of the stakeholders consulted, a summary of the feedback received and a brief explanation of how the feedback was taken into account, or the reasons why it was not.

9.3.1 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.

9.3.2 Process for Disclosure of Information

As a standard practice, this ESIA will be released for public review according to the AfDB 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 general public at the following locations:

- The EA Department of the Federal Ministry of Environment;
- The Akwa Ibom State Ministry of Environment and Mineral Resource,
- The Federal University of Technology, Ikot Abasi, Akwa Ibom and
- Other designated public locations to ensure wide dissemination of the materials.

Electronic copies of the ESIA report will be placed on the website of the AfDB. This will allow stakeholders with access to Internet to view information about the planned development and to initiate their involvement in the public consultation process. The mechanisms which will be used for facilitating input from stakeholders will include press releases and announcements in the media, notifications of the aforementioned disclosed materials to local, regional and national NGOs, relevant professional bodies as well as other interested parties.

9.3.3 Timetable for Disclosure

The disclosure process associated with the release of project E&S documentation will be implemented within the following timeframe:

- Placement of the ESIA report in public domain (FMEnv and AfDB website) – dates to be confirmed by REA
- 21-day disclosure period – dates to be confirmed by FMEnv
- Addressing stakeholder feedback received on the entire disclosure package – Dates to be confirmed by FMEnv and REA

The ESIA will remain in the public domain for the entire period of project development and will be updated on a regular basis as the project progresses through its various phases, in order to ensure timely identification of any new stakeholders and interested parties and their involvement in the process of collaboration with the project. The methods of engagement will also be revised periodically to maintain their effectiveness and relevance to the project's evolving environment.

The outline presented in the table 9.1 summarizes the main stakeholders of the project, types of information to be shared with stakeholder groups, as well as specific means of communication and methods of notification. Table 9.1 provides a description of stakeholder engagement and disclosure methods recommended to be implemented during stakeholder engagement process.

Table 47 Stakeholder Engagement and Disclosure Methods

Stakeholder Group	**Project Information Shared**	**Means of Communication / Disclosure**
Project Beneficiaries (Students, Staff, & Local Community)	• ESIA & ESMP Reports • Resettlement Action Plan (RAP/aRAP) • Regular Project progress updates	• Physical notices posted at FUTIA • Website updates & electronic press releases • Hard copies at public libraries/offices • Local media announcements • Town hall & consultation meetings
AfDB (African Development Bank)	• Full ESIA & RAP Reports • Periodic Project development milestones	• Official publication on AfDB's website • Formal submission of hard-copy reports • Electronic portals
Non-Governmental Organizations (NGOs)	• ESIA Reports • Environmental & Social impact updates	• Public notices • Website publications • Hard copies at designated locations • Press releases in local newspapers

9.3.4 Stakeholder Register

The project shall maintain a stakeholder engagement register for recording stakeholder information such as contact details, dates of engagement with comments and follow up requirements.

9.4 Stakeholder Identification and Analysis

Summary of the deliberations with a senior staff directly in-charge of coordinating the proposed project on behalf of the school management are presented in Table 9.2.

*Table 48**: Stakeholder Engagement & Consultation Summary***

Session Details:
Date: February, 2026
Location: FUTIA Campus
Stakeholders: University Project Team
Medium: English Language

Discussion Theme	Specific Stakeholder Feedback & Key Outcomes
Project Buy-in & Awareness	The University community expressed high enthusiasm for the project's official commencement. The team confirmed that both the leadership and the broader campus population are well-informed and supportive of the solar plant's objectives.
Strategic Benefits	Stakeholders highlighted the project as a critical solution to the University's chronic unsteady power supply. Beyond electricity, the Training Centre component was identified as a major win for renewable energy certification and student capacity building.
Social Cohesion & Safety	It was noted that improved campus lighting from the solar plant would enhance security and foster better social interaction and safety for students and staff during evening hours.
Site Selection Integrity	The project team confirmed the site meets all E&S criteria: it is non-disputed land and specifically chosen to be free of permanent human settlements, thereby avoiding the need for complex resettlement or physical relocation.
Land Use Management	Regarding seasonal farming observed on-site, the University confirmed that these activities are temporary. Crops will be harvested prior to mobilization, and staff will be transitioned to alternative land parcels, ensuring zero project encumbrance.
Institutional Support	The University reiterated its commitment to providing full cooperation, data, and administrative support through every stage of construction and operation.

Consultation Highlights & Strategic Value

- **Risk Mitigation:** By addressing the "seasonal farming" issue proactively, the project avoids being labeled as a source of displacement. The University's plan to provide alternative land is a key Social Safeguard.

- **Academic Alignment:** This isn't just an infrastructure project; it is an academic one. The focus on **certification and training** aligns the ESMP with the University's core mission.
- **Security through Infrastructure:** The mention of "social cohesion" through "proper lighting" highlights a subtle but important impact: reducing the risk of GBV and campus crime through environmental design (CPTED).

Figure 18: Pictures with the FUTIA Project Committee after Recon Meeting

Table 49: Issues Raised During Community Consultation at Ikot Ukpo Inua and Responses

S/N	Name of Community Member	Issues Raised by the Community	Response by the Project Team
1	Ubong Rufus Umoh (Youth President)	Construction of a mini security post to improve security within the community.	The request has been noted. While the project may not directly construct security facilities, the concern will be communicated to the relevant government authorities. The project will also collaborate with local security agencies to maintain security during project implementation.
2	Eteidung Ettang Okon Benson (Village Head)	Construction of a bridge along the newly constructed state government road to improve accessibility, especially during the rainy season.	The request has been documented and will be forwarded to the appropriate government agency responsible for road infrastructure. The project will assess whether the bridge falls within its scope or can be recommended as a complementary infrastructure project.
3	Akpan Jackson Umoh (Family Head)	Construction of a new and standard civic centre for community meetings and social activities.	The request has been noted for consideration under the project's Corporate Social Responsibility (CSR) or Community Development initiatives, subject to project scope, available resources, and approval by the implementing agency.
4	Nsisong Okon	Provision of a community market to promote local economic activities.	The request is acknowledged and will be communicated to the relevant government authorities. Where feasible, the project will explore opportunities to support local economic development initiatives.
5	Eteidung Ettang Okon Benson (Village Head)	Fair allocation (quota) in the use and benefits of the community solar lighting project.	The project supports equitable distribution of development benefits. Community leaders and the relevant implementing agencies are encouraged to ensure transparency and fairness in the allocation and utilization of community facilities.
6	Ubong Rufus Umoh (Youth President)	Employment opportunities for community youths during all phases of	The project is committed to promoting local employment where qualified labour is available. Contractors will be encouraged to give priority to competent youths from the host community in accordance with project procurement and labour management procedures.

		project implementation.	
7	Eteidung Ettang Okon Benson (Village Head)	Compensation for economic trees at the site of the project.	All affected economic trees and other eligible assets will be assessed and compensated in accordance with applicable national laws and the project's Resettlement Policy Framework (RPF)/Resettlement Action Plan (RAP), where applicable, before or in line with project requirements.
8	Akpan Jackson Umoh (Family Head)	Respect for community shrines, deity, sacred sites, and traditional customs, including observance of Edet Obo Day.	The project recognizes the importance of the community's cultural heritage. Contractors will be sensitized to avoid disturbing sacred sites and to respect local customs and traditional observances throughout project implementation.
9	Udo Stephen Akpan	Improvement of social infrastructure, including the provision of a secondary school and a health centre.	Although these facilities are outside the direct scope of the project, the concerns have been documented and will be communicated to the appropriate government agencies for future planning and intervention.
10	Udo Stephen Akpan	Improvement in electricity supply due to the irregular public power supply.	The concern has been noted and will be referred to the relevant electricity service providers and government agencies. The project will encourage the use of available energy infrastructure where appropriate.

9.4.1 Summary of the socioeconomic study and stakeholder consultation

- Socioeconomic study for the proposed Solar Project under the phase III of the energizing education program (DTP) project by the government of Nigeria in collaboration with the donor agency have been carried out;
- The socioeconomic study was carried through random questionnaires administration, in-depth interview (IDI), literature review, and community survey;
- The proposed Solar Power project for the Federal University of Technology, Ikot Abasi campus, Akwa Ibom.
- Administratively, the school is headed by the Vice-Chancellor and other five principal officers;
- The planned project would be located on a land that is presently not in major use except for seasonal farming; consequently, no displacement of livelihoods (as staff farmers can harvest their crops and be allocated other portions of land in the University to continue farming), cultural properties, and human habitation is envisaged;
- Economy of the school basically retails and it includes commercial tricycle operators;
- Site location met the necessary requirement indicated in the project technical;
- Major environmental challenge of the community is erosion and poor drainage system due to unpaved road networks;
- No youth restiveness is associated with the University;
- Various security measures are in place to ensure safety of people and properties;
- Common health challenge of the people of the project area is Malaria and typhoid;
- The proposed development is expected to contribute positively to the academic learning of the University and reduce cost of powering the school through diesel powered generators.

Figure 19: Consultation with Different Stakeholders

9.5 Grievance Redress Mechanism

This section shall describe the grievance redress mechanism for general grievances and GBV/SEA related grievances (including a GBV action Plan). The standard GRM of REA will support but not replace the site-specific grievance mechanisms established at subproject level.

Grievance redress mechanism (GRM) is a framework which enables local communities and relevant stakeholders of a project to raise issues (including logging, tracking, and grievances resolution) about the project which are addressed efficiently and effectively while issues as regards implementation are resolved. The GRM will be communicated to all stakeholders in the course of project development and implementation and will make publicly available a record documenting the responses to all grievances received. The GRM shall be maintained throughout the project life cycle.

Grievance Redress Timelines and Performance Indicators

To ensure that grievances are managed in a timely, transparent, and effective manner, the Project will implement a structured grievance resolution process with defined timelines for each stage. All grievances

received from project workers, affected communities, contractors, and other stakeholders will be documented in a grievance register and tracked until closure

Table 50: Grievance Redress Timelines and Performance Indicators

GRM Stage	Activity	Expected Timeline
Receipt of grievance	Grievance received through designated channels (GRM desk, suggestion boxes, telephone, email, community representatives, or contractor focal persons) and entered into the grievance register	Same day or within 24 hours
Acknowledgement	Formal acknowledgement provided to the complainant, including grievance reference number and explanation of the resolution process	Within 2 working days
Screening and Classification	Determine the nature, severity, and responsible party; identify whether the grievance requires immediate attention (e.g., SEA/SH, child protection, security incidents)	Within 3 working days
Investigation	Conduct fact-finding, consultations, site inspections, and review of relevant evidence	Within 10 working days
Resolution and Response	Agree on corrective actions and communicate the proposed resolution to the complainant	Within 15 working days from receipt of grievance
Implementation of Corrective Actions	Implement agreed mitigation or corrective measures	Within 30 working days, depending on the complexity of the grievance
Closure	Confirm complainant's satisfaction (where applicable), document the outcome, and formally close the grievance	Within 5 working days after implementation of corrective actions
Appeal (if required)	Escalate unresolved grievances to higher-level Project Management, the Rural Electrification Agency (REA), or other appropriate authorities	Within 15 working days of receiving the appeal

Special procedures will apply to Gender-Based Violence (GBV), Sexual Exploitation and Abuse/Sexual Harassment (SEA/SH), and Violence Against Children (VAC) complaints. Such cases will be handled confidentially through a survivor-centred approach, referred immediately to qualified service providers where necessary, and managed in accordance with the Project's GBV Action Plan. The identity of survivors and sensitive information will be strictly protected.

Key Performance Indicators (KPIs)

The effectiveness of the Project Grievance Redress Mechanism will be monitored using measurable performance indicators, including:

- Percentage of grievances acknowledged within 2 working days (Target: 100%).
- Percentage of grievances resolved within 15 working days (Target: ≥90%).
- Percentage of grievances closed within the agreed timeframe (Target: ≥90%).
- Average number of days taken to resolve grievances.
- Number of grievances received per month, categorized by issue type (environmental, social, labour, community health and safety, GBV/SEA/SH, etc.).
- Percentage of complainants satisfied with the grievance resolution process (Target: ≥80%, based on follow-up feedback).
- Number and percentage of grievances escalated to higher levels due to non-resolution.
- Number of repeat grievances on the same issue (Target: declining trend over time).
- Percentage of corrective actions implemented within agreed timelines (Target: 100%).
- Number of GBV/SEA/SH grievances referred through confidential survivor-centred referral pathways and managed in accordance with established protocols (reported without disclosing identifying information).

9.5.1 Grievance Redress Mechanism Process

Affected persons are given copies of grievance procedures as a guide on how to handle grievance(s).

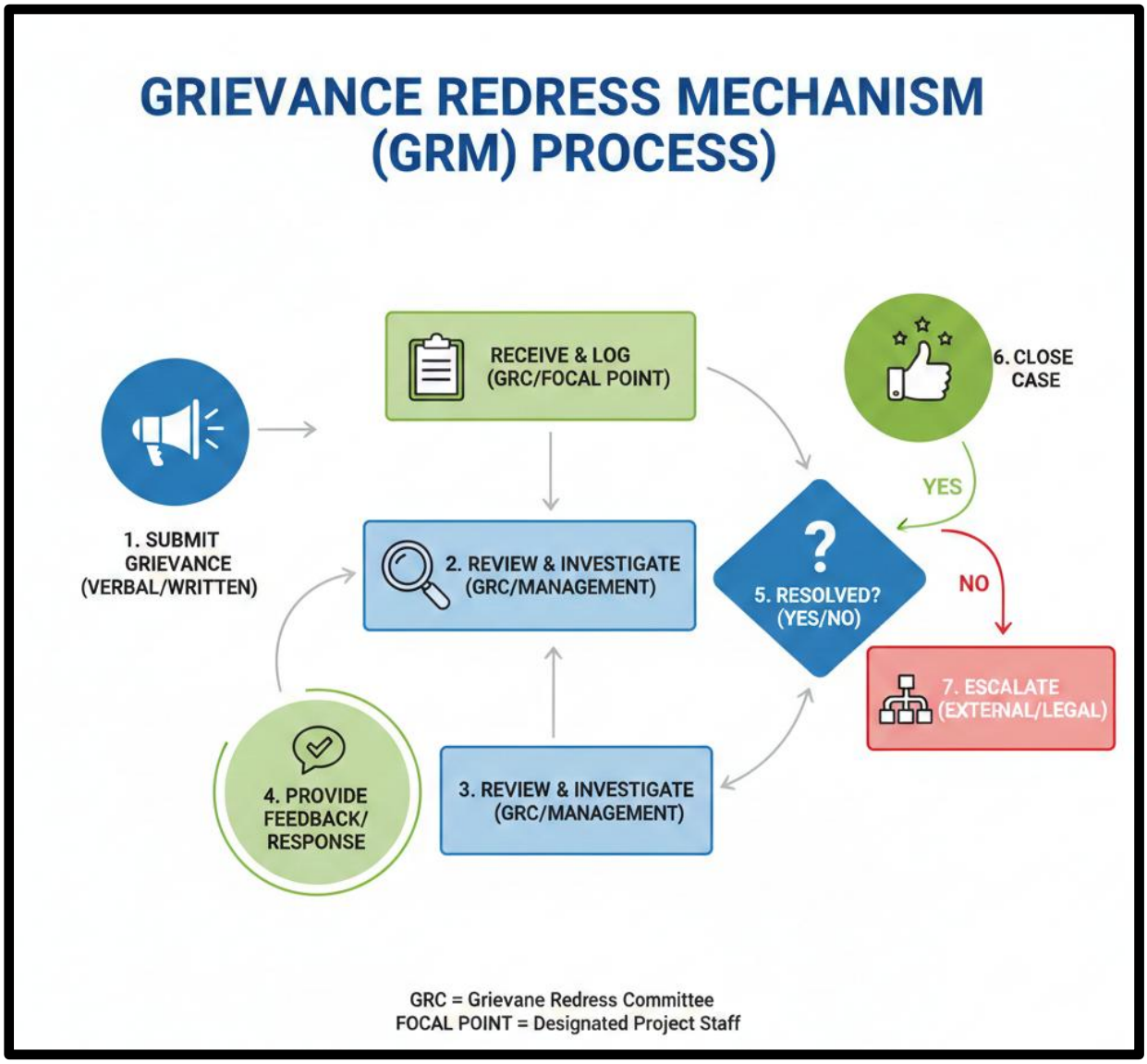


*Figure 20: **GRM process***

- Receipt and Registration of the grievance(s) in Grievance Log.
- Local mechanism e.g. peers and local leaders to screen complaints in order to ensure equal treatment, eliminate nuisance claims & satisfy legitimate claimants at low cost.
- Grievance Redress Committee (GRC) will act on grievance within 10 working days of receipt.
- If no amicable solution reached or no response within 15 working days, affected person can appeal to a designated office in the PIU. PIU should act within 15 days.
- If the affected person is not satisfied with the decision received, he/she could at the last resort, appeal to a court of competent jurisdiction. He/she will be exempted from administrative and legal fees incurred pursuant to grievance redress procedures.

9.5.2 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.

9.5.3 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 (in the format given in Table 9.3) to the project representatives or to the designated Grievance Officer (GO) directly. If the 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. A sample grievance form is as follows:

Table 51: Grievance Recording Form

SECTION 1: GRIEVANCE REGISTRATION	
Case Number: _____	**Date of Filing:** //20____
Complainant Name:	
Contact (Phone/Email):	
Department / Unit / Location:	
Detailed Description of Grievance:	
Recorded By (Name):	**Designation:**
Proposed Response Date:	
Signature (Recording Officer):	**Signature (Complainant):**

All project staff will be informed that they must pass all grievances, communications to the Grievance Officer (discussed in the following section) on site as soon as possible after they are received. Details of the person lodging the grievance shall be noted and passed along with the grievance. The Grievance Officer in turn will communicate all grievances to the Social Safeguard Officer for the project. For assisting the communication of grievances, a Register will be maintained at the project office and site camp, at which any individual/ group can come have their complaint registered.

9.5.4 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.

9.5.5 Acknowledgment of Grievance

Upon the completion of the recording of the grievance, the stakeholder will be provided with an acknowledgment of the receipt, along with a summary of the grievance. Sample of acknowledgement Receipt for Claimant is found below;

PROJECT: FUTIA Solar Power Project

DOCUMENT: Official Grievance Acknowledgement Slip

This receipt serves as formal acknowledgement of a grievance registration filed by:

Name: _____

Affiliation: [ ] Community Member / Resident of _____

[ ] Staff of _____ Department

Registration Details:

Case Number: _____

Date of Filing: _____

Scheduled Response Date: _____

The Project Management Unit (PMU) commits to investigating this matter and providing a response by the date indicated above.

Authorized Signature: _____ Date: _____

(Recording Officer Name & Designation)

In case the grievance is assessed to be out of the scope of the GRM, a communication towards the same shall be made to the grievant, and an alternative mode of redressal shall be suggested.

9.5.6 Site Inspection and Resolution

For the purpose of verifying and resolving the grievances received, site inspection may not be required in all the cases. Depending upon the sensitivity of the issue, requirement of a site inspection will be identified. A site inspection will be undertaken by the site level community liaison officers or the project member assigned by the Social Safeguard Officer. The purpose of the site inspection will be to check the validity and severity of the grievance. For this purpose, the personnel may also undertake discussions with the concerned external stakeholder. The inspection will be undertaken within ten days of receiving the grievance. The assigned individual will then work with other relevant members of the Project team to investigate the problem and identify measures to resolve the grievance as appropriate. The personnel to

be involved in the grievance resolution shall be dependent upon the nature of the grievance, as discussed in Table 52

Table 52: Classification and Categorisation of External Grievances

S/N	Nature of Grievance	Primary Responsibility for Resolution	Key Action Unit
1	Compensation Issues (General)	Environmental and Social Safeguard Officers	Safeguards Unit / REA-PMU
2	Resettlement Implementation (Land use/access)	University Project Management & Social Safeguard Officer	FUTIA Physical Planning / Contractors
3	Property Damage (Community forest, crops, or private assets)	EPC Contractor & Environmental Safeguard Officers	Project Site Office / Contractor HSE Team
4	Environmental & Cultural Impacts (Public health, customs, or access to resource sites)	Project Management, Environmental & Social Safeguard Officers	Safeguards Unit / University Liaison
5	Migrant Worker Issues (Labor disputes, community-worker relations)	Contractor & Social Safeguard Officer	Contractor HR / PMU Social Desk
6	Sexual Harassment / GBV	Contractor HR Executive & PMU Social Safeguard Officer	Specialized GBV Unit / PMU Management
7	Miscellaneous / Others	Contractor, E&S Safeguard Officers, & Project Manager	Joint Project Steering Committee

9.5.7 Resolution, Escalation, and Closure

Based on the understanding thus developed, the social safeguard officer, in consultation with the concerned departments, shall identify a suitable resolution to the issue. This could involve provision of information to clarify the situation, undertaking measures to remedy actual problems or compensate for any damage that has been caused either by financial compensation or compensation in-kind, and introduction of mitigation measures to prevent recurrence of the problem in the future. This resolution shall be accordingly communicated to the grievant within 10 working days of completing the site investigation. In case the issue is beyond the purview of the social safeguard officer, it should be escalated to the Head PMU of the NEP (as appropriate). A communication regarding the same shall be provided to the grievant. The Head PMU of the NEP shall in turn endeavour to resolve the grievance within 10 working days of the escalation.

If, however, the grievance remains unsettled, and the Head PMU of the NEP is not able to identify an adequate resolution for the grievance, then an adequate response shall be given to the grievant along with a suggested alternative resolution to the grievance including to take the matter to the citizens' rights mediation-centre for the settlement before a law court is considered. If at any stage, the grievant is not satisfied with the solution, s/he may choose to ask for an escalation of the grievance to the next level.

Where a grievance is found to be not a real problem a clear explanation will be provided to the complainant.

9.5.8 Update of Records

The records of the grievance register shall be updated every working week with the present status of the grievance. Once the grievance is resolved, and the same has been communicated to the grievant, the grievance shall be closed in the grievance register. The grievance register should also provide an understanding of the manner in which the grievance was resolved. These instances shall then serve as references for any future grievances of similar nature. Where there is evidence of recurring issues or grievance coming up on the project, it is necessary to flag this up to Head PMU of the NEP in order to assess if the project design requires updating.

CHAPTER TEN: CONCLUSION AND RECOMMENDATIONS

10.1 Conclusion

The Environmental and Social Impact Assessment (ESIA) for the proposed 2.9 MW solar power plant at the Federal University of Technology, Ikot Abasi (FUTIA), Akwa Ibom State, has been conducted in full compliance with national regulations, financiers' requirements, and international standards. This assessment ensures that proactive environmental and social considerations are integrated into the design, planning, and implementation of the project. The study was undertaken in accordance with Nigerian EIA Act Cap E12 LFN 2004, which mandates environmental assessments for projects with potential significant environmental impacts. Additionally, the ESIA aligns with the African Development Bank's (AfDB) Operational Safeguards and best practices in sustainable energy development. The objective of the ESIA is to provide detailed information for informed decision-making and to contribute to environmentally and socially responsible development of the project.

Extensive consultations with stakeholders including university management, staff, students, and host/community representatives were conducted to ensure that concerns and questions were addressed. Environmental and social baseline conditions, encompassing biophysical and socio-economic elements of the study area, were established through field data collection in February 2026, supplemented with literature, maps, and desktop research. These baseline data will serve as reference points for future monitoring and impact evaluation. Interactions between project activities and the existing environment were assessed to identify, characterize, and evaluate both positive and negative impacts. Appropriate mitigation measures and recommendations were then developed to ensure project sustainability, considering industry best practices, available technology, and health, safety, and environmental (HSE) considerations.

Accordingly, the proposed Project is considered environmentally and socially acceptable and feasible, subject to the effective implementation of the recommended mitigation measures, the Environmental and Social Management Plan (ESMP), the environmental and social monitoring programme, stakeholder engagement commitments, the Grievance Redress Mechanism (GRM), emergency preparedness and response measures, and all applicable national regulatory requirements and international environmental and social standards, including the Federal Ministry of Environment (FMEnv) Guidelines, NESREA regulations, and other relevant Good International Industry Practice (GIIP). With these commitments in place, the proposed Project is expected to proceed without causing significant residual environmental or social impacts and will make a positive contribution to sustainable energy development, climate change mitigation, socio-economic development, and improved quality of life within the Project area and beyond.

10.2 Recommendations

Based on the findings of this ESIA, the following recommendations are proposed to ensure the successful and sustainable implementation of the project:

1. Continuous Performance Monitoring: The Project Management Unit (PMU) should regularly track the performance of the solar power plant to ensure operational efficiency and sustainability.

2. Ethical and Social Compliance: All project activities should be conducted in line with ethical and social guidelines, ensuring minimal disruption to the university community and host communities (Ikot Ukpo Inua, Ata Udoh Usung, Ikot Etenge Ete, and Ikot Etetuk).

3. Security Oversight: A monitoring committee should ensure that all personnel, equipment, and project installations are protected from security risks during both construction and operational phases.
4. Implementation of ESMP: Strict adherence to the Environmental and Social Management Plan, including mitigation measures for air, water, soil, and biodiversity, is essential throughout the project lifecycle.
5. Community Engagement: Ongoing engagement with stakeholders and host communities is recommended to address concerns promptly and maintain social acceptance of the project.

By implementing these measures, the proposed solar power plant is expected to deliver sustainable, reliable, and environmentally responsible energy to FUTIA while supporting local socio-economic development and national climate commitments.

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Annex 1: Terms of Reference for the preparation of Environmental and Social Impact Assessment

Annex 2: Survey Questionnaire

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT PLAN (ESIA) PHASE III: ENERGIZING EDUCATION PROGRAM (DTP) PROJECT Dear Respondent,

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 KDtPing (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) Non-Resident, 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 Post Graduate

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/sickness, you suffer from most accordingly?

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 thiscan be averted during construction and implementation……
……

SECTION C. Standard of Living / Socio-Economic 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			

Sources	for drinking	for cooking	for bathing and washing
f. Rain harvesting			
g. Water vendor			
h. Tanked water			
i. Other (specify)			

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 or 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 (g) Destruction of infrastructures (h) encroachment of land properties (i) Pollution (air, surface water, ground water, noise) (j) 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:

……

Annex 3: Waste Management Plan

This Waste Management Plan (WMP) has been developed as an integral component of the Environmental and Social Impact Assessment (ESIA) for the proposed Nigeria Electrification Project (Desert to Power) Phase II at the Federal University of Technology, Ikot Abasi (FUTIA), Akwa Ibom State. Effective waste management is critical to ensuring that project activities are conducted sustainably and with minimal impact on the environment and surrounding communities.

The primary purpose of this WMP is to establish clear procedures for the generation, handling, storage, transportation, and disposal of waste arising from all project activities on-site. It provides structured guidance to ensure that waste is managed safely, efficiently, and in compliance with national regulations and best international practices.

Specifically, the WMP outlines measures for the collection, temporary storage, treatment, and final disposal of all waste streams associated with the project. It also incorporates provisions for waste reduction, recovery, reuse, and recycling, thereby promoting resource efficiency and minimizing environmental impacts. Through adherence to this plan, the project aims to prevent pollution, protect human health, and support the long-term sustainability of the FUTIA campus and its host communities.

The document examines the possible types of wastes to be generated during the various phases of the proposed project as well as details of how the wastes can be handled. In putting this document together, due cognizance has been taken of the AfDB Integrated Safeguard Systems and also AFDB EHS Guidelines on Environmental waste management, which requires, among others:

- Establishing waste management priorities at the outset of activities based on an understanding of potential Environmental, Health, and Safety (EHS) risks and impacts and considering waste generation and its consequences.
- Establishing a waste management hierarchy that considers prevention, reduction, reuse, recovery, recycling, removal and finally disposal of wastes.
- Avoiding or minimizing the generation waste materials, as far as practicable.
- Where waste generation cannot be avoided but has been minimized, recovering and reusing waste.
- Where waste cannot be recovered or reused, treating, destroying, and disposing of it in an environmentally sound manner

2.0 GENERAL WASTE MANAGEMENT STRATEGY

- **Reduce**: Avoid waste by reducing the quantity of waste being generated. This is the simplest and most cost-effective way to minimise waste. It is the most preferred option.
- **Reuse**: Reuse is when a product is used again for the same or similar use, without reprocessing. Reusing a product more than once in its original form reduces the waste generation and energy consumption associated with recycling.

- **Recycle**: Recycling involves processing waste into a similar non-waste product, which consumes less energy than production from raw materials. Recycling prevents further environmental degradation, and saves landfill space and resources
- **Dispose**: Removing waste from worksites, compounds and offices, and discarding the material in a licensed landfill site, or other appropriately licensed facility.

In order to minimise and appropriately manage the waste generated on site, the following good management practices will be used:

- Reduction of waste generation (through management practices, avoiding or decreasing materials use, etc.) is the primary goal of this plan.
- Non-hazardous wastes will be segregated from hazardous wastes.
- Wastes to be sent to licensed recycling/dumpsites will be segregated by type.
- Effort will be made to minimise the quantity of hazardous materials used.
- Personnel that handle hazardous materials and wastes, will be trained for proper handling and management.
- Spills of hazardous materials will be prevented through careful and sensible management of the materials.
- Regular inspections of storage areas will be conducted. If damaged or leaking containers are detected, they will be replaced.
- Preventive maintenance will be performed on equipment to avoid potential spills.
- Waste storage areas will have secondary containment or spill trays.
- Under no circumstances will waste be disposed on site.

2.1 Classification of Wastes

The Project activities will lead to the generation of various non-hazardous and hazardous wastes.

2.1.1 Non-Hazardous Wastes

Typical non-hazardous wastes are given below:

- Domestic waste,
- Recyclable wastes (e.g. paper, glass, metals, wooden waste, trees, tin cans, textile, etc.),
- Packaging waste,
- Waste tires, and
- Excavation waste / Concrete waste generated from civil works and foundations.

2.1.2 Hazardous Wastes

Different type of hazardous wastes, that may potentially be generated as a result of the project activities, are given below:

- Electrical wastes including waste and/or damaged batteries and accumulators,
- Waste oil (from maintenance of equipment and vehicles, transformers, etc.),
- Waste paint, and
- Other hazardous waste related to operation and maintenance (O&M) and decommissioning activities.

Table 1: Potential Waste Streams and Management Method

Activity / Waste Aspect	Types	Classification	Proposed Reuse / Recycling / Disposal Method
Site clearing and preparation	Vegetation (logs, mulched timber, weeds)	General Solid (non- putrescible)	Native Vegetation – Reuse as biodiversity measures such as habitat enhancement, compost for topsoil or soil conditioner, or modify mulching equipment to create Woodchip
	Concrete, brick asphalt and gravel	General Solid (non- putrescible)	Crushed and used as backfill or as road Base

	Scrap metal	General Solid (non- putrescible)	Off-site recycling
	Excavated Materials	General Waste	Beneficial soil material - reuse onsite. Balance cut and fill earthworks, where possible, to optimise reuse on the Project
	Potentially contaminated soils	Hazardous waste	Off-site disposal at an approved facility
Construction Waste	Steel reinforcing	General Solid (non- putrescible)	Off-site recycling
	Conduits and pipes	General Solid (non- putrescible)	Off-site recycling
	Concrete (solids and washouts) and asphalt	General Solid (non- putrescible)	Crushed and used as backfill or as road Base
	Timber formwork	General Solid (non- putrescible)	Reuse onsite where possible or Off-site Recycling
	Packaging materials, including wood, plastic, cardboard and metals	General Solid (non- putrescible)	Off-site disposal at an approved facility
	Empty oil and other drums	General Solid (non- putrescible)	Off-site recycling
	spill clean ups, paints and other chemicals	Hazardous waste	Off-site disposal at an approved facility
	Metals and bulk electrical cabling	General Solid (non- putrescible)	Off-site recycling

	Sediment basin discharge and solids (sediment)	General Solid (non- putrescible)	Beneficial reuse onsite
General Waste from compounds during construction and operation	Waste generated by the maintenance of equipment including air and oil filters, worn components and rags	General Solid (non- putrescible)	Off-site disposal at an approved facility
	Oil, grease, fuel, chemicals and other fluids	Liquid	Off-site disposal at an approved facility
	Damaged/ expired Batteries/ Inverters	Hazardous waste	Off-site Management according to the EPR with the producer or an approved FMEnv facility

Annex 4: Biodiversity Management Plan.

1. POTENTIAL ENVIRONMENTAL ASPECTS AND IMPACTS

The majority of the development footprint is covered by native grassland. The potential impacts of the project on the vegetation community would be both direct and indirect. The direct impacts include access roads, inverter stations and other buildings, parking and solar panel piles. The indirect impacts include areas under panels, between panel rows and areas not being used, which would experience difference levels of shading, rainfall and temperature.

During the project's planning phase, it became evident that there were some complex issues associated with the potential impacts upon native grassland as a result of installation of the solar panels and operation of the solar farm. Potential indirect impacts on native grassland include but are not limited to:

- Existing use of the native grassland over many decades for stock grazing, cropping and the impacts such grazing and other existing agricultural use of the native grassland might already be behaving upon grassland integrity and growth.
- What impact installation of the solar panels and associated aspects might have on the native grassland and use of the grassland habitat by fauna.
- Might there be negative, neutral or positive impacts to the native grassland as a result of the solar panel installation.
- What impacts factors such as shading from the solar panels might have on the native grassland.
- Opportunities to work with the ecology and natural seasons of the native grassland to avoid or minimize negative impacts while still being able to construct and operate the solar farm.

Key aspects of the Project that could result in impacts to biodiversity have been described in Table 1.1.

Table 1.1: Potential biodiversity impacts as a result of the project.

Impact	Frequency	Intensity	Duration	Consequence
Direct				
Habitat clearance for permanent and temporary Construction facilities (e.g. solar infrastructure, compound	Regular	High	Construction	• Direct loss of native flora and fauna habitat including: grassland habitat, woodland habitat and aquatic habitat in few University sites. • Potential over-clearing of habitat outside of the

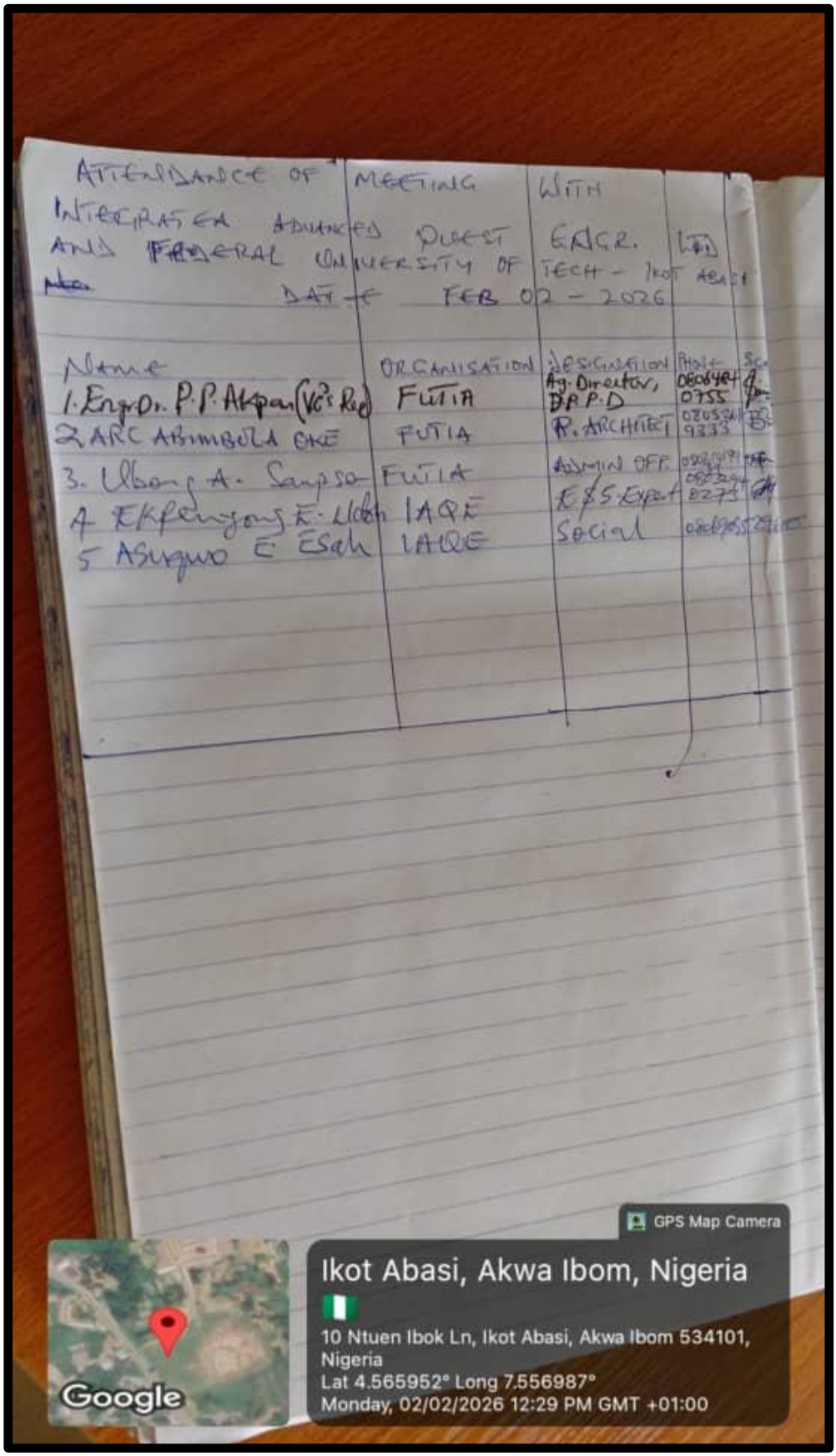
sites, stockpile sites, access tracks).				development footprint. • Injury and mortality to fauna during clearing of fauna habitat and habitat trees. • Disturbance to fallen timber, dead wood and bush rock.

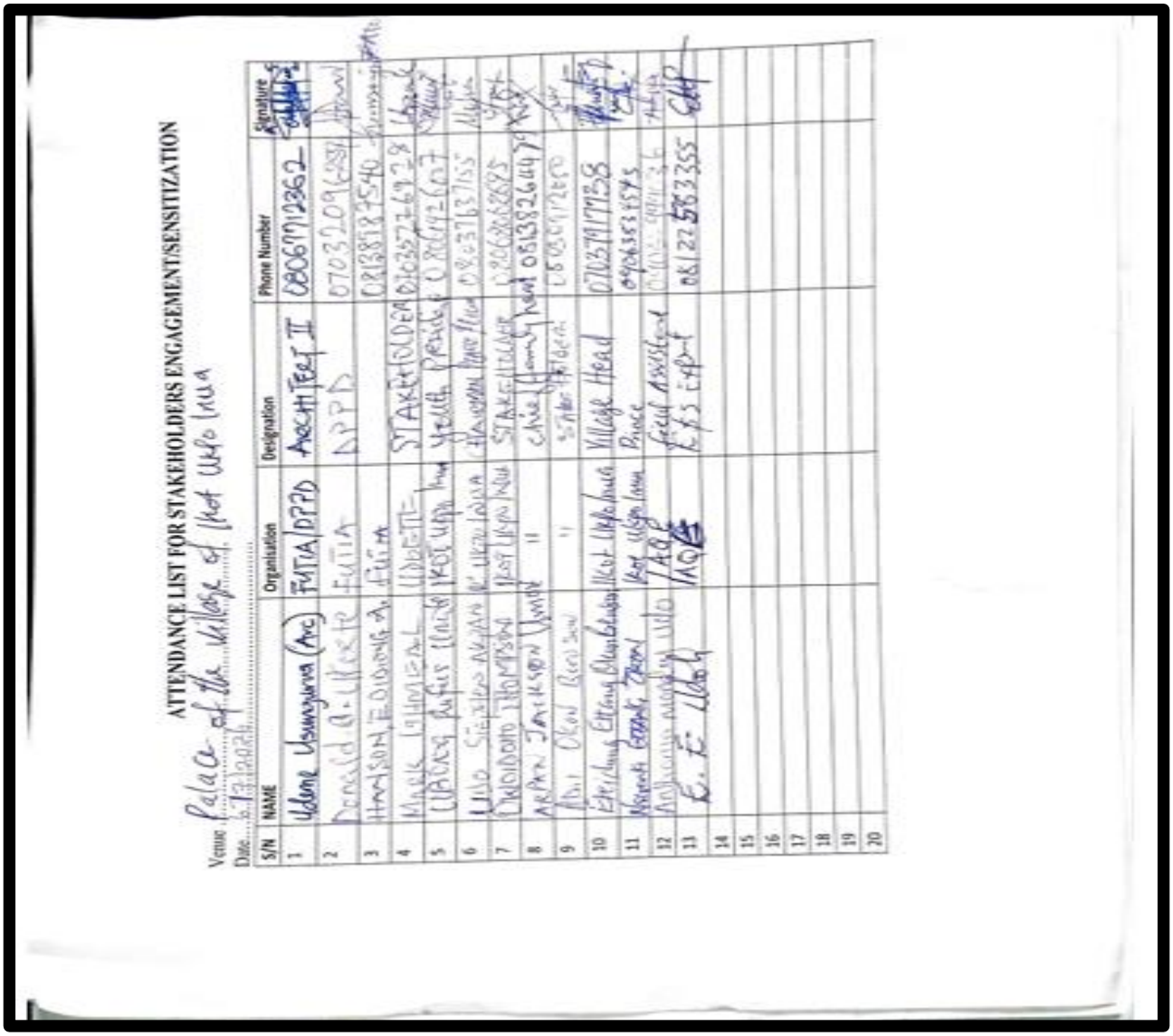
Impact	Frequency	Intensity	Duration	Consequence
Direct				
Fire Break (10 m) creation and maintenance	Regular	Moderate	Construction and operations	• Alteration to grassland habitat and clearing of some woodland. • Impact on ground dwelling fauna.
Vehicle movements	Regular	Moderate to high	Construction and operations	• Patches of bare ground created by repeated tyre movements.
Indirect				
Impact	**Frequency**	**Intensity**	**Duration**	**Consequence**
Edge and barrier Effects	Regular	Moderate	Operations	• Colonisation by weeds, non-native plants and pest animals.
Management of grassland biomass by mowing	Regular	High	Operations	• Potential degradation of native grassland by increased biomass reducing native species germination.
Management of grassland biomass by grazing	Regular	High	Operations	• Potential degradation of native grassland by producing nutrient rich patches from shDtP waste under shaded panels. Nutrient enrichment may favour exotic animals over

				natives.
Shading by solar panels	Regular	Moderate	Operations	• Changes in soil moisture. • Changes in species abundance by benefitting certain species over others (likely positive).
Accidental spills and contamination from construction activities (including compound sites)	Rare	Moderate	Construction	• Pollution of waterways.
Earthworks	Regular	Moderate	Construction	• Erosion and sedimentation of waterways.

Impact	Frequency	Intensity	Duration	Consequence
Direct				
Noise	Regular	Low	Construction	• Construction machinery and activities may disturb local fauna.
Dust Generation	Regular	Low	Construction	• Inhibit the function of plant species and communities, waterways.
Light spills during night works	Rare	Low	Construction	• Night works may alter fauna activities /movements.
Increased vehicle traffic	Regular	Low	Construction	• Increase potential for fauna mortality through vehicle strike.
General construction activities	Regular	Moderate	Construction	• Feral pest, weed and/or pathogen encroachment.
Vehicle Movements	Regular	Moderate	Construction and operations	• Weeds spread to moderate condition PCT 45 grassland.
Fencing	Regular	Low	Construction and operations	• Fauna fatalities.

Annex 5. Attendance





ATTENDANCE LIST FOR STAKEHOLDERS ENGAGEMENT/SENSITIZATION

Venue: Palace of the Village of Ikot Udo Inua

Date: 13/2/2026

S/N	NAME	Organisation	Designation	Phone Number	Signature
1	Udom Usungura (Mrs)	FUTIA/DPD	Architect II	08069012362	
2	Donald A. Ukeme	FUTIA	DPD	07032096838	
3	Hanson E. Diomo Jr.	FUTIA		08188185540	
4	Mark Udoette	Udoette	STAKEHOLDER	08035736928	
5	Ubiang Bassey Ekpo	Ikot Udo Inua	Village Head	08037672607	
6	Udo Sidney Akpan	Ikot Udo Inua	Community Leader	08037637155	
7	Unyoung Thompson	Ikot Udo Inua	STAKEHOLDER	08068688825	
8	Akpan Jackson Udo	"	Chief Community Head	08138226447	
9	Abel Okon Asuquo	"	Senior Master	08036011260	
10	Etiedung Etteng Bluebeard	Ikot Udo Inua	Village Head	07037911758	
11	Nseobong Essien Ekpoh	Ikot Udo Inua	Prince	09063531595	
12	Anthony Moses Udo	IAAP	Legal Assistant	08033...	
13	E. E. Udoh	IAAP	E.E.S. Expert	08122583355	
14					
15					
16					
17					
18					
19					
20					

Annex 6: Labour Influx Plan

This plan identifies labour requirements and sets out the procedures for addressing labour conditions and risks associated with the proposed project, which is aimed at helping FUTIA determine the resources necessary to address project labor issues.

Sub-Category	Worker Impacts\Risks	Project Impacts\Risks	Mitigation Measures	Monitoring	Monitoring Frequency	Responsibility
Employment	Influx of many foreigners into project community	Competition on livelihood and job opportunity with locals	60% of unskilled labour shall be from the project community. Where possible qualified skilled workers on contract shall also be sourced within the community	Verify	Onset of Project and bi-weekly	ESO; SSO
Housekeeping.	The general appearance of the camp deteriorates making camp life unpleasant.	The overall camp experience is compromised which in turn leaves workers demoralised and unproductive.	Ensure that camp grounds and common areas are routinely cleaned and organised with appropriate signage in place, and that grounds are maintained (e.g., grassed areas are regularly mown). Establish easily accessible, designated smoking areas which are clearly highlighted and regularly cleaned.	Verify	Monthly	ESO; SSO
Recreation.	Workers spend most of their time in the camps and could become disenchanted and bored. They may want to leave the camps and go into the local towns and villages in search of recreation.	Tensions arise from the local communities as workers impact their activities in search of recreation. An increase in alcohol consumption and prostitution could result due to the influx of workers into local communities.	Provide appropriate recreational facilities and activities. These should be discussed with the camp residents' committee.	Assessment	Quarterly	ESO; SSO
Spiritual /Religion.	Workers will want access to places of worship for their chosen religion. They may leave the camps and go into the local towns and villages in search of an appropriate place of worship.	Tensions arise from the local communities as workers impact their activities.	Provide appropriate places of worship where residents express a need for this in accordance with cultural sensitivities, and assess transport arrangements on a case-by-case basis. Ensure that equipment and facilities are kept clean and well maintained.	Assessment	Quarterly	ESO; SSO
Security.	Inconsistent and aggressive behaviour of security personnel towards workers can result in tensions and conflict in the workplace and a perception of human rights abuses.	Insufficient training and control of security personnel can lead to the inappropriate use of force, while protecting Project workers and assets, or inappropriate behaviour towards local populations, resulting in	Ensure that camp security personnel meet at least the following requirements: • Have not been implicated in past abuses • Are trained in appropriate conduct towards workers and community members including: o Exercising constraint and caution and understand how force may be used o Respecting human rights o Behaving consistently o Knowing and abiding by applicable laws	Assessment	Quarterly	ESO; SSO

		human rights claims.	o Fostering good community relations through their interaction and behaviour towards the workforce and communities			
Community relations.	Communities are negatively impacted by camp activities: noise, waste, traffic, lighting and so forth. This may result in negative actions towards camp operations such as road closures and the prevention of workers or suppliers from entering the worksite.	Workers are stopped from going to work, which affects productivity.	Implement control measures to avoid and minimise the impacts of camp and living conditions on communities. Limit foreign worker interaction with communities and provide cultural sensitivity awareness training to facilitate appropriate interaction with communities.	Assessment	Quarterly	ESO; SSO

Annex 7: Community Affairs, Safety, Health, Environment and Security (Cashes) Plan

The contractor recognizes that failure to perform its duties with the highest sense of responsibility and in line with laid down procedures, regulations and standards could result in accidents, incidents or dire consequences. It is the company's belief that good CASHES performance is an integral part of efficient and profitable business management. We shall therefore:

- Provide and maintain safe and healthy working environment and conditions, taking account of any statutory requirement of our client and the national regulatory agencies.
- Ensure that no activity shall be carried out unless it is safe to the environment, workers and third parties.
- Provide training and instruction to enable employees to perform their job safely and efficiently.
- Make available all necessary safety devices and protective equipment and enforce their use.
- Maintain a constant and continuing interest in environment, health and safety matters application to the company's activities, in particular by consulting and involving employees and clients where ever possible.
- Ensure that there exist adequate facilities and avenues for consultation between our company and clients/projects host communities.
- Comply with the provisions and implementation of supplementary plans in this ESMP such as TMP, WMP, Borrow Pit Management Plan, OHS Plan, Code of Conducts and General Conditions for Contract
- The company will give full backing to this policy and to the company HSE Officer, whose function it shall be to monitor and operate this policy.

A sample generic CASHES Plan is presented below:

Potential Risk	Mitigation Plan
Disturbance from project activities such as noise, emissions, movement of vehicles/equipment	• Contractors to minimise noise by retrofitting equipment with noise mufflers • Contractors to maintain equipment regularly and use BAT/BEP technologies to minimise emissions • Water roads in built up areas frequently to reduce dust • Avoid construction activities before 8.00am and after 6.00pm • Project SPIU to establish and implement an effective GRM to enable timely receipt and resolution of complaints
Increased risks of accidents from project activities	• Contractors to demarcate/cordon off construction areas and lit up adequately at night, fence out danger zones and keep out of reach. • Restricted access to be placed at construction sites using caution signs and manned personnel • Adequate road signs to warn pedestrians and motorists of construction activities, diversions, etc. shall be provided at appropriate points. • Drivers should be competent and trained by FRSC • Ensure the use of flagmen at strategic locations such as junctions, pedestrian crossings, near schools and other public facilities etc. • Implement associated plans including Traffic Management Plan, Burrow pit reclamation plan, OHS plan, WMP etc.
Exposure to social risks such as theft, vandalism, STIs/STDs, GBV/SEA/SH, child labor	• Contractor to strictly implement the code of conduct for all workers • Contractor shall enforce a 'closed' camp policy unless otherwise agreed and approved by Company. Workers will comply with the agreed camp closure hours • Ensure that children and minors are not employed directly or indirectly on the project
Increased risk of COVID-19 contamination	• COVID-19 prevention mechanisms shall also be put in place including access to handwashing, regular health checks and reporting. • Minimise the need for public gatherings and where required safe practices such as use of nose masks, handwashing/sanitisers should be used • Workers to comply with the COVID-19 regulations in Appendix 12
Competition for scarce resources such as water	• Contractors to provide alternative source of water for construction, staging area and campsite. • Community sources of water will not be exploited by the contractors
Pollution of the environment from different waste categories	• Contractor to sensitise workers on the provisions and implementation of the WMP and monitor compliance • Contractor to avoid littering the project areas with spoils/unsuitable and shall not restrict access to community assets with waste.

Annex 8: Occupational Health and Safety (Ohs) Plan

Every project poses its HSE risks. This plan was necessitated to meet up with OHS standards and to achieve the objectives set for the proposed project. The OHS cost of mitigation measures of all envisaged environmental and social impact will be embedded in to the bidding document as it is clearly spelt out in the ESMP which is the management plan to be used by the contractor.

Key components of the OHS plan	Description
Competency	All personnel required to operate or work with any equipment or machine must be tested for each equipment he/ she must be operating. All personnel who as part of their profession require licensing or certification must obtain the necessary certification before he/she shall be allowed to work on the site.
Fitness	All personnel working on site shall be required to be certified medically fit to do so by an approved medical facility or Medical Doctor (pre-employment medical examination)
HSE Training : Induction/ Orientation	Every new or rehire employee and subcontractors' employees must undergo mandatory OHS orientation/ induction. The purpose of the induction is to educate workers and make them aware of the major potential hazards he or she shall come into contact with while working on the site; also, it is one more opportunity to stress the importance of HSE being the first priority in the operation. The content of the HSE orientation/ induction shall cover the following subjects: Site safety rules Personnel protective equipment requirements (PPE) Environmental sensitivity and protection Preparation and planning of the job (Daily Pre-tasks talk), Emergency plan and muster points.
Project specific training	In addition to the HSE orientation/induction, there shall be specific HSE trainings which shall cover the following topics • Manual handling • Electrical safety • Emergency prevention, preparedness and response • First Aid training (for site First Aiders) • Lifting and rigging • Safe driving techniques (for drivers)
Hazard identification & HSE risk assessment	The project HSE risk assessment shall be developed and recorded. The project's HSE risk assessment shall be conducted by a team consisting of the HSE Manager/ Supervisor and technical managers/ supervisors. It must be approved by the project manager.
Fire Risk Assessment	A fire risk assessment shall be developed and recorded. A fire safety plan shall be in place in the site
Job Hazard Analysis	Job hazard analysis is required when the hazards and risks associated with a specific task is to be identified so as to implement control measures. The HSE department together with the technical managers/supervisors shall develop a job hazard analysis when applicable
Emergency Preparedness and Response	Emergency procedures and evacuation plan shall be developed by the HSE Department and displayed on the notice board. These procedures shall be communicated to all staff. Also each section/department shall have at least a trained first aider at all times.
HSE IMPLEMENTATION AND PERFORMANCE MONITORING	
HSE Meetings	HSE management meetings shall be held once a month. The meeting is to help identify safety problems, develop solutions, review incident reports, provide training and evaluate the effectiveness of our safety program. Some of the meetings shall be: Project/Site Management HSE Meeting for management and supervision (Monthly). Tool box talk meetings for all workforce (Weekly). Pre-task briefing for all workforces (Daily). Special situation meeting (As required).
HSE Reporting	All incidents and illnesses must be reported to site supervisor after which investigation shall commence and recorded so that appropriate corrective actions shall be implemented to prevent any re-occurrence and report findings shall be forwarded to management for review. Reporting requirements shall include notification of incident, investigation report, and monthly report. Notification of Incident form shall be developed which shall be filled and submitted to HSE department for investigation.
HSE Inspection and Audits	For continual improvement of HSE management system, HSE inspection and audit shall be conducted. An inspection checklist shall be developed. This is to ensure that the HSE management system is being adhered to. The inspection shall be conducted by the HSE department together with site management.
Corrective and Preventive Actions and Non Conformities	During the cause of inspections, concerns raised shall be addressed and closed out. It is expected that in a period of two weeks, a close out inspection shall take place to verify that the corrective actions have been closed.
Project HSE Rules	The project HSE rules shall be developed and supervision shall develop specific rules and procedures when necessary. The following site rules shall be implemented at all times. The Site Manager shall draw these rules to the attention of their own workmen or staff. All sub-contractors must ensure that these rules are drawn to the attention of their workmen and staff. The Principal Contractor may implement additional site rules during the contract programme. Any such additional rules shall be notified to all personnel engaged on the project prior to their implementation. The HSE rules shall include but not limited to: 1. Personal Protective Equipment must be worn at all times. 2. All instructions issued by the Site Manager regarding the storage, handling or cleaning of materials, plant and equipment must be followed. 3. All vehicles must be parked in the designated areas.

	4. Any workman suffering from a medical condition that might affect his work and/or that could require specific Medical treatment must inform the supervisor before commencing work. 5. All site tools shall either be battery operated or 110 volts. 6. No one shall be permitted on site if it is believed that they are under the influence of alcohol or drugs. 7. Vehicles must not reverse without a banksman in attendance. 8. All visitors to site must undergo a site-specific induction and operative Identity badges must be worn at all times. 9. All excavations must be secured. 10. Smoking and eating shall only be permitted in the designated area. This area shall be identified during induction. 11. No hot works operations are permitted without a hot work permit in place. 12. There shall be no radios or other music playing devices on site. 13. Good housekeeping practices to be adopted. 14. Compliance with all Ethical Power Permit to Work systems 15. The site keyed access procedure must be strictly adhered to. 16. All Contractors must comply with Site Health & Safety Guidelines / Site Safety Method Statement 17. No untrained worker shall be permitted to operate heavy machineries.
SAFE WORK PRACTICES	
Personal Protective Equipment (PPE)	The basic PPE required for the project shall be Safety Glasses, Safety Boots, Hand Gloves, Hard Hat and Coverall. Any other PPE shall be used as applicable. Management is responsible for the provision of PPE and usage shall be enforced at all time. PPE shall be provided in circumstances where exposure to hazards cannot be avoided by other means or to supplement existing control measures identified by a risk assessment. An assessment shall be made to ensure that the PPE is suitable for purpose and is appropriate to the risk involved. Information, instruction & training shall be given to all employees on safe use, maintenance and storage of PPE. Employees shall, in accordance with instructions given, make full use of all PPE provided and maintain it in a serviceable condition and report its loss or defect immediately to the maintenance department where it shall be replaced PPE shall be replaced when it is no longer serviceable and returned on a new for old basis. Employees shall sign to state that they have received PPE when issued.
Welfare Facilities	The provision of welfare facilities on the site shall be communicated to all operatives at site induction. A cleaning regime shall be implemented and maintained for the duration of the construction phase to ensure the site welfare facilities remain in a clean and tidy condition. If mains drinking water becomes unavailable during the construction phase bottled water shall be brought to site for all operatives for the necessary period.
Signage	Adequate provision for warning and directional signs shall be made.
Project HSE Procedures	OHS procedures shall be developed. Project activities shall generally be controlled in accordance with OHS Procedures. These procedures shall include: • Lifting and Rigging Procedure • HSE Reporting Procedure • Working at Height Procedure. • Emergency Procedure.
Key roles	**Responsibilities**
Project manager	Set good example in HSE issues. Ensure the availability of resources essential to establish, implement, maintain and improve the OHS Management System. Define, document and communicate roles, allocate responsibilities and accountabilities, delegating authorities, to facilitate effective OHS management. Ensure that all of the activities undertaken in the Project conform to Nigerian legislation, client requirements or international standards when applicable. Review objectives achievements throughout the year
Project supervisors	• Enforcing all phases of the established HSE plan. • Set good example in HSE issues. • Preparing Job Hazard Analysis when required. • Ensuring the safety of all workers associated with the site. • Conducting HSE inspections. • Ensuring workers are competent for their allocated tasks. • Attending and participating in HSE meetings. • Participating in accident investigations.
HSE Manager/ Supervisor	• Prepare relevant OHS documentation and procedures. • Monitor the efficient implementation of OHS requirements. • Participate and organize the OHS risk assessments. • Advise management of compliance and of conditions requiring attention. • Conduct regular HSE inspections. • Make thorough analysis of statistical data and inspections; delineates problem areas; and makes recommendation for solutions. • Take part in the review of all OHS incidents and assist in investigating incident. • Monitor the efficient implementation of the Project's OHS requirements. • Organize the Project's OHS risk assessment exercises. • Check on the use of all types of personal protective equipment specifies the use of appropriate PPE for the various work activities. Evaluates their effectiveness and suggests improvements where indicate
HSE Advisor	• Check on the use of all types of personal protective equipment specifies the use of appropriate PPE for the various work activities. Evaluates their effectiveness and suggests improvements.

	• Conduct independent inspections to observe conformance with established OHS Plan and determines the effectiveness of individual elements of the plan (pre-task briefing, weekly toolbox talk, etc) • Establish contact with Subcontractors with the objective of maintaining good relations and coordination of accident prevention activities and compliance with the established OHS plan. • Correct unsafe acts and unsafe conditions. • Deliver HSE induction/orientation course to all employees, including subcontractors. • Deliver HSE awareness course and toolbox talk. • Advise employees on OHS matters. • Take all reasonable and practical steps to care for their own health and safety and avoid affecting the health and safety of co-workers and the general public. • Follow all instructions and use the equipment properly • Not interfere with any safety arrangements. • Report any circumstances which may not comply with the project's OHS management system.

Annex 9: Code Of Conduct For Gender-Based Violence

Company's Code of Conduct

Preventing Gender Based Violence and Violence Against Children

The company is committed to creating and maintaining an environment in which gender-based violence (GBV) and violence against children (VAC) have no place, and where they will not be tolerated by any employee, associate, or representative of the company. Therefore, in order to ensure that all those engaged in the project are aware of this commitment, and in order to prevent, be aware of, and respond to any allegations of GBV and VAC, the company commits to the following core principles and minimum standards of behavior that will apply to all company employees, associates, and representatives including sub-contractors, without exception:

The company—and therefore all employees, associates, and representatives—commit to treating women, children (persons under the age of 18), and men with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status. Acts of GBV and VAC are in violation of this commitment.

Demeaning, threatening, harassing, abusive, culturally inappropriate, or sexually provocative language and behavior are prohibited among all company employees, associates, and its representatives.

Acts of GBV or VAC constitute gross misconduct and are therefore grounds for sanctions, which may include penalties and/or termination of employment. All forms of GBV and VAC, including grooming are unacceptable, regardless of whether they take place on the work site, the work site surroundings, at worker's camps or at worker's homes.

In addition to company sanctions, legal prosecution of those who commit acts of GBV o
r VAC will be pursued if appropriate.

Sexual contact or activity with children under 18—including through digital media—is prohibited. Mistaken belief regarding the age of a child is not a defense. Consent from the child is also not a defense or excuse.

Sexual favors—for instance, making promises or favorable treatment dependent on sexual acts—or other forms of humiliating, degrading or exploitative behavior are prohibited.

Unless there is full consent1 by all parties involved in the sexual act, sexual interactions between the company's employees (at any level) and members of the communities surrounding the workplace are prohibited. This includes relationships involving the withholding/promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex—such sexual activity is considered "non-consensual" within the scope of this Code.

All employees, including volunteers and sub-contractors are highly encouraged to report suspected or actual acts of GBV and/or VAC by a fellow worker, whether in the same company or not. Reports must be made in accordance with GBV and VAC Allegation Procedures.

Managers are required to report suspected or actual acts of GBV and/or VAC as they have a responsibility to uphold company commitments and hold their direct reports responsible.

To ensure that the above principles are implemented effectively the company commits to ensuring that:

All managers sign the 'Manager's Code of Conduct' detailing their responsibilities for implementing the company's commitments and enforcing the responsibilities in the 'Individual Code of Conduct'.

All employees sign the project's 'Individual Code of Conduct' confirming their agreement not to engage in activities resulting in GBV or VAC.

Displaying the Company and Individual Codes of Conduct prominently and in clear view at workers' camps, offices, and in in public areas of the work space. Examples of areas include waiting, rest and lobby areas of sites, canteen areas, health clinics.

Ensure that posted and distributed copies of the Company and Individual Codes of Conduct are translated into the appropriate language of use in the work site areas as well as for any international staff in their native language.

An appropriate person is nominated as the company's 'Focal Point' for addressing GBV and VAC issues, including representing the company on the GBV and VAC Compliance Team (GCCT) which is comprised of representatives from the client, contractor(s), the supervision consultant, and local service provider(s).

Ensuring that an effective Action Plan is developed in consultation with the GCCT which includes as a minimum:

GBV and VAC Allegation Procedure to report GBV and VAC issues through the project Grievance Redress Mechanism (GRM);

Accountability Measures to protect confidentiality of all involved; and,

Response Protocol applicable to GBV and VAC survivors and perpetrators.

That the company effectively implements the Action Plan, providing feedback to the GCCT for improvements and updates as appropriate.

All employees attend an induction training course prior to commencing work on site to ensure they are familiar with the company's commitments and the project's GBV and VAC Codes of Conduct.

All employees attend a mandatory training course once a month for the duration of the contract starting from the first induction training prior to commencement of work to reinforce the understanding of the project's GBV and VAC Code of Conduct.

I do hereby acknowledge that I have read the foregoing Company Code of Conduct, and on behalf of the company agree to comply with the standards contained therein. I understand my role and responsibilities to prevent and respond to GBV and VAC. I understand that any action inconsistent with this Company Code of Conduct or failure to take action mandated by this Company Code of Conduct may result in disciplinary action.

Company name: _____ Signature: _____

Printed Name: _____ Title: _____ Date: _____

1 Consent is defined as the informed choice underlying an individual's free and voluntary intention, acceptance or agreement to do something. No consent can be found when such acceptance or agreement is obtained through the use of threats, force or other forms of coercion, abduction, fraud, deception, or misrepresentation. In accordance with the United Nations Convention on the Rights of the Child, the AFDB considers that consent cannot be given by children under the age of 18, even in the event that national legislation of the country into which the Code of Conduct is introduced has a lower age. Mistaken belief regarding the age of the child and consent from the child is not a defense.

Manager's Code of Conduct

Preventing Gender Based Violence and Violence Against Children

Managers at all levels have particular responsibilities to uphold the company's commitment to preventing and addressing GBV and VAC. This means that managers have an acute responsibility to create and maintain an environment that prevents GBV and VAC. Managers need to support and promote the implementation of the Company Code of Conduct. To that end, managers must adhere this Manager's Code of Conduct and also sign the Individual Code of Conduct. This commits them to supporting and developing systems that facilitate the implementation of the Action Plan and maintain a GBV-free and VAC-free environment at the workplace and in the local community. These responsibilities include but are not limited to:

Implementation

To ensure maximum effectiveness of the Company and Individual Codes of Conduct:

Prominently displaying the Company and Individual Codes of Conduct in clear view at workers' camps, offices, and in in public areas of the workspace. Examples of areas include waiting, rest and lobby areas of sites, canteen areas, health clinics.

Ensuring all posted and distributed copies of the Company and Individual Codes of Conduct are translated into the appropriate language of use in the work site areas as well as for any international staff in their native language.

Verbally and in writing explain the Company and Individual Codes of Conduct to all staff.

Ensure that:

All direct reports sign the 'Individual Code of Conduct', including acknowledgment that they have read and agree with the Code of Conduct.

Staff lists and signed copies of the Individual Code of Conduct are provided to the GCCT and the client.

Participate in training and ensure that staff also participate as outlined below.

Staff are familiar with the Grievance Redress Mechanism (GRM) and that they can use it to anonymously report concerns of GBV or VAC incidents.

Staff are encouraged to report suspected or actual GBV or VAC through the GRM by raising awareness about GBV and VAC issues, emphasizing the staff's responsibility to the Company and the country hosting their employment, and emphasizing the respect for confidentiality.

In compliance with applicable laws and to the best of your abilities, prevent perpetrators of sexual exploitation and abuse from being hired, re-hired or deployed. Use background and criminal reference checks for all employees.

Ensure that when engaging in partnership, sub-contractor or similar agreements, these agreements:

Incorporate the GBV and VAC Codes of Conduct as an attachment.

Include the appropriate language requiring such contracting entities and individuals, and their employees and volunteers, to comply with the Individual Codes of Conduct.

Expressly state that the failure of those entities or individuals, as appropriate, to take preventive measures against GBV and VAC, to investigate allegations thereof, or to take corrective actions when GBV or VAC has occurred, shall constitute grounds for sanctions and penalties in accordance with the Individual Codes of Conduct.

Provide support and resources to the GCCT to create and disseminate internal sensitization initiatives through the awareness-raising strategy under the Action Plan.

Ensure that any GBV or VAC issue warranting police action is reported to the client and the AFDB immediately.

Training

All managers are required to attend an induction manager training course prior to commencing work on site to ensure that they are familiar with their roles and responsibilities in upholding the GBV and VAC Codes of Conduct. This training will be separate from the induction training course required of all employees and will provide managers with the necessary understanding and technical support needed to begin to develop the Action Plan for addressing GBV and VAC issues.

Ensure that time is provided during work hours and that staff attend the mandatory project facilitated induction training on GBV and VAC required of all employees prior to commencing work on site.

Ensure that staff attend the monthly mandatory refresher training course required of all employees to combat increased risk of GBV and VAC during civil works.

Managers are required to attend and assist with the project facilitated monthly training courses for all employees. Managers will be required to introduce the trainings and announce the self-evaluations.

Collect satisfaction surveys to evaluate training experiences and provide advice on improving the effectiveness of training.

Response

Managers will be required to provide input to the GBV and VAC Allegation Procedures and Response Protocol developed by the GCCT as part of the final cleared Action Plan.

Once adopted by the Company, managers will uphold the Accountability Measures set forth in the Action Plan to maintain the confidentiality of all employees who report or (allegedly) perpetrate incidences of GBV and VAC (unless a breach of confidentiality is required to protect persons or property from serious harm or where required by law).

If a manager develops concerns or suspicions regarding any form of GBV or VAC by one of his/her direct reports, or by an employee working for another contractor on the same work site, s/he is required to report the case using the GRM.

Once a sanction has been determined, the relevant manager(s) is/are expected to be personally responsible for ensuring that the measure is effectively enforced, within a maximum timeframe of 14 days from the date on which the decision to sanction was made.

Managers failing to report or comply with such provision can in turn be subject to disciplinary measures, to be determined and enacted by the company's CEO, Managing Director or equivalent highest-ranking manager. Those measures may include:

Informal warning.

Formal warning.

Additional Training.

Loss of up to one week's salary.

Suspension of employment (without payment of salary), for a minimum period of 1 month up to a maximum of 6 months.

Termination of employment.

Ultimately, failure to effectively respond to GBV and VAC cases on the work site by the company's managers or CEO may provide grounds for legal actions by authorities.

I do hereby acknowledge that I have read the foregoing Manager's Code of Conduct, do agree to comply with the standards contained therein and understand my roles and responsibilities to prevent and respond to GBV and VAC. I understand that any action inconsistent with this Manager's Code of Conduct or failure to take action mandated by this Manager's Code of Conduct may result in disciplinary action.

Signature: _____ Printed Name: _____

Title: _____ Date: _____

Individual Code of Conduct

Preventing Gender Based Violence and Violence Against Children

I, _____, acknowledge that preventing gender-based violence (GBV) and violence against children (VAC) is important. The company considers that GBV or VAC activities constitute acts of gross misconduct and are therefore grounds for sanctions, penalties or potential termination of employment. All forms of GBV or VAC are unacceptable be it on the work site, the work site surroundings, or at workers camps. Prosecution of those who commit GBV or VAC may be pursued if appropriate.

I agree that while working on the project I will:

Consent to police background check.

Treat women, children (persons under the age of 18), and men with respect regardless of race, color, language, religion, political or other opinion, national, ethnic or social origin, property, disability, birth or other status.

Not use language or behavior towards women, children or men that is inappropriate, harassing, abusive, sexually provocative, demeaning or culturally inappropriate.

Not participate in sexual contact or activity with children—including grooming or contact through digital media. Mistaken belief regarding the age of a child is not a defense. Consent from the child is also not a defense or excuse.

Not engage in sexual favors—for instance, making promises or favorable treatment dependent on sexual acts—or other forms of humiliating, degrading or exploitative behavior.

Unless there is the full consent2 by all parties involved, I will not have sexual interactions with members of the surrounding communities. This includes relationships involving the withholding or promise of actual provision of benefit (monetary or non-monetary) to community members in exchange for sex—such sexual activity is considered "non-consensual" within the scope of this Code.

Attend and actively partake in training courses related to HIV/AIDS, GBV and VAC as requested by my employer.

Consider reporting through the GRM or to my manager any suspected or actual GBV or VAC by a fellow worker, whether employed by my company or not, or any breaches of this Code of Conduct.

With regard to children under the age of 18:

Wherever possible, ensure that another adult is present when working in the proximity of children.

Not invite unaccompanied children unrelated to my family into my home, unless they are at immediate risk of injury or in physical danger.

Not sleep close to unsupervised children unless absolutely necessary, in which case I must obtain my supervisor's permission, and ensure that another adult is present if possible.

Use any computers, mobile phones, or video and digital cameras appropriately, and never to exploit or harass children or to access child pornography through any medium (see also "Use of children's images for work related purposes" below).

Refrain from physical punishment or discipline of children.

Refrain from hiring children for domestic or other labor which is inappropriate given their age or developmental stage, which interferes with their time available for education and recreational activities, or which places them at significant risk of injury.

Comply with all relevant local legislation, including labor laws in relation to child labor.

Use of children's images for work related purposes

When photographing or filming a child for work related purposes, I must:

Before photographing or filming a child, assess and endeavour to comply with local traditions or restrictions for reproducing personal images.

Before photographing or filming a child, obtain informed consent from the child and a parent or guardian of the child. As part of this I must explain how the photograph or film will be used.

Ensure photographs, films, videos and DVDs present children in a dignified and respectful manner and not in a vulnerable or submissive manner. Children should be adequately clothed and not in poses that could be seen as sexually suggestive.

Ensure images are honest representations of the context and the facts.

Ensure file labels do not reveal identifying information about a child when sending images electronically.

Sanctions

I understand that if I breach this Individual Code of Conduct, my employer will take disciplinary action which could include:

Informal warning.

Formal warning.

Additional Training.

Loss of up to one week's salary.

Suspension of employment (without payment of salary), for a minimum period of 1 month up to a maximum of 6 months.

Termination of employment.

Report to the police if warranted.

I understand that it is my responsibility to avoid actions or behaviors that could be construed as GBV or VAC or breach this Individual Code of Conduct. I do hereby acknowledge that I have read the foregoing Individual Code of Conduct, do agree to comply with the standards contained therein and understand my roles and responsibilities to prevent and respond to GBV and VAC. I understand that any action inconsistent with this Individual Code of Conduct or failure to take action mandated by this Individual Code of Conduct may result in disciplinary action and may affect my ongoing employment.

Signature: _____ Printed Name: _____

2 Consent is defined as the informed choice underlying an individual's free and voluntary intention, acceptance or agreement to do something. No consent can be found when such acceptance or agreement is obtained through the use of threats, force or other forms of coercion, abduction, fraud, deception, or misrepresentation. In accordance with the United Nations Convention on the Rights of the Child, the AFDB considers that consent cannot be given by children under the age of 18, even in the event that national legislation of the country into which the Code of Conduct is introduced has a lower age. Mistaken belief regarding the age of the child and consent from the child is not a defense.

Title: _____ Date: _____