DRAFT ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) REPORT

FOR THE

ENERGIZING EDUCATION PROGRAMME PHASE II

FEDERAL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY (FUNATO), OKEHO, OYO STATE, NIGERIA.

BY

RURAL ELECTRIFICATION AGENCY (REA)

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SYMBOLS OF UNITS OF MEASUREMENTS

Cubic metres	(m3)
Decibel	(dB)
Hectare	Area (Ha)
Hertz	(Hz)
Kelvin	(K)
Kilometres	(Km)
Kilovolt-ampere	(kVA)
Kilovolts	(Kv)
Kilowatts	(Kw)
Megawatt	(MW)
Meter per second	(m/s)
Metres	(M)
Volt	(V or E)
Watt per square meter	(W/ m^2)
Watt	(W)

LIST OF ACRONYMS AND ABBREVIATIONS

AfDB	African Development Bank
APPI	Area of Potential Project Influence
ARAP	Abbreviated Resettlement Action Plan
ASTM	American Society for Testing and Materials
BMP	Biodiversity Management Plan
BOD	Biochemical Oxygen Demand
BOS	Balance of System
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
EMF	Electromagnetic Field
EMS	Environmental Management Strategy
EPC	Engineering, Procurement and Construction
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
GPS	Global Positioning System
GRM	Grievance Redress Mechanism
HSE	Health, Safety, and Environment
HT	High Tension
ICREEE	Inter-ministerial Committee on Renewable Energy and Energy Efficiency
KWAC	Kilowatts Alternating Current
KWDC	Kilowatts Direct Current
LGA	Local Government Area
NACOP	National Council on Power
NEEAP	National Energy Efficiency Action Plan
NEP	Nigeria Electrification Project
NEPP	National Electric Power Policy
NERC	Nigerian Electricity Regulatory Commission
NESREA	National Environmental Standards and Regulations Enforcement Agency

NIMET	Nigerian Meteorological Agency
NML	Noise Management Level
NOx	Nitrogen oxides
NSIFT	National Social Insurance Trust Fund
NUC	National University Commission
O&M `	Operations and maintenance
OHS	Occupational Health and Safety
PAPs	Project Affected Persons
PCT	Plant Community Type
PESCP	Progressive Erosion and Sediment Control Plan (aka ESCP)
PMP	Project Management Plan
POCR	Pre-operation Compliance Report
RAP	Resettlement Action Plan
RAV	restricted access vehicles
RBL	Rating Background Level
REA	Rural Electrification Agency
RoW	Right of Way
SE4All	Sustainable Energy for All
Sp./sp	Species/Species (plural)
STEL	Short Term Exposure Limit
SWMP	Soil and Water Use Management Plan
TCN	Transmission Company of Nigeria
TCP	Traffic Control Plans
TMP	Traffic Management Plan
TWA	Time Weighted Average
VEZ	Vegetation Exclusion Zone
VLMP	Vegetation and Land Management Plan
WMP	Waste Management Plan
WPMP	Weed and Pest Management Plan

EXECUTIVE SUMMARY

ES 1.0 Introduction

The Federal Government of Nigeria (FGN), through the Rural Electrification Agency (REA), is implementing the Nigeria Electrification Project Phase II (Desert-to-Power) with financial support from the African Development Bank (AfDB). The project's primary objective is to accelerate Nigeria's electrification efforts by deploying sustainable, off-grid and grid-connected solar-powered renewable energy solutions. By leveraging Nigeria's vast solar energy resources, the initiative aims to provide clean, reliable, and long-lasting electricity to Federal Universities and their affiliated teaching hospitals. The broader goal is to enhance academic performance, support research initiatives, and improve healthcare service delivery.

The quest for a steady, affordable and sustainable power supply remains a major challenge confronting the management of tertiary institutions in Nigeria. Epileptic power supply has severely affected tertiary education in Nigeria thereby impeding research, disruption of academic and administrative activities, with institutions having no other options than to rely on diesel-fired generators which are very expensive and unsustainable.

The classification of customers in 2025 into Bands by the eleven (11) privatized electricity Distribution Companies (DisCos) across Nigeria has further elevated the cost of electric consumption as the tertiary institutions are classified as "Band A" due to the peculiarity of the sector.

ES 1.1 Overview of the Project

In its bid to ensuring cheap and sustainable power supply for improved research, academic environment, security and livelihood of the University environment, the Federal Government of Nigeria (FGN), through the Rural Electrification Agency (REA), is implementing the Nigeria Electrification Project Phase II (Desert-to-Power) with financial support from the African Development Bank (AfDB). The project's primary objective is to accelerate Nigeria's electrification efforts by deploying sustainable, off-grid and grid-connected solar-powered renewable energy solutions. By leveraging Nigeria's vast solar energy resources, the initiative aims to provide clean, reliable, and long-lasting electricity to Federal Universities and their affiliated teaching hospitals.

The abysmal state of public power supply together with its expensiveness no doubt requires the deployment of intervention to rescue the much-important Ivory Towers from imminent collapse due to poor electric supply. The continuous operation of fossil fuel operated power generating sets by institution remains another source of drain on the finance of the University while the pollution and emission from the operation portend debilitating impact on climate change and environmental sustainability in general.

ES 1.2 Project Site and Location

The project location is at the permanent site of Federal University of Agriculture and Technology, Okeho. Okeho is a historic town in the Oke-Ogun region of Oyo State, Nigeria, serving as the headquarters of the Kajola Local Government. Known as a "valley-town" surrounded by Rocky Mountains, Okeho originated from the union of eleven settlements that sought refuge on the hills. It is a prominent agricultural hub, often referred to as the "food basket of Oyo State.

The proposed project site has a spatial coverage of 3.465 hectares of land within the temporary site (Awoyemi Commercial High School along the Isemi-Ile Road, Okeho, Kajola Local Government Area (LGA) of Oyo State.

ES 1.3 Legal and Administrative Framework

In order to establish the proposed EEP in Federal University of Agriculture and Technology, Okeho, Oyo State, it is pertinent to be compliant with applicable laws at the Federal and State levels of Government as well as with International Conventions. The applicable national laws for the proposed project include: -

i. African Development Bank's Integrated Safeguards System (2024)
ii. The regulations, guidelines and standards of the Federal Ministry of Power as it concerns high voltage power transmission in Nigeria.
iii. Environmental Impact Assessment Act Cap E12 LFN 2004
iv. FMEnv EIA Procedural Guidelines (2017)
v. The regulations, guidelines and standards of the Federal Ministry of Environment concerning power generation and transmission activities in Nigeria.
vi. National Environmental (Solar Energy) Regulations (2017)
vii. NESREA Act (2007) and sectoral guidelines
viii. Labour Act (2004) and Employee Compensation Act (2010)
ix. Land Use Act (1978) and Urban and Regional Planning Act
x. Climate Change Act (2021);
xi. Occupational Safety and Health (Factories) Regulations (2010)
xii. National Gender Policy (2006) and Discrimination Against Persons with Disabilities Act (2018)
xiii. All International Conventions/Treaties on Environmental Protection/Social Welfare to which Nigeria is a party: Paris Agreement (2015), Convention on Biological Diversity, ILO Conventions, and the UN Guiding Principles on Business and Human Rights
xiv. The regulations, guidelines and standards of the various State Ministries of Environment and Social Welfare.

ES 2.0 PROJECT JUSTIFICATION

ES 2 .1 Need for the Project and the Benefits

The justification for the Project is primarily based on the need to power Nigeria's federal universities to better serve for research and educational development. The EEP is also part of measures ensuring that Nigeria achieves its carbon emission targets (20% carbon emissions reduction by the year 2030) as contained in her Nationally Determined Contributions (NDC), under the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties (COP) 26.

The benefits of the Project include: -

a. Stimulation of academic and research activities within the University as a result of access to constant and reliable power supply, thereby promoting educational advancement.
b. Improvement in the provision of health care services by the University as a result of steady power supply.
c. Reduction in fossil fuel consumption by the benefiting institutions thereby leading to reduction in carbon emissions and ecosystem enhancement
d. Significant reduction in the cost of generating power through diesel generators by the Institutions. Such savings can be used for other undertakings that are more beneficial to the Universities and Teaching Hospitals.
e. Increase in social interactions of the students within the Universities and enhanced security that void opportunistic crimes and violence as a result of the street lights provide to further illuminate the campuses.
f. Enhanced learning in renewable energy with certification from the training centres to be established as part of the Programme.
g. Improvement in livelihood enhancement activities within the Universities.
h. More direct and indirect employment opportunities during the programme development and operations.
i. Increase in local and regional economy through award of contracts and purchase of supplies for Project development.
j. Increase in financial and technical collaborations between the FGN, the University, the Rural Electrification Agency (REA), AFDB and other relevant Ministries, Departments and Agencies (MDAs).
k. The project will contribute to Nigeria's Nationally Determined Contributions for the Paris Agreement to cut carbon emissions by at least 20% by the Year 2030.

ES 2.2 Value of the Project

The total fund for the EEP Phase, Nigeria Electrification Project Phase II (Desert-to-Power) project component is US$123 Million that covers the initial Engineering, Procurement and Construction (EPC) thereafter the Operations and Maintenance (O&M) Contracts for all the sites. The entire cost of implementation of the project within Federal university of Agriculture and Technology Okeho shall be sourced from this US$123 Million. The selection of the EPC contractors is competitive to build, operate and maintain the power plant on each site as well as to build and equip the training centres for one year.

ES 2.3 Envisaged Sustainability of the Project

ES 2.3.1 Technical Sustainability: The project development shall be handled by qualified and experienced EPC contractor (to be selected by REA through a competitive process) according to pre-established standards and procedures. The design and construction phase of the project shall be overseen by qualified engineers from REA and the Department of Works and Physical Planning in the University. 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 the University's Works and Physical Planning Department.

ES 2.3.2 Economic Sustainability: The Project on completion shall significantly reduce generators use in the University, thereby save costs of diesel and generator maintenance. Also, the monthly payment to the Distribution Company for power supply will greatly reduce or even stop since the project shall be the dedicated source of power for the University. A cost-reflective service charge shall be implemented for all facilities of the University including the private businesses within the campus that connect to the power project, to generate revenue for the University. This generated revenue shall be put into maintaining the project on a sustainable basis and shall minimize the University's dependency on allocation from the Federal Government.

ES 2.3.3 Environmental Sustainability**:** The environmental sustainability measures for the Project include the use of renewable source of energy (solar) for electricity generation (because of the negligible greenhouse gas emissions compared to fossil fuel power plants). In addition, the establishment of REA Project Management Unit (PMU) shall entail experienced Environmental and Social Safeguards Specialists to oversee the implementation of the project, thus contributing to the environmental sustainability of the Project.

ES 2.3.4 Social Sustainability**:** Stakeholders 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 from the onset. This has also assisted in laying the foundation for building good relationships with the stakeholders. In addition, a Stakeholders Engagement Plan (SEP) has been developed as part of the ESIA study to ensure continuous engagement with relevant stakeholders throughout the project life cycle. In addition, a grievance redress mechanism (GRM) has been developed by REA for the Project.

ES 2.4 Project Alternatives

Within the context of the proposed project, varied alternatives were considered based on environmental, economic and operational factors. The alternatives include technology types, PV module and battery type. The use of polycrystalline silicon photovoltaic (PV) panels and lithium-ion batteries is preferred alternative taken for the proposed project.

ES 2.5 No Project Option

The "No Project Option" was considered and rejected because it will deny the University the necessary technology to enhance learning, research, security and protection of those in it. Also, the lack of or epileptic power supply is a setback to any institution of learning and can completely render the institution ineffectual.

ES 3.0 PROJECT DESCRIPTION

ES 3.1 The Rational for the Project

The socio-economic benefits attached to this rural electrification access intervention, the EEP, are significant and largely impact not only the power, education and healthcare sectors but also provides a measure to ensure Nigeria achieves its targets as contained in the Nation's Nationally Determined Contributions (NDCs) to the Paris Agreement of 2016. The EEP 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.

ES 3.3 Project Components and Activities

The EEP Phase, Nigeria Electrification Project Phase II (Desert-to-Power) project in the Federal University of Agriculture and Technology, Okeho, Oyo State shall be established as a solar power system. The components include: - solar photovoltaic panels, lithium-ion batteries, shelter, wirings, steel rods and other installations on 3.465 Hectares land take within the University Campus.

The development is expected to take 6 – 12 months and the activities associated with the project development from Pre-Construction to Operations and Maintenance include: -

i. Mobilization to the site
ii. Installation of temporary shelter and convenience for the construction workers
iii. Movement of heavy-duty trucks, vehicles, equipment, materials and workers to site
iv. Clearing of the site
v. Soil compaction for the project
vi. Digging of trenches for foundation
vii. Commencement of construction activities
viii. Installation of equipment
ix. Maintenance of trucks, vehicles, equipment
x. Diverse wastes generation
xi. Test run installed equipment for the project
xii. Commission the project and hand over to O & M Contractor
xiii. Operate and maintain project throughout the lifespan.

ES 4.0 Description of the Project Existing Environment

The description of environmental and social conditions of the project location is based on both desktop studies and field investigations. The field sampling was conducted by a team of environmental and social specialists covering 500m spatial boundary around the project site. Quality Assurance and Quality Control (QA/QC) was taken to keep the samples in stable state from the field to the laboratory for analyses. The laboratory used is accredited by the Federal Ministry of Environment. The baseline data was established for the project in the following areas: -

- Climate and Meteorology
- Air Quality
- Soil and Land Use
- Groundwater
- Vegetation
- Wildlife Survey

ES 4.1 Stakeholders Engagement

Stakeholder engagement was conducted between 26 and 27th of April, 2026 as part of the ESIA for the proposed project. This included a review of the legal and administrative framework, stakeholders' identification and analysis, and initial consultation with stakeholders. Comments and issues raised by relevant stakeholders consulted during the ESIA study were provided in the report. The consultations served to provide stakeholders with information about the proposed Project and to gather information important to the ESIA. Consultation with the identified stakeholders showed general acceptance of the proposed Project.

ES 5.0 Associated and Potential Impacts of the Project

There are several impacts identified for the project, both Beneficial and Adverse. The beneficial (positive) impacts shall be improved upon with enhancement measures and include: -

a) More reliable and sustainable power supply for the University activities
b) Combat climate change effects through the use of renewable energy technology
c) Improve safety and security on the campus with street lightings powered by the project
d) Increase work efficiency and business opportunities on the campus
e) Enhance students to study, research and carry-on necessary experiments.

Notwithstanding, there are negative (adverse) impacts associated with the project which require mitigation measures as follows: -

i. Distortion of the natural ecosystem by clearing the site
ii. Displacement of biodiversity on the site
iii. Increased noise from vehicular movements and workers on the project
iv. Increased dust from construction activities
v. Contamination of the proximate surface water
vi. Indiscriminate dumping of waste generated on the project
vii. Slips, falls, Injuries, accidents on the site
viii. Used oil or other hazardous spills
ix. Low quality equipment/installations and poor workmanship
x. Poorly maintained equipment

xi. Irregular working hours
xii. Fire risk
xiii. Worker's safety

ES 6.0 Mitigation Measures

For the significant negative impacts identified for the project phases, the proffered mitigation measures are as follows: -

1) Pre-Construction Phase

i. Site clearing activities shall be limited to just enough space needed for the project on the site.
ii. The extent of vegetation to be cleared for the project shall be appropriately demarcated.
iii. The undeveloped areas around the project shall be vegetated with native plants.
iv. Site clearing shall be carried out with machinery that have optimal fuel-efficiency and less emissions.
v. The site clearing shall only be carried out during daytime (weekdays from 8:00am to 5:00pm but weekends from 9:00am to 1:00pm).
vi. A traffic management plan (TMP) shall be developed for the project and operated by the EPC Contractor.
vii. Place caution signs strategically across the project site and put in place safety measures to prevent incidences/accidents.
viii. Drivers shall be assessed on competency level and trained appropriately for the project activities.
ix. Provision and enforcement of adequate PPE like gloves, safety boots, and hard hats for the project workers.
x. Any labourer/daily worker employed on the project shall be properly screened before commencing work.
xi. The site shall be secured with perimeter fencing and security men.

2) Construction Phase

a) Excavation works shall only be carried out during fair weather conditions.
b) Excavated soil shall be stockpiled on a dedicated spot in the project location for future use.
c) The work area for the project shall be clearly demarcated and cordon off to prevent encroachment into the site.
d) The construction workers shall be provided with appropriate PPE to enable carry out the job safely.
e) As many as possible construction workers shall be employed from the host communities.
f) Gender-Based Violence (GBV) Action Plan for EEP shall be implemented for the Project throughout the lifecycle.
g) All workers shall be required to sign a code of conduct to prohibit any form of Gender-Based Violence/Sexual Exploitation and Abuse (GBV/SEA) on the project.
h) GBV sensitive channels for reporting in GRM shall be implemented for the Project.

i) The EPC Contractor shall be required to hire at least a GBV officer.
j) The EPC Contractor shall collaborate with appropriate government institutions or GBV service providers to address any form of GBV case.
k) EPC Contractor shall provide separate conveniences for men and women use on the project site with appropriate caution signs.
l) Health, Safety and Environment Policy shall be developed and implemented for the EEP to first prevent as well as adequately address any incident/accident. There shall be toolbox talks prior to commencement of work activities daily. Construction activities shall be limited to daytime only.
m) At least a safety officer shall be engaged to monitor the compliance of workers to safety rules.
n) Proper safety and caution signs shall be placed at strategically across the site.
o) There shall be routine safety training specific to each job type for all workers on the site.

3) Commissioning Phase

i. On installing the components of the project in line with the manufacturers' standards, the packages shall be cleared off the site and properly disposed by accredited vendors.
ii. The entire site shall be cleared of all waste/unused materials, empty packages and appropriate receptacles for segregating wastes shall be placed in strategic points across the constructed facility.
iii. The components of the project shall be subjected to testing by experienced personnel in the EPC Contractor.
iv. On establishing that the components are functioning optimally, the project shall be handed over to the Operations and Maintenance (O & M) Contractor by the EPC Contractor.

4) Operations and Maintenance Phase

i. Ensure that all materials/resources needed to operate the project are available, stocked and regularly replenished.
ii. Appropriate PPE shall be provided and enforced for all workers pertaining to their duties on the project.
iii. Ensure regular and routine training of the workers on the project.
iv. Ensure the health and safety of the workers through enactment of the HSE Policy developed for the project.
v. Appropriate safety and caution signs shall be placed at strategic points across the facility.
vi. Ensure strict compliance by employees to the SOPs that are established for the project.
vii. A grievance redress mechanism (GRM) procedure for receiving and addressing the concerns of employees shall be established for the project.
viii. The GBV Action Plan for EEP shall be sustained throughout the Project lifespan.

ix. All employees on the project shall be required sign a Code of Conduct form to prohibit any form of Gender-Based Violence/Sexual Exploitation and Abuse (GBV/SEA).
x. There shall be a GBV sensitive channel for addressing GRM on the project.
xi. The O & M Contractor shall be required to employ at least a Gender/GBV Officer.
xii. The O & M Contractor shall collaborate with relevant government institutions and/or GBV service providers to address any GBV case on the project.
xiii. The O & M Contractor shall provide separate and sufficient conveniences for men and women use on the facility with appropriate caution signs.
xiv. An appropriate Waste Management Plan (WMP) has been developed (Annex 3) and shall be implemented throughout the project lifespan.
xv. A comprehensive Environmental and Social Management Plan (ESMP) shall be developed and implemented throughout the project lifespan.

ES 7.0 Environmental and Social Management Plan

The Environmental and Social Management Plan (ESMP) is part of the key elements of the ESIA study to satisfy long term objectives of managing and monitoring the diverse negative impacts of the proposed project. It covers the entire lifecycle of the Project and also includes desired outcomes; performance indicators; monitoring (parameters to be monitored and frequency); responsibilities and cost estimates required for implementation. REA-PMU is committed to the implementation of the ESMP and shall work with relevant agencies at local, state and national levels to ensure full compliance. REA shall have principal responsibility for all measures outlined in the ESMP, but may delegate responsibility to its contractors, where appropriate and monitor the implementation. The relevant regulatory authorities at Federal, State and Local Government levels shall also be involved in the monitoring of the ESMP implementation.

ES 8.0 Decommissioning and Rehabilitation Plan

Every manmade object has a lifespan, so it is with this EEP project though it shall be sustained with regular maintenance and routine upgrades. When it can no longer perform optimally, the project shall be decommissioned into the varied parts and each part disposed in line with the manufacturers' guidelines while local components shall be recycled in line with prevailing standards. Thereafter, the site shall have rehabilitated and restored for farming purposes being the initial state before the project was developed.

ES 9.0 Conclusion and Recommendation

The proposed Energizing Education Programme (EEP), Nigeria Electrification Project Phase II (Desert-to-Power) project to be established in the Federal University of Agriculture and Technology, Okeho is an eco-friendly development and is in compliance with the transition to adopt more renewable energy/power sources in the effort to combat global climate change effects. More importantly, it will improve the entire function of the University as well as other business ventures within the campus and enhance security for all on the campus. In light of the Environmental and Social Management Plan (ESMP) that has been developed to adequately mitigate all the identified significant impacts, the EEP Phase Nigeria Electrification Project Phase II (Desert-to-Power) project is hereby recommended for EIA Approval and subsequent commencement of project activities.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Subproject

The Federal Government of Nigeria (FGN), through the Rural Electrification Agency (REA), is implementing the Nigeria Electrification Project Phase II (Desert-to-Power) with financial support from the African Development Bank (AfDB). The project's primary objective is to accelerate Nigeria's electrification efforts by deploying sustainable, off-grid and grid-connected solar-powered renewable energy solutions. By leveraging Nigeria's vast solar energy resources, the initiative aims to provide clean, reliable, and long-lasting electricity to Federal Universities and their affiliated teaching hospitals. The broader goal is to enhance academic performance, support research initiatives, and improve healthcare service delivery.

As part of the Energizing Education Programme, the REA intends to electrify 24 Federal Universities and Teaching Hospitals through solar-hybrid mini-grid systems exceeding 1 MW per site. The Government intends to apply part of the proceeds toward engaging a qualified Environmental and Social Consulting Firm to prepare Environmental and Social Impact Assessments (ESIAs) for 13 universities proposed under the AfDB-financed component.

1.2 Objectives of the ESIA

The overall objectives of an ESIA are: 1) to avoid or minimize adverse environmental and social effects before they occur; 2) to integrate environmental and social concerns into decision-making.

The specific objectives of this ESIA are to:

- Establish environmental and socio-economic baselines for the site;
- Identify, predict, and evaluate environmental, social, health, and safety impacts (positive and negative);
- Recommend mitigation and enhancement measures;
- Ensure compliance with AfDB and Nigerian E&S standards;
- Develop site-specific Environmental and Social Management Plans (ESMPs); and
- Facilitate environmental approvals, and stakeholder acceptance.
- Support REA in securing FMEnv ESIA certification and AfDB no-objection;
- Conduct inclusive stakeholder engagement (including women, youth, and persons with disabilities); and
- Build local institutional capacity for ESMP implementation.

Special attention shall be given to vulnerable groups, gender equality, disability inclusion, resettlement risks, occupational health and safety, and climate resilience. This must be in line with the requirements of the Federal Government of Nigeria and the African Development Bank's Integrated Safeguards System to ensure that any adverse effects on the environment and wellbeing of people are properly identified and mitigated.

1.3 Scope of the ESIA Study

In line with the Terms of Reference (TOR), the scope of the ESIA study covers the following:

1.3.1 Scope of the Assignment – Methodology and General Approach

The Consultant, who shall be duly registered with the Federal Ministry of Environment, towards achieving the objectives noted under section 4 above, shall carry out the following activities:

a) Phase 1 – Desk Review and Scoping

- Review prior NEP documentation, feasibility studies, conceptual project design and maps.
- Conduct preliminary stakeholder identification and risk screening.
- Prepare forms and register the project with the FMEnv.
- Prepare and submit detailed work plans

b) Phase 2 – Baseline Studies (within at least 5km radius)

- Biophysical: Air, water, soil, noise, flora, fauna, hydrology.
- Socio-economic: Demography, livelihoods, gender, land tenure, cultural heritage, transport/traffic studies.
- Laboratory analysis shall be performed by FMEnv-accredited laboratories.
- GIS and remote sensing tools shall be used for mapping and sensitivity analysis.

c) Phase 3 – Impact Assessment

- Identify and evaluate direct, indirect, and cumulative impacts.
- Assess greenhouse gas emissions and pollution pathways.
- Use AfDB's and FMEnv's risk rating methodology (high, moderate, low).
- Develop mitigation hierarchy (avoid, minimize, mitigate, offset).

d) Phase 4 – Stakeholder Engagement

- Conduct Free, Prior, and Informed Consultations (FPIC) with communities, institutions, and Federal/ state agencies.
- Ensure inclusive participation of women, youth, and persons with disabilities.
- Maintain engagement logbooks with signatures, photos, and feedback.
- Establish and operationalize a multi-tier costed Grievance Redress Mechanism (GRM).
- Develop a costed stakeholder engagement plan.

e) **Phase 5 – ESMP Development:** Each ESMP shall include:

- Mitigation measures and performance indicators;
- Roles, responsibilities, and institutional arrangements;
- Monitoring framework and schedule;
- Capacity-building plan;

- Estimated costs and financing sources;
- Integration strategy into EPC contracts.

f) Phase 6 – Reporting and Disclosure

- Submit inception, draft, and final ESIA reports all in soft and hard copies
- Facilitate public disclosure in line with FMEnv procedures (public notice, hearing, gazette publication).
- Ensure AfDB disclosure on its website and InfoShop portal via the PMU E&S Unit.
- Payment of Final access charge and IMM fees.
- Issuance of ESIA Approval Letters and certificates by the FMEnv.

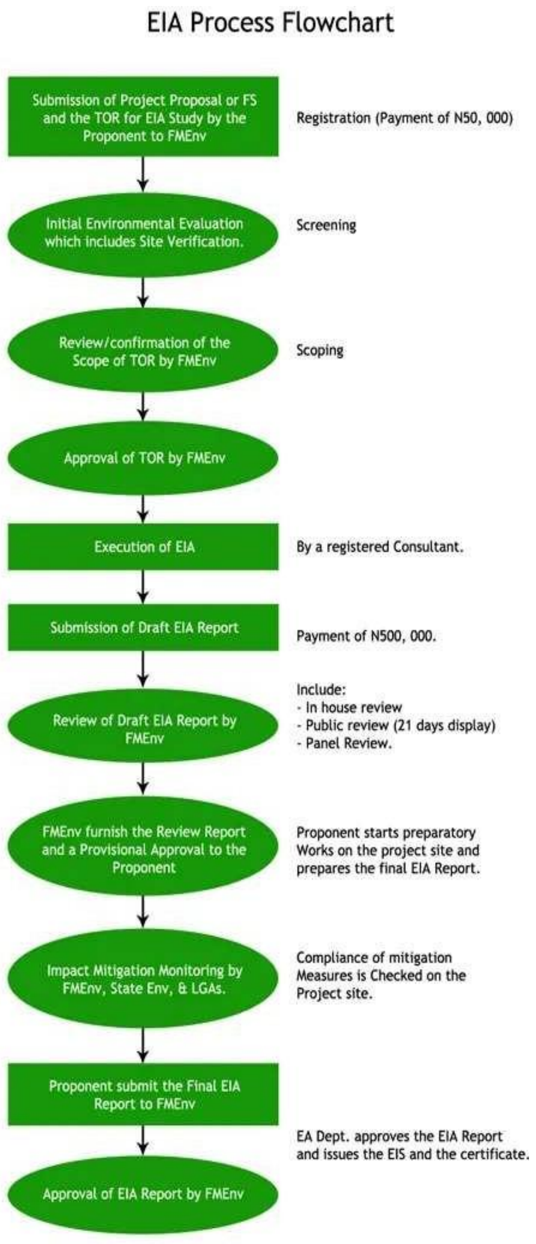


Figure 1. 1: Federal Ministry of Environment Environmental Impact Assessment Process *(Source: Environmental assessment department, Federal Ministry of Environment)*

1.5 Limitation of the study

The Environmental and Social Impact Assessment (ESIA) for the proposed project was conducted in accordance with applicable local and international guidelines and regulatory requirements to identify and evaluate potential environmental and social impacts, and to propose appropriate mitigation measures for the identified adverse impacts. Consequently, stakeholder consultations were conducted using a combination of one-on-one interviews, focus group discussions, and the administration of structured questionnaires. These engagements involved project contact persons, academic and non-academic staff residing on the university campus, as well as the review of relevant secondary data. This approach ensured that sufficient stakeholder input was obtained to support a robust environmental and social assessment of the proposed project.

However, data collection was limited to one (dry) season while data from a previously approved similar study was also used to supplement the second (rain) season dataset for the study. Suffice it to mention that aside from the control samples (AQ_{ctrl}, S_{ctrl} and BH_{ctrl}), data collection was limited to the immediate project's ambient environment.

1.6 Policy, Legal and Administrative Framework

The proposed Project is part of the Federal Government of Nigeria's Energizing Education Programme, a component of the Nigeria Electrification Project being implemented by the Rural Electrification Agency. Several laws and regulations apply to the energy sector in Nigeria. In addition to the above, 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.

1.6.1 FGN Requirements and Relevant Legislation

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

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

1.6.2 Policy, Legal and Institutional Framework

As part of the Energizing Education Programme, the REA intends to electrify 24 Federal Universities and Teaching Hospitals through solar-hybrid mini-grid systems exceeding 1 MW per site. The Government intends to apply part of the proceeds toward engaging a qualified Environmental and Social Consulting Firm to prepare Environmental and Social Impact Assessments (ESIAs) for 13 universities proposed under the AfDB-financed component.

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 (NSITF) drafted a social security strategy. The social protection policy approached social protection using a life-cycle and gender lens, recognizing both economic and social risks, including, for example, job discrimination and harmful traditional practices. The policy was organized around four main themes: social assistance, social insurance, child protection and the labour market.

However, only a few of the instruments of this approach were adopted in the national implementation plan, most notably the provision of specific and limited social assistance, social insurance (such as expanding national health insurance to the informal sector) and labour market programmes (such as developing labor-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 coordination.

A significant number of actors are involved in funding and implementing social protection, including those from government, donors, international non-governmental organizations and civil society. Federal government-led social protection includes three main programmes:

i. 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);
ii. the health fee waiver for pregnant women and children under five (financed through the debt relief gains (DRG fund); and
iii. 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 privatization of the electric power sector.

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

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

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 categorized 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 bedifficult 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 section is relevant:

- **Section 6** prohibits the taking or destruction of fish by harmful means. This offence is punishable with a fine of ₦3, 000 or an imprisonment term of 2 years, or both. One of the integral components of 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.

1.6.4.1 National Commission for Museums and Monuments Act

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.

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.

1.6.4.2 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 EEP 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.

1.6.4.3 Labour Act

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. Wages Board and Industrial Council Act, 1974

The Act provides for the establishment of a National Wages Board and Area Minimum Wages Committee for States and for Joint Industrial Councils for particular industries. It empowers the Minister to order or direct that an industrial wages board be established to perform, in relation to the workers described in the order and their employers, the functions specified in the provisions of this Act, including minimum wage. The minimum wage is currently ₦70,000.00 per month, and all individuals contracted/employed in relation to this programme shall not earn less than the minimum wage.

1.6.4.13. Workers' Compensation Act, 1987

The Act makes provisions for the payment of compensation to workmen for injuries suffered in the course of their employment. The compulsory insurance covers employees for injury or death resulting in the course of work or in work places. All types of workers are covered including those employed under a contract for service or an apprenticeship with an employer, whether by way of manual labour, clerical work or otherwise, and whether the contract is expressed or implied, is oral or in writing. The programme will employ both skilled and non- skilled labour and shall be subject to this law as applicable.

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 (Energy Sector) Regulations, 2014. S.I. 63.
- National Environmental (Electrical/Electronic Sector) Regulations, 2011, S.I. No. 23
- 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.

1.6.5 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
- Convention on Biological Diversity
- Endangered Species (Control of International Trade and Traffic)
- Conservation of Migratory Species of Wild Animals 1973
- Framework Convention on Climate Change 1992
- Convention to Combat Desertification 1994
- Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW)
- Human and Peoples' Rights on the Rights of Women in Africa 2005
- Civil and Political Rights Covenant
- Economic, Social and Cultural Rights Covenant
- Convention on the Elimination of All Forms of Violence Against Women
- Convention on the Rights of the Child

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) ensure the embodiment of laws and regulations focused on the protection and sustainable development of the environment and its natural resources are monitored and complied with. NESREA ensures that the operational phase of the solar power system mini-grid project complies with national environmental standards and regulations.

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) Rural Electrification Agency (REA). The responsibilities of the Federal Ministry of Power are as follows:

- Initiating and formulating broad policies and programmes on the development of the power sector Initiating concessions in the power sector Licensing of electrical contractors and electric generating sets of 1MW capacity and below
- Conducting investigation on electrical accidents and to ensure safety in the electricity industry in Nigeria.
- Conducting statutory tests and certification of electric poles (concrete, wooden, steel etc.) and other major electrical materials before they are used on the grid and networks in Nigeria.
- Implementing renewable energy programmes/ initiatives (solar, wind, biomass, small hydro etc.) Coordinating activities of the power sector.
- Handling policy matters relating to research and development in the power sector.
- Promoting the development of hydro power plants through public private partnership (PPP) Participating in bilateral and multilateral relations affecting the power sector
- Facilitating the overall coordination of the activities of the parastatals under 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:

i. Monitor and regulate the activities of the electricity industry in Nigeria;
ii. Issue licenses to market participants; and
iii. Ensure compliance with market rules and operating guidelines.

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

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 licenses 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

Oyo State Ministry of Environment

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

Oyo State Ministry of Women Affairs and Social Development

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

Oyo State Lands and Survey

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

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

2 The programme has been assigned a category II by the African Development Bank in line with the guidelines within the Bank's ESAP for all power generating plants even though the generating capacity is between 1MW to 10MW. However, the E&S OS 1 (OS1): Assessment and Management of Environmental and Social Risks and Impacts on environmental and social assessment has been triggered because the component activities have the potential to generate some environmental and social impacts to identified receptors within its area of influence which if not well managed can lead to disruption of ecosystem services for the community. E&S OS 2 (OS2): Labour and Working Conditions ~~**OS 5 on Labour Conditions, Health and Safety**~~ is applicable since the construction will involve a significant number of construction workers. E&S OS 3 (OS3): Resource Efficiency and Pollution Prevention and Management ~~**OS 4 on Pollution Prevention and Hazardous Substances**~~ is triggered since construction will involve use of fuels and possibly some hazardous materials. Also, the E&S OS 5 (OS5): Land Acquisition, Restrictions on Access to Land and Land Use, and Involuntary Resettlement ~~**Operational Safeguard (OS2)**~~ is triggered because there will be physical or economical displacement with respect to the seasonal farmers on site. ~~**OS3 on Biodiversity, Renewable Sources and Ecosystem Services**~~ E&S OS 6 (OS6): Habitat and Biodiversity Conservation and Sustainable Management of Living Natural Resources is also trigged due to the activities of the EEP Phase III. However, this OS focuses on the issues of modified, natural and critical habitats, on the requirements to address impacts on ecosystem services; and the importance of applying the Mitigation Hierarchy (Avoid, Minimize, Reduce, Restore, Offset and Compensate).

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 LOCATION AND JUSTIFICATION

This chapter highlights the project location, the rationale for the proposed beyond 1MW solar- hybrid power plant and associated infrastructure at the Federal University of Agriculture and Technology of Technology (FUNATO), Okeho, Oyo State, Nigeria as part of the Federal Government of Nigeria (FGN) Energizing Education Programme (EEP) Phase II. It also includes the description of alternatives and development options considered for the proposed Project.

2.1 Project Site and Locations

The Federal University of Agriculture and Technology, Okeho (FUNATO) is a newly established federal institution located in the Oke-Ogun area of Oyo State, Nigeria. Located in the ancient town of Okeho, the University commenced full academic activities at its temporary site (Awoyemi Commercial High School along the Isemi-Ile Road, Okeho) in November 2025 to further improved the access to education amongst the catchment area and Nigeria in general. The GPS coordinates are Latitude 8.09019 Longitude 3.34645 N8^{0}5’24.67104 E3^{0}20’47.2128

However, the proposed project site is located on the temporary site of FUNATO and has a landmass of 3.465 hectares.

The political map of Nigeria showing the proposed project site (FUNATO) is shown below in figure 2.1.

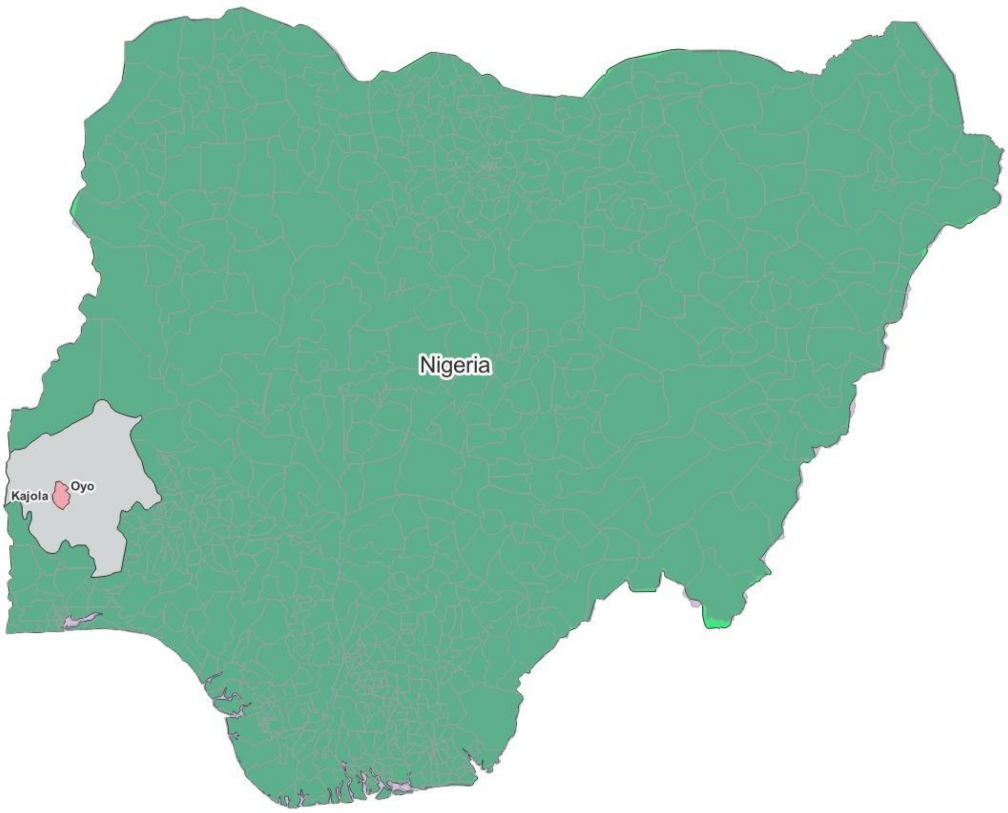


Figure 2. 1: Map location of EEP project site in FUNATO

2.1.1 Federal University of Agriculture and Technology, Okeho, Oyo State

The Federal University of Agriculture and Technology, Okeho (FUNATO) is a newly established federal university located in Okeho, Kajola Local Government Area, Oyo State, within the Oke-Ogun sub-region of Southwestern Nigeria. The institution was established by the Federal Government of Nigeria in 2025 under the administration of President Bola Ahmed Tinubu, with approval from the National Universities Commission (NUC). The university was created to strengthen Nigeria's capacity in agriculture, science, engineering, and technology-driven innovation.

Institutional Mandate and Strategic Focus

FUNATO was established to serve as a specialized institution integrating agriculture with modern science and technology to address national priorities such as food security, climate resilience, agribusiness development, digital agriculture, and sustainable rural transformation. The university's vision is to become a world-class institution recognized for excellence in agricultural innovation and technological advancement. Its mission centers on quality teaching, applied research, community engagement, and production of highly skilled graduates capable of solving real-world agricultural and environmental challenges.

Academic Structure

The university is structured into specialized colleges covering core agricultural and technology disciplines. Approved academic units include:

- College of Agricultural Development & Human Ecology
- College of Livestock Development & Environmental Sciences
- College of Plant Science & Crop Production
- College of Engineering & Technology
- College of Science & Computing
- College of Environmental Design & Geospatial Technology

The institution offers over 30 undergraduate programmes spanning agriculture, agribusiness, animal science, crop production, computer science, engineering, environmental management, and geospatial technologies. Academic operations for the pioneer cohort commenced in the 2025/2026 academic session following resource verification by the NUC.

Leadership and Governance

The university is currently led by its pioneer Vice-Chancellor, Professor Olaniyi Jacob Babayemi, who is overseeing institutional development, academic stabilization, and infrastructure expansion. Governance structures are aligned with federal university standards in Nigeria.

Infrastructure and Campus Development

FUNATO is presently operating from a temporary take-off site in Okeho while permanent campus development is ongoing. Planned infrastructure includes modern lecture halls, laboratories, research farms, innovation hubs, student hostels, administrative complexes, and recreational facilities. The long-term master plan emphasizes sustainability, smart campus systems, renewable energy integration, and research-driven agricultural demonstration facilities.

Strategic Importance

The establishment of FUNATO represents a major milestone for Oyo State and the Oke-Ogun region.

The university is expected to:

- Drive regional agricultural modernization
- Enhance research and innovation in agritech and environmental sciences
- Generate employment and stimulate local economic growth
- Strengthen Nigeria's human capital in STEM and agricultural disciplines
- Support national development priorities under food security and climate adaptation frameworks

2.2 Description of Project Site

The proposed project site is located at the temporary site of the Federal University of Agriculture and Technology, Okeho, Oyo State.

The summary description of the project site, is given in the table 2.1.

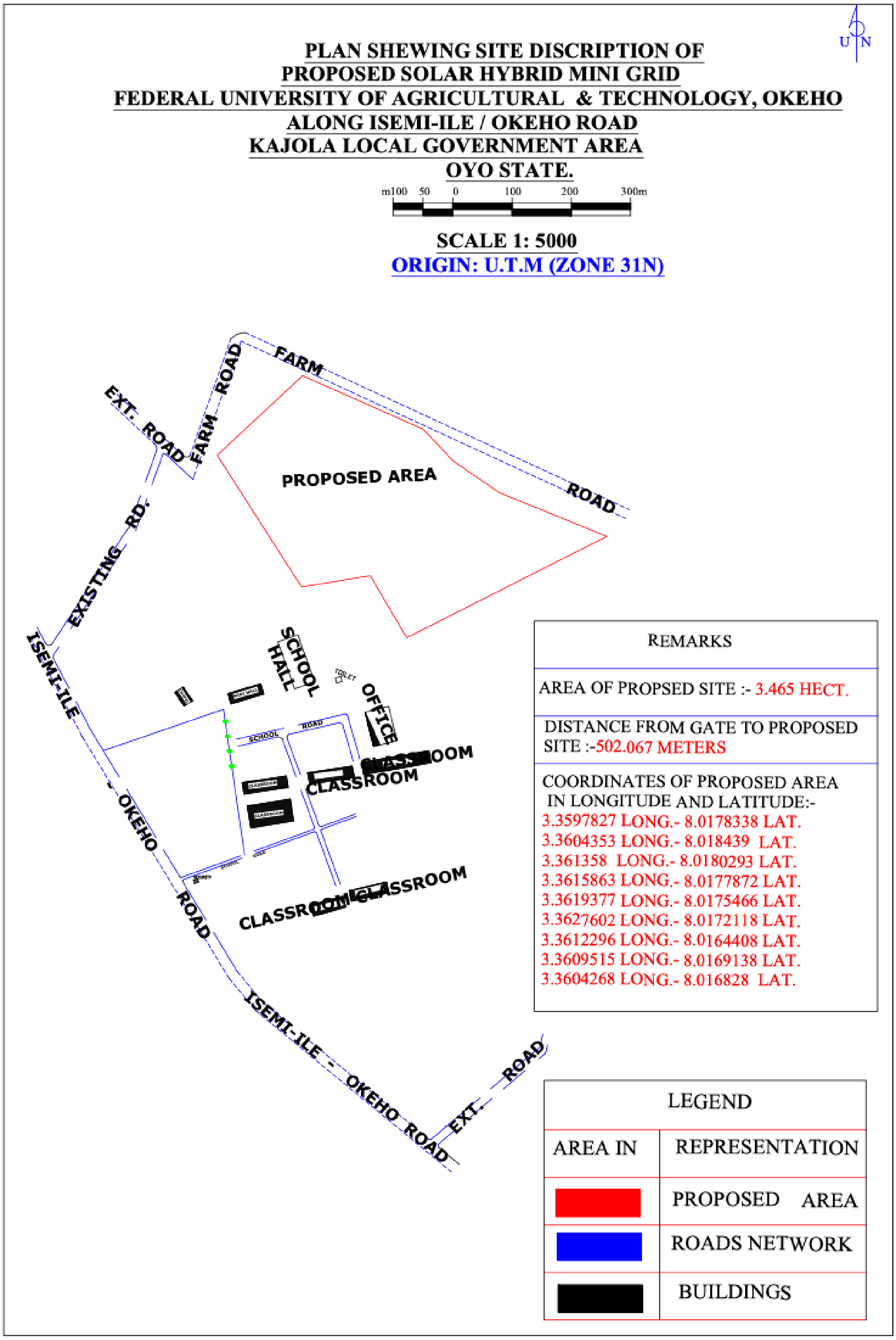
Table 2. 1: Location Characteristics

PV Plant location characteristics	
City / Town	Oyo
Region/ country	Oyo, Nigeria
Latitude	8.09019
Longitude	3.34645
Altitude	1,368 ft
Time zone	UTC +1

(Source: REA NEP 3 FEED)

Survey Assessment of the Proposed Site

The site is located at the main campus and is situated on a relatively flat land. The site is 502.067-meter way from the school security gate. With the permission of the project committee, following the school's standard for buffer zones, setbacks and necessary planning rules the surveyed area of the new site has a total size of 3.465Ha. Table 2.2 is the final coordinates of the proposed project area.


PLAN SHEWING SITE DISCRIPTION OF
PROPOSED SOLAR HYBRID MINI GRID
FEDERAL UNIVERSITY OF AGRICULTURAL & TECHNOLOGY, OKEHO
ALONG ISEMI-ILE / OKEHO ROAD
KAJOLA LOCAL GOVERNMENT AREA
OYO STATE.
m100 50 0 100 200 300m
SCALE 1: 5000
ORIGIN: U.T.M (ZONE 31N)
U N
FARM ROAD
EXT. ROAD
EXISTING RD.
PROPOSED AREA
ISEMI-ILE - OKEHO ROAD
SCHOOL HALL
OFFICE
CLASSROOM
CLASSROOM
CLASSROOM
CLASSROOM
EXT. ROAD
REMARKS
AREA OF PROPSED SITE :- 3.465 HECT.
DISTANCE FROM GATE TO PROPOSED SITE :-502.067 METERS
COORDINATES OF PROPOSED AREA IN LONGITUDE AND LATITUDE:-
3.3597827 LONG.- 8.0178338 LAT.
3.3604353 LONG.- 8.018439 LAT.
3.361358 LONG.- 8.0180293 LAT.
3.3615863 LONG.- 8.0177872 LAT.
3.3619377 LONG.- 8.0175466 LAT.
3.3627602 LONG.- 8.0172118 LAT.
3.3612296 LONG.- 8.0164408 LAT.
3.3609515 LONG.- 8.0169138 LAT.
3.3604268 LONG.- 8.016828 LAT.
LEGEND
AREA IN
REPRESENTATION
PROPOSED AREA
ROADS NETWORK
BUILDINGS

2.3 Need for the 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-powered 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 EEP, with the objective of providing dedicated, clean and reliable power supply to Federal Universities and affiliated University Teaching Hospitals across the country. Also, the EEP 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 Agriculture and Technology, Okeho, is part of the FGN's EEP Phase III, under NEP. The Project will help to significantly address the challenges of power supply currently faced in the University, which will likely lead to many positive spill-over effects. The associated infrastructure such as the training centre to be provided as part of the Programme would enhance learning in renewable energy leading to certification, while the street lighting will improve security within the campus as a result of proper illumination.

2.4 Value of the Project

NEP is being co-financed by the African Development Bank through a US$200 million loan facility. The total funding available for the EEP phase II component is US$123 Million. Funding breakdown of the EEP 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.

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 1.8 Giga watt hours (GWh) of solar energy per year.
- The electricity generated will be sufficient to power more 250 additional facilities including student hostels and 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.
- Increase in social interactions within the University. There will be enhanced security in the University as a result of more streetlights for illumination which would help keep off opportunistic crimes and gender-based violence. Enhancement of learning in renewable energy as a result of training centre to be provided as part of the Project.
- Improvement in livelihood enhancing activities within the University.
- Direct and indirect employment opportunities during Project development and operation. The employment opportunities will lead to acquisition of new skills and introduction of all manners of income generating spill-over effects. Increase in local and regional economy through award of contracts and purchase of supplies for Project development.
- Increase in financial and technical collaborations between the FGN, the University, REA, AfDB and other relevant Ministries, Departments and Agencies (MDAs).
- Contributing to the Nigeria's NDC to cut carbon emission by at least 20 % by the year 2030, under the Paris Agreement.

Thus, the socio-economic benefits attached to this rural electrification access intervention, the EEP, 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 EEP 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 contractor (to be selected by REA through a competitive process) according to pre-established standards and procedures. The design and construction phase of the Project shall be overseen by qualified engineers from REA and the Department of Works and Physical Planning in Federal University of Agriculture and Technology of Technology, Okeho. 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 Agriculture and Technology of Technology's Works and Physical Planning Department. In addition, adequate capacity building shall be provided to the University personnel that will work with the O&M Contractor for the day-to-day operations of the Project in the long run. 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 EEP initiative, a component of NEP. NEP is being co-financed by the AFDB. The total funding available for the EEP phase II component is US$123 Million. Funding breakdown of the EEP 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, power consumption through the grid would stop or reduce significantly.

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

2.5.4 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) is being 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 EEP 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 Agriculture and Technology, Okeho was carried out duly by the Consultant. 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 2.4 parabolic troughs, heliostats (for power towers), linear Fresnel lenses, and dish receivers.

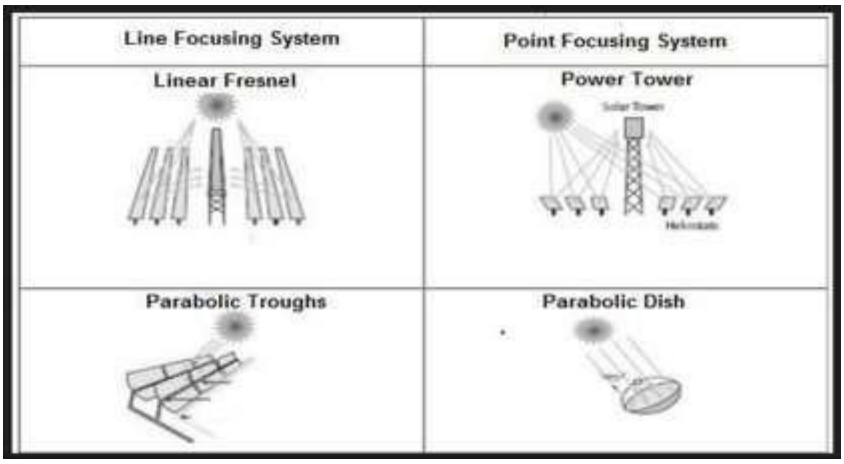


Figure 2. 4: Four different types of solar collector designs
(Source: The end of CSP as we know it? | Energiek (wordpress.com))

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 2. 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%

2.7.4. Solar Batteries Alternatives

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

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.

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.

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.

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. **N.B.** The final design option is in preference of lithium battery.

2.7.5 Project Options 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.

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.

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 proposed construction and installation of a beyond 1MW solar hybrid project at the Federal University of Agriculture and Technology, Okeho in the Kajola LGA of Oyo State by the Federal Government of Nigeria (FGN) through the Rural Electrification Agency (REA) is aimed at transforming the new University to an enviable standard due to the potential of the project to ensure sustainable supply (24/7) of electricity which no doubt will enhance research, improved academic activities, improved security and more importantly trigger socio-economic activities within the campus.

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 silicon. The plant would consist of solar panel arrays sufficient to generate the rated power of 1200 kWac and the peak power is 1,000kWdc resulting in a DC/AC ratio of 1.2. 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 center
- Site office and maintenance building
- Lay down and assembly area

Project: FEDERAL UNIVERSITY OF AGRICULTURE AND TECHNOLOGY, OKEHO HYBRID SOLAR PV CAPTIVE POWER PLANT

POWER		QUANTITIES	
Rated Power	4180 kW	Modules (415.0 Wp)	12090
Peak power	5000 kW	Strings	403
DC/AC Ratio	1.2	Structures	403
PRODUCTION		Inverters up to 110	38
Specific production	1627 kWh/kWp	Power stations (up to	3
Energy (year 1)	8172		
Performance ratio	70.15%		

SITE CHARACTERISTICS

LOCATION		TERRAIN SLOPES	
Site name	MAUTECH REVISED 3	Average NS/EW	1.38% / 1.64%
Country	Nigeris	Max N-S	12.81%
Lat / Long	9.35° / 12.49°	Max E-W	12.85%
Net available area	15.0 ha	Elevation max/min	215.18 / 200.43 m

METEOROLOGICAL DATA		HORIZON	
GHI	2266.0 kWh/m2	Source	SOURCE_PVGIS
Temp	29.38 °C	Average	0.9°
Temp Max/Min	43.55 / 17.52 °C	Maximum	2.7°
Source	PVGIS		

EQUIPMENT

PV MODULE		FIXED MOUNTING STRUCTURE	
Company	Generic	Company	Generic
Model	Generic	Model	Generic - 1H
Technology	Si-poly, monofiocal	Type	1H
Peak Power	415.0 Wp	Pitch	3.04
Voltage Max	1500.0 V	Maximum modules	0

INVERTER		POWER STATION	
Company	Generic	Power AC	1980.0 kVA
Model	Generic	Num. inverters	18
Rated Power	110.0 kVV	Num. transform.	1
Range MPPT	880 - 1300 V	Transf. Ratio	0.8/11.0kV
Voltage Max	1500.0 V	Service	Indoors

CONFIGURATION

CIVIL		ELECTRICAL WIRING	
Roads position	Vertical	Configuration	String inverter
Roads width	4	String cables	4 mm2 Cu
Layout type	ADAPTATIVE	LV AC cables	25, 70 mm2 Al
		MV cables	150 mm2 Al

Figure 3. 1: Overview of Site Characteristics, Equipment and General Configuration
(Source: REA EEP 3 Front End and Engineering Design)

3.2 Project Requirements

Land: The area where the PV plant is to be built consists of one available area within the temporary campus (Awoyemi Commercial High School, Okeho), with a total surface area of 3.465ha. The final available area covers a surface of 3.465ha. The size of each area and the total suitable area for installation purposes is shown in Table 3.1.

Table 3. 1: Spatial Coverage of Proposed Project Area

Description of Available Area	Size (Ha)
Available areas	3.465
Restricted areas	0ha
Sub-station area	0ha
Total available area	3.465ha

Also, the coordinates showing the spatial boundaries of the proposed project (Solar Hybrid Project) at the Federal University of Agriculture and Technology, Okeho, Oyo State is presented in Table 3.2 below.

Table 3.2: Spatial Boundaries of the Proposed Site

S/n	Eastings (Long)	Northings (Lat)
1.	3.3598719	8.0178338
2.	3.36039	8.0181688
3.	3.3608227	8.0181253
4.	3.3603931	8.0176482
5.	3.3600288	8.0175839
6.	3.360299	8.0172605
7.	3.3607393	8.0175761
8.	3.3611112	8.0180604
9.	3.3614824	8.017719
10.	3.3610096	8.0174035
11.	3.3606306	8.0170053
12.	3.3612546	8.0171089
13.	3.3611179	8.0167869
14.	3.3615288	8.0170909
15.	3.3608692	8.0175439

Figure 3.2 is an illustration of the general layout of the PV plant showing the component of the project including solar panel area (blue), training center (yellow), sub-station (purple), and restricted area not suitable for the installation of PV modules (red) while the satellite image of the proposed project site is also presented in figure 3.3.

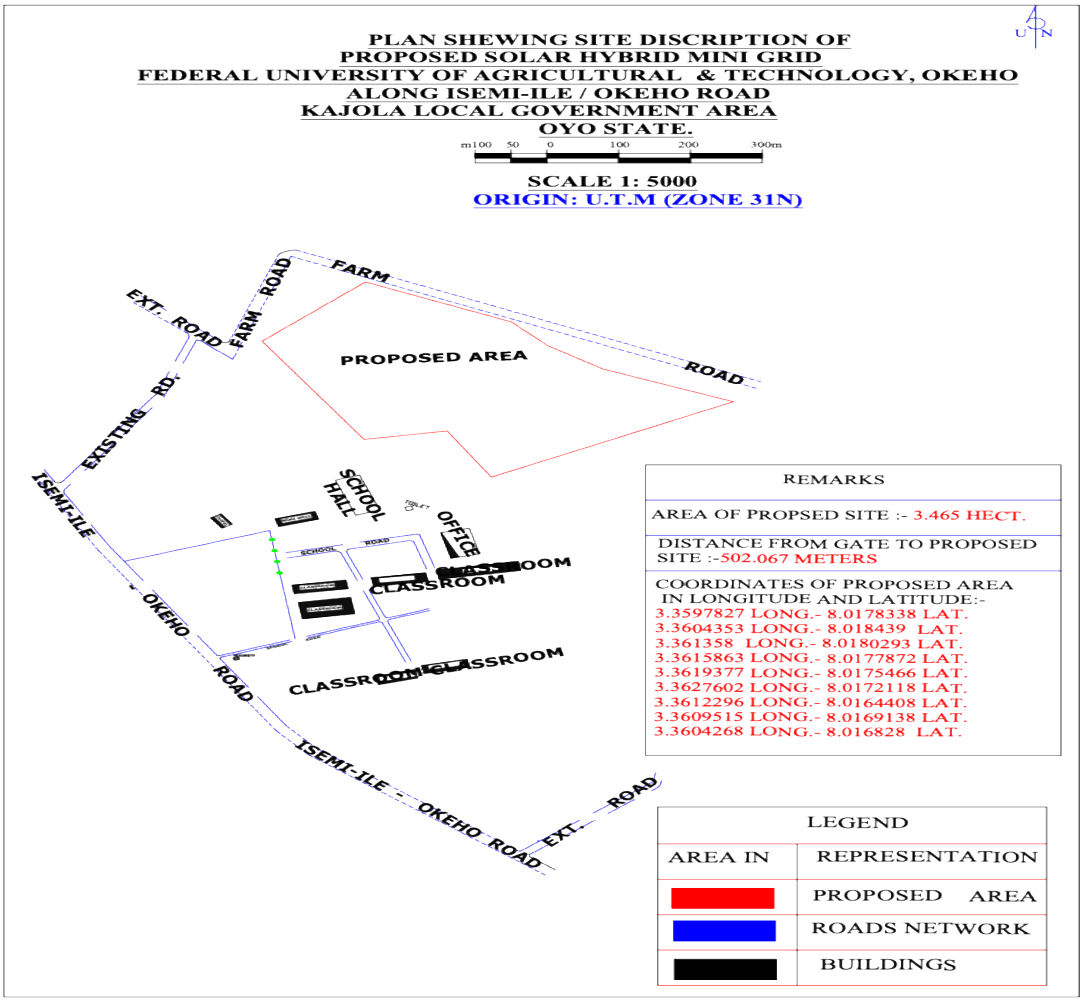


Figure 3. 2: Plot Areas of the Proposed FUNATO PV Plant

Figure 3.3: Satellite Image of the Proposed Project Site at FUNATO, Okeho

Water Use and Supply: Climate Conditions and Water Resource Management

Climatic Characteristics of Okeho Community

The proposed Project is located in Okeho Community, Kajola Local Government Area of Oyo State. The area falls within the Köppen Aw climatic classification, characterized as a tropical savannah climate with a distinct dry season during the low sun period.

Okeho experiences two clearly defined seasons:

- Dry Season: October to late March (approximately five months)
- Rainy Season: April to September, with peak rainfall typically occurring in August and September.

The area records an average annual rainfall of approximately 958.99 mm, indicating moderate precipitation sufficient for seasonal groundwater recharge. The average minimum temperature is approximately 15.2°C, while the average maximum temperature is approximately 39.7°C. The hottest months are March and April, during which temperatures may rise to about 42.7°C, while the coldest months are November and December, with minimum temperatures as low as 11.11°C.

During the dry season, particularly between December and February, the Harmattan wind transports fine dust particles from the Sahara region, resulting in increased atmospheric dust concentration. This condition has operational implications for solar photovoltaic (PV) installations, particularly in relation to panel efficiency and maintenance frequency.

Implications for Solar Photovoltaic Operations

The tropical savannah climate of Okeho presents favorable solar irradiation conditions suitable for photovoltaic power generation. However, seasonal dust accumulation during the dry Harmattan period may reduce panel efficiency if not properly managed.

Panel Cleaning Frequency

Based on climatic conditions and experience from similar solar installations in comparable ecological zones:

- During the rainy season, natural rainfall provides partial cleaning of PV panel surfaces. Manual cleaning is anticipated not more than twice within this period.
- During the dry season, particularly at the peak of Harmattan, cleaning frequency will be determined by the rate of dust accumulation and performance monitoring data.

Routine inspection and preventive maintenance protocols will be established to ensure optimal performance while minimizing water usage.

Water Requirement for Operational Phase

The primary water demand during the operational phase of the Project will be for periodic cleaning of PV panels.

Based on industry practice and similar project benchmarks:

- Each PV panel requires approximately 5 litres of water per cleaning cycle.
- Cleaning will occur intermittently and will not represent continuous or large-scale abstraction.

The estimated volume of water for the operational phase is presented below.

Table 3.3: Estimated Volume of Water During Operation Phase

S/N	Activities	Estimated Quantity Required
1.	Number of solar panels (approximately)	5,500
2.	Volume of water per panel	5 Litres
3.	Annual cleaning cycle	3 times ~~12 (i.e. panels will be cleaned~~pr year-~~once per month)~~
Total annual water requirement		330,000L

The total projected water demand for panel cleaning is considered minimal relative to available groundwater resources in the area.

Water Sources and Supply Strategy

Water required for panel cleaning will be sourced from the following:

1. On-site borehole installation within the Project footprint.
2. Rainwater harvesting system, including runoff collection pond.
3. Supplementary groundwater abstraction if required during prolonged dry periods.

Groundwater recharge within the Project area is primarily driven by direct precipitation. During the rainy season, aquifer reserves increase and borehole yield improves significantly. Given the moderate annual rainfall (approximately 958.99 mm), seasonal recharge is expected to sustain limited abstraction for maintenance activities.

Assessment of Potential Impacts on Groundwater Resources

Based on field observations and estimated operational water demand:

- Water abstraction for panel cleaning is intermittent and low volume.
- The abstraction rate is negligible relative to natural recharge capacity.
- No significant drawdown of the aquifer is anticipated.
- No interference with existing community boreholes or water users is expected.

Furthermore, runoff generated during panel cleaning is minimal. The discharged water will:

- Either evaporate due to high ambient temperatures; or
- Infiltrate naturally into the soil beneath the panel arrays.

As such, the used water remains within the local hydrological cycle, and no surface drainage infrastructure is required due to the low discharge volume.

The Project is therefore not expected to result in significant adverse impacts on groundwater quantity, aquifer sustainability, or community water access.

Water Conservation and Management Measures

To ensure sustainable resource utilization and alignment with national environmental guidelines, the following measures will be implemented:

- Installation of a rainwater harvesting and storage system.
- Construction of a runoff collection pond within the Project site.
- Adoption of water-efficient cleaning methods (e.g., controlled pressure systems).
- Recycling and reuse of water where technically feasible.
- Routine monitoring of borehole yield and groundwater levels.
- Implementation of a Water Management Plan during the operational phase.

These measures will minimize groundwater dependence and promote responsible water stewardship throughout the Project lifecycle.

Conclusion

The climatic characteristics of Okeho Community, Kajola LGA, support the viability of solar PV operations. While seasonal dust accumulation during the Harmattan period may necessitate periodic cleaning, the associated water demand is minimal and environmentally sustainable.

Given the moderate annual rainfall, natural aquifer recharge, limited abstraction volume, and proposed conservation measures, the Project is not anticipated to exert significant pressure on local groundwater resources.

The operational phase water use is therefore assessed as having negligible to minor environmental impact, subject to implementation of the proposed mitigation and monitoring measures.

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 3.3. The university has a good waste management system in place.

3able 3. 3: Waste Streams of Project Phases

Waste Stream	Sources	Waste Generation Phase		
		Construction (C)	Operation (O)	Decommissioning (D)
General rubbish, refuse, and putrescible wastes (food wastes)	Wood splinter, domestic waste, food packs, used bottles	X	X	X
Cleared vegetation	During site clearing and preparation	X	X	X
Scrap metals	Used tubular and casings, used iron rods	X	X	X
Excavated materials	Foundation works	X		X
Damaged/expired PV panels	PV modules	X	X	X
Expired inverters	Electrical installation		X	X
Damaged/expired Batteries	Power generation		X	X
Sanitary waste	Training centre	X	X	X

(Source: Adapted from IFC 2015 Project Developer's Guide to Utility-Scale Solar Photovoltaic Power Plants)

Solar PV network installation standards

Several organizations have developed standards and codes for PV systems. For instance, the American Society of Testing and Materials (ASTM) has developed over 12,000 international standards in order to improve the quality of the products and safety enhancement. Thus, 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 organizational aspects of mini-grids (design, installation, maintenance, contracting) and a checklist of good practices.

3.3 Project Components

The project comprises six components:

- A solar PV farm complete with inverters and transformers,
- Substation,
- Transmission line,
- Access Road,
- Buildings (control room, site office, renewable energy workshop training centre (WTC)), and
- Street Light.

The power plant will use solar panels fitted on fixed structures (mounts). The main characteristics of the fixed mounted structure is stated in Table 3.4.

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 3. 4: Features of the Fixed Mounting Structure

S/n	Feature	Characteristics
1.	Structure type	1H
2.	Tilt angle	9.0 °
3.	Poles type	Bi pole
4.	Pitch distance	3.04 m
5.	Designed for	Mono facial modules
6.	Minimum ground clearance	0.5 m
7.	Gap between modules in the axis direction	0.0 mm
8.	Gap between modules in the pitch direction	0.0 mm

(Source: REA EEP 3 FEED)

The summary of the project's features is presented above in Table 3.5 while the electrical configuration of the proposed PV plant is presented in figure 3.3.

Table 3. 5: Key Project Characteristics

Main Characteristics	
Location	Oyo state
Rated power (AC)	1,000 kW (1.0 MWac)
Peak Power (DC)	1,200 kWp
Ratio DC/ AC	1.20
Civil characteristics	
Suitable plot area	3.465Hectares
Ground coverage ratio (GCR)	32 %
Structure type	Fixed-tilt mounting structure
Pitch distance	3.0 – 3.2 Meters
Electrical characteristics	
PV modules 335.0 (Wp)	3580
Power station (up to 1980.0 kW)	2
Number of inverters (up to 110.0 KVA)	12
Environmental Characteristics	
Gaseous Emissions	None
Discharges	Uncontaminated storm water to be diverted around plant, to be made discharged to natural watercourses as appropriate.
Noise	< 15 dB(A) at nearest noise sensitive premises ≤ 15 dB(A) at plant boundary
Roads	An existing single road offering access to the field will be rehabilitated within the university to link the plants perimeter. All other means of transportation will be held within the boundaries of the field.

(Source: REA EEP 3 FEED)

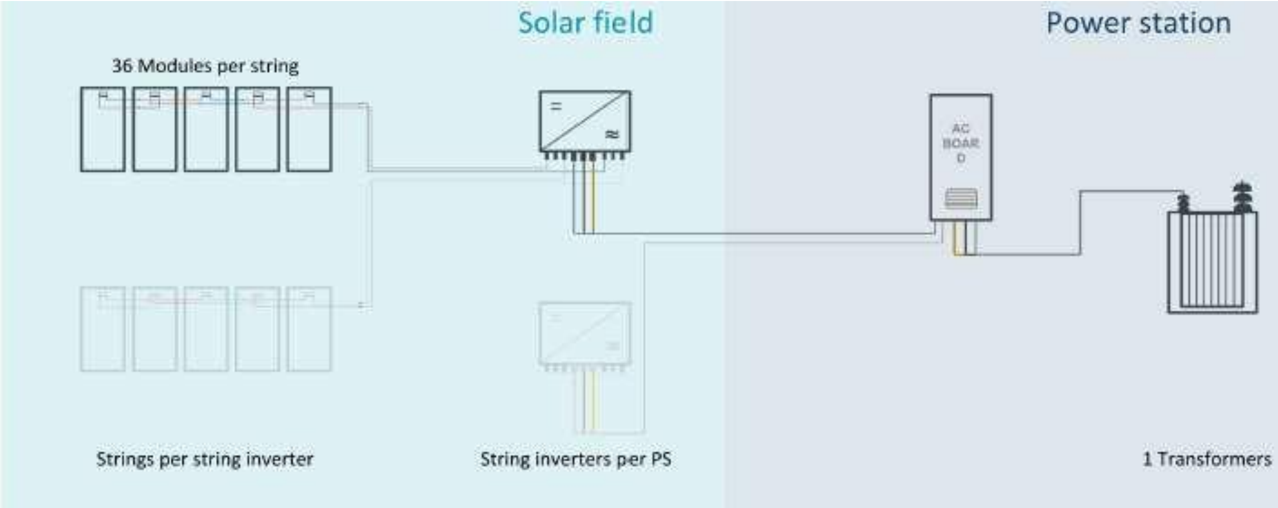


Figure 3. 3: Simplified electrical configuration diagram
(Source: REA EEP 3 Front End and Engineering Design)

Component 1: Solar PV Farm

Solar PV Modules

Solar Photovoltaic (PV) Modules

A photovoltaic (PV) cell is a semiconductor device that converts sunlight directly into electricity through the photovoltaic effect. Multiple PV cells are interconnected to form a PV module, and several modules are assembled into arrays to achieve the desired power output.

The efficiency of a PV module is measured by its ability to absorb photons (light particles) and convert them into electrical energy. Higher photon absorption translates to greater energy conversion efficiency.

The proposed 1 MW Solar Hybrid Mini Grid will consist of ground-mounted photovoltaic arrays installed on fixed-tilt support structures to achieve a total project capacity of approximately:

- 1,000 kW (AC)
- Approximately 1,200 kWp (DC installed capacity)
- DC/AC ratio: 1.20

The feedstock (solar radiation) is naturally available and renewable. Southwestern Nigeria receives strong solar irradiation throughout the year, ensuring reliable long-term energy generation.

Solar PV modules are generally designed for an operational lifespan exceeding 25–30 years, with gradual performance degradation over time (typically <0.7% per annum depending on manufacturer specifications).

Selected Photovoltaic Module Specification

The selected minimum reference photovoltaic module has a peak power rating of 415.0 Wp under Standard Test Conditions (STC). The cell technology is Silicon Polycrystalline (Si-poly) and the module configuration is monofacial.

Estimated Number of Modules Required

To achieve approximately 1,200 kWp (DC):

1,200,000W÷415W≈2,892 modules1,200,000W÷415W≈2,892 modules

Therefore, approximately 2,890 – 2,900 modules will be required, subject to detailed engineering design.

The features of the photovoltaic module are shown in Table 3.5, an example picture of a Monofacial Si-poly module is shown in Figure 3.4.

Table 3. 5: Photovoltaic Module Characteristics

Main characteristics	
Technology	Si-poly
Type of module	Monofacial
Maximum voltage	1500 V
Standard test conditions (STC)	
Peak power	415.0 W
Efficiency	18.79 %
MPP voltage	39.3 V
MPP current	10.55 A
Open circuit voltage	47.8 V
Short circuit current	11.14 A
Temperature coefficients	
Power coefficient	-0.370 %/°C
Voltage coefficient	-0.291 %/°C
Current coefficient	0.050 %/°C
Mechanical characteristics	
Length	2108.0 mm
Width	1048.0 mm
Thickness	0.04 mm
Weight	24.9 kg

(Source: REA EEP 3 FEED)

Figure 3. 4: Example of a Monofacial Si-poly photovoltaic module
(Source: REA EEP 3 FEED)

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).

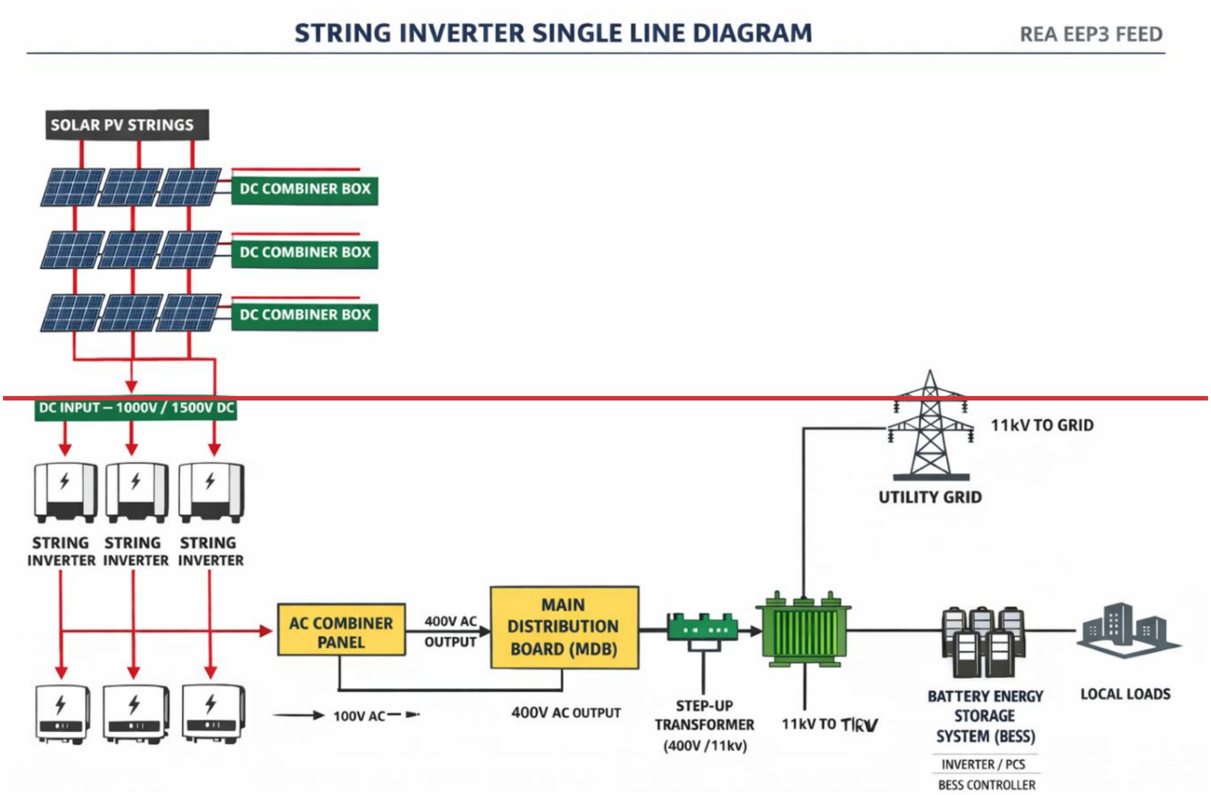
In Figure 3.5, a commonly used photovoltaic inverter for utility-scale PV plant. is presented, and its characteristics detailed in table 3.6. The single line diagram for the inverter is shown in figure 3.6.

Figure 3. 5: Example of String Photovoltaic Inverter
(Source: REA EEP 3 FEED)

Table 3. 6: Features of the Inverter

Features of the Inverter	
Inverter type	String
Maximum DC to AC conversion efficiency	98.79 %
Input side (DC)	
MPPT search range	880- 1300 V
Maximum input voltage	1500 V
Output side (AC)	
Rated power	110.0 kVA
Power at 30 C (datasheet)	110.0 kVA
Power at 50 C (datasheet)	100.0 kVA
Output voltage	800 V
Output frequency	50 Hz

(Source: REA EEP 3 FEED)



~~Figure 3.6: Single Line Diagram for Inverter~~

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.

Figure 3. 7: Example of Transformer

(Source: REA EEP 3 FEED)

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

Table 3. 7: Features of Transformers

Features of Transformers	
Rated power	1980.0 kVA
Voltage ratio	0.8/ 11.0kV
Cooling system	ONAN
Tap changer	2.5%, 5%, 7.5%, 10%
Short circuit (Xcc)	0.08

(Source: REA EEP 3 FEED)

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. An example of an Indoors power station is shown in Figure 3.8.

Figure 3. 8: Example of a power station
(Source: REA EEP 3 FEED)

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 main features of the default power station are shown in Table 3.8. Figure 3.9 is the Power Station Single Line Diagram and figure 3.10 is the proposed FUNATO Power System Master Plan.

Table 3. 8: Power station characteristics

Power station characteristics	
Number of transformers	1
Voltage ratio	0.8/20.0kV
Service Indoors	Indoors

(Source: REA EEP 3 FEED)

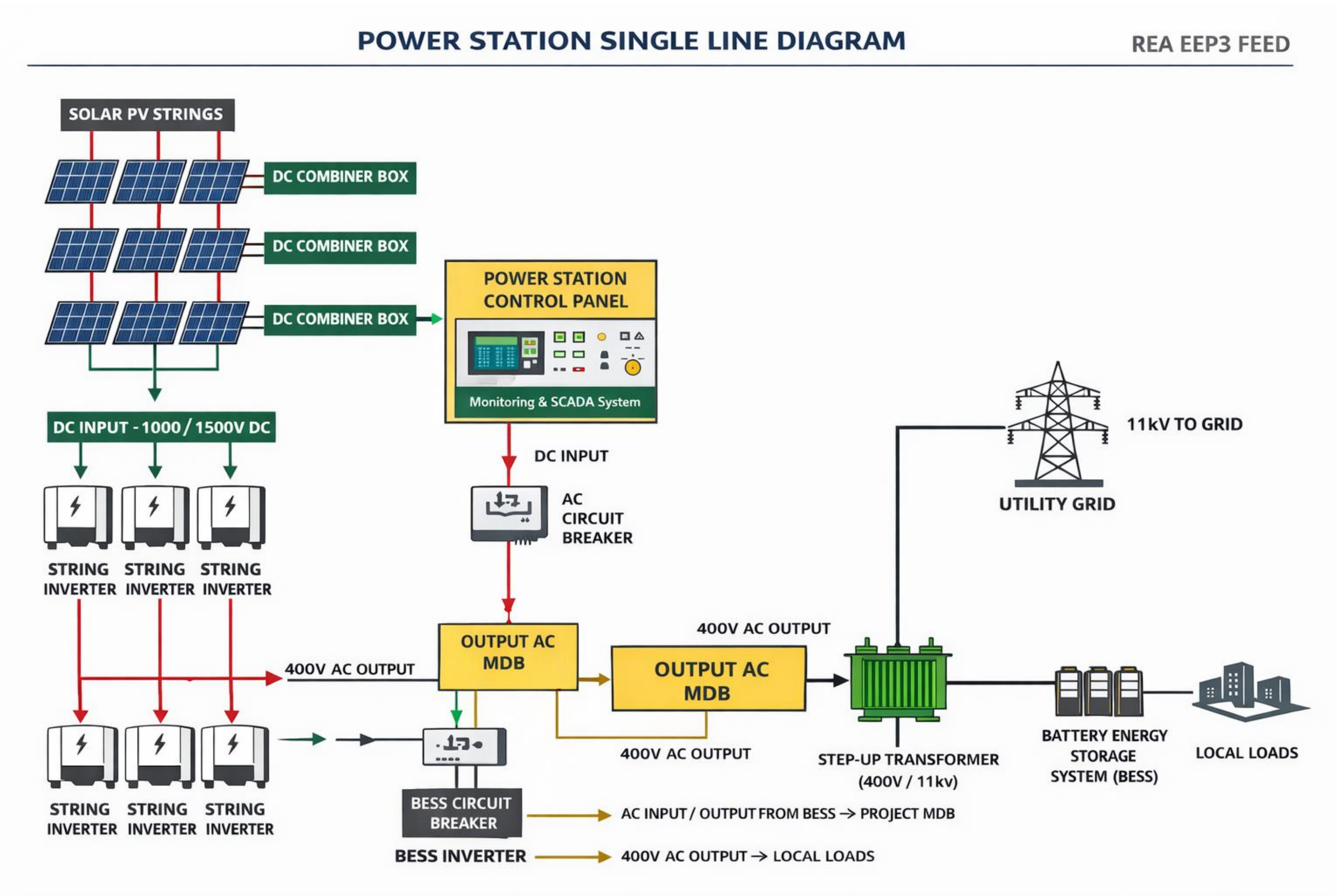


Figure 3. 9: Power station Single line Diagram

(Source: EEP3 FEED)

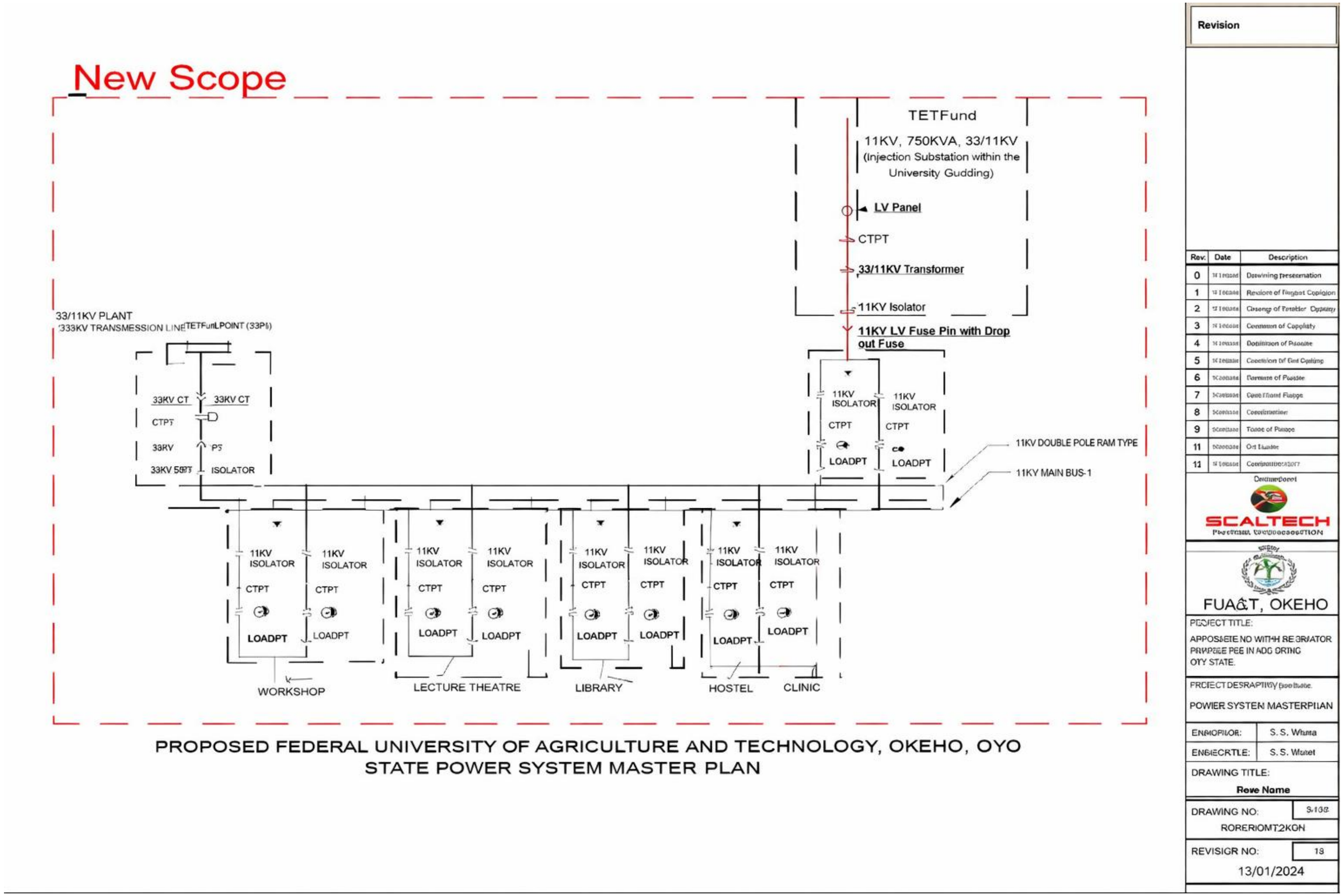


Figure 3. 10: Proposed Federal University of Agriculture and Technology, Okeho Power System Master Plan
(Source: EEP3 FEED)

Component 3: Access Roads

Gravel paved earth access roads within the facility will be constructed (figure 3.11). 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.

For the design of the proposed PV plant, roads of 4.0 m have been used. These roads run a total distance of 404.09 m. Road ditches used for drainage and for channeling water are placed on one side of the roads. Figure 3.11 shows a Typical Road Cross Section for the university. A total perimeter of 1135.42 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.

Component 4: Buildings

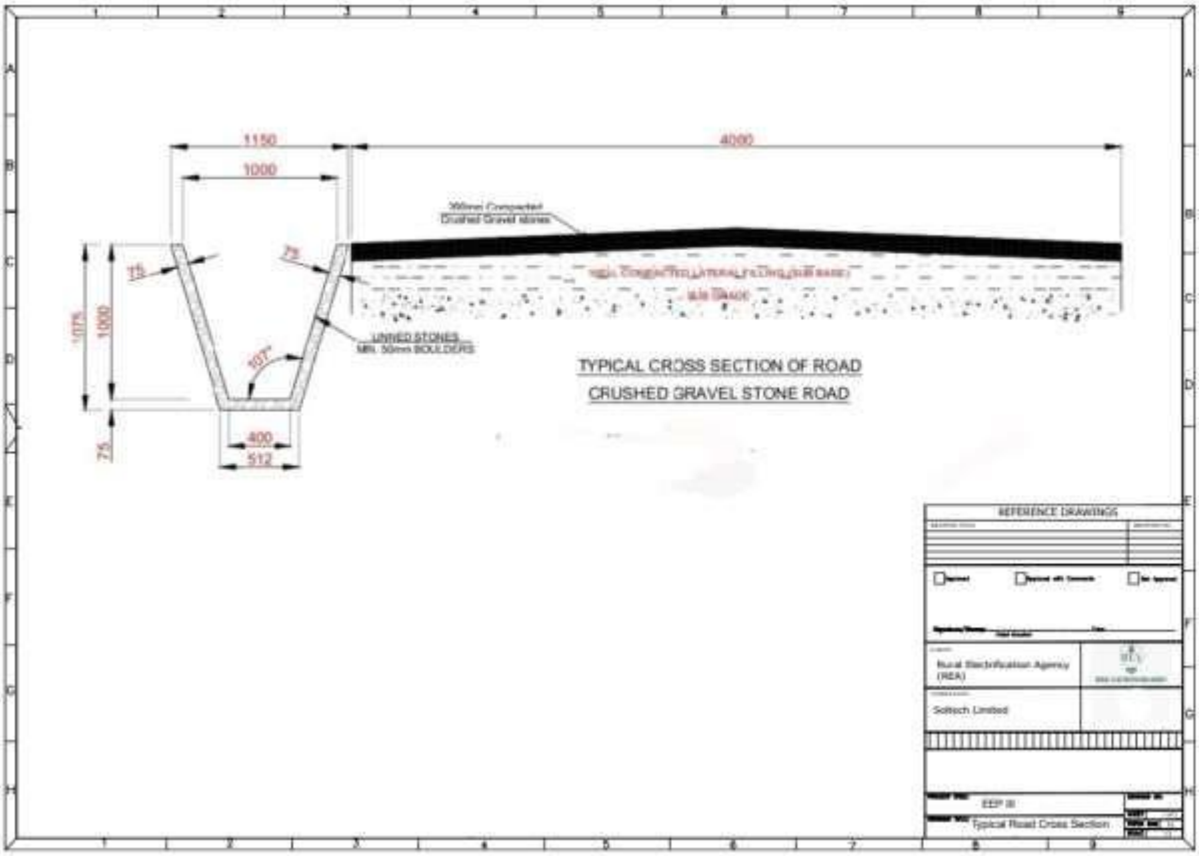


Figure 3. 11: Typical Road Cross Section
(Source: REA NEP 3 FEED)

A renewable workshop centre will be built and ancillary facilities that 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. 12 is an illustration of the elevation plans of the training Centre.

Control Building

The control building would take up an area of approximately 30 m × 15 m. The main construction compound would temporarily require an area of approximately 60 m × 40 m, 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.

Figure 3. 12: Elevation plans of the training Centre
(Source: EEP FEED)

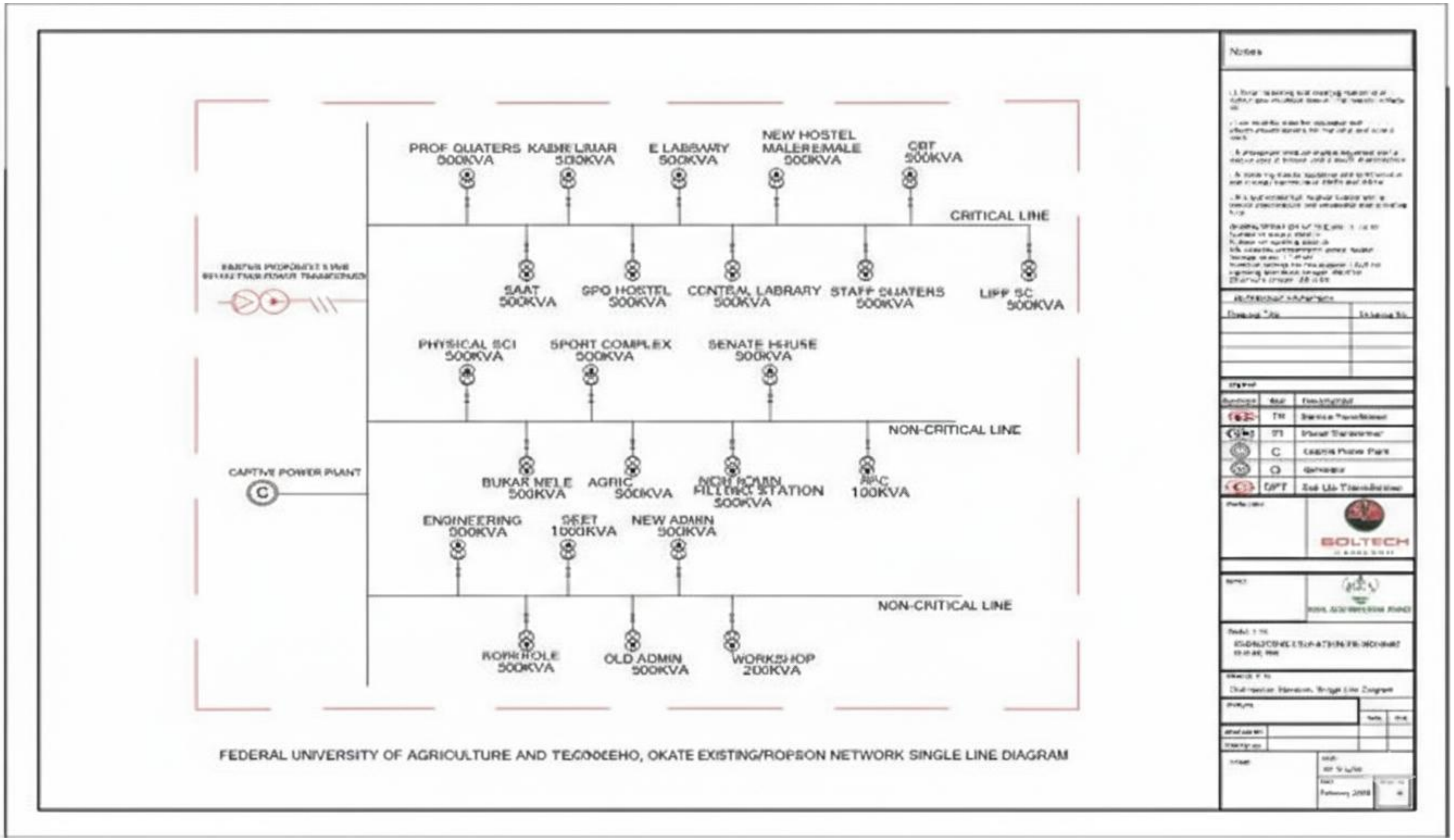


Figure 3. 14: Federal University of Agriculture and Technology Existing/Proposed Distribution Network Single Line Diagram

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:

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.

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.

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.

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 stockpile of spare parts will be kept on-site to facilitate replacement of broken-down or out- dated 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.

3.4 Project Implementation Phase Activities

3.4.1 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.

3.4.2 Construction

Construction activities would last about 12-18 months. The major 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 and install the grid connection;
- Lay power and instrumentation cables;
- Construct the control station;
- ~~Erect~~ install and connect the panels;
- ~~Erect~~ install weather station;
- Commission the panels/transmission lines; and
- Carry out land reinstatement, remove temporary compounds and clear the site.

The construction 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.

3.4.3 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.

3.4.4 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 3. 9: Project Implementation Phase Activities

Pre-construction Phase Activities	Construction Phase Activities	Commissioning Phase Activities	Operational Phase Activities	Decommissioning Phase Activities
1. Completion of engineering design for the Project and receipt of relevant approvals, 2. Site clearing, preparation and mobilization of equipment, materials and personnel to site.	1. Recruitment of low skilled workers (e.g. construction labour who will make up the majority of workers), semi-skilled workers (drivers, technicians, etc.), and skilled personnel (e.g. engineers and expatriates). 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 as well as underground armoured cable for power evacuation. 6. Also, where required, an upgrade of some of the existing power distribution infrastructure within the University will be carried out.	1. Testing and checking individual equipment /system, aswell as the associated infrastructure to ensure they have been installed correctly and can be handed over for use. 2. The EPC contractor shall develop standard operating procedures (SOPs) for the operation and maintenance of the solar panels, inverters, batteries, and other associated	1. Power generation and distribution to various sections of the University 2. The preventive, corrective and predictive maintenance of the power plant and associated facilities. 3. In addition, the training centre will be put into use to enhance learning in renewable energy	1. Dismantling and removal of PV panels and associated infrastructure (mounting structure, power evacuation cable, inverters, transformers, batteries, etc.). 2. Removal of any sub- surface installations (e.g. underground cables). 3. Waste management. 4. Restoring the environment to allowable baseline conditions and monitoring of the process. 5. Assessing the residual impacts, if any, that the project has on the environment.

		components of the Project.		

(Source: Adapted from IFC 2015 Project Developer's Guide to Utility-Scale Solar Photovoltaic Power Plants)

Table 3. 10: Staff Requirements

PERSONNEL
PRE-CONSTRUCTION STAGE
Manual Workers
Skilled Labor/ Professionals/ Managers
Security
CONSTRUCTION STAGE
Manual Workers
Skilled Labor/ Professionals/ Managers
Security
OPERATIONS STAGE
Cleaners
Security
Heavy maintenance
Light electrical maintenance
Infrastructure maintenance
Parts and Inventory management
DECOMMISSION STAGE
Manual Workers
Skilled Labor/ Professionals/ Managers
Security

(Source: Adapted from IFC 2015 Project Developer's guide to utility-scale solar photovoltaic power plants)

3.5 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 3. 11: Solar PV Project Interfaces

Item	Element	Organisations	Interface/ Comments
1.	Consents	• All contractors • Landowner • Planning authority.	Monitoring of compliance with all planning conditions and permits.
2.	Civil Works	• Civil contractor • Mounting or tracking system supplier • Central inverter supplier • Electrical contractor • Grid connection contractor • Security contractor	Site clearance. Layout and requirements for foundations, cable trenches, ducts, roads and access tracks.
3.	Security	• Civil contractor • Electrical contractor • Security contractor	Layout of the security system, including power cabling and
4.	Module Mounting or Tracking System	• Communications contractor • Mounting or Tracking system supplier • Civil contractor • Module supplier • Electrical contractor	Communications to the central monitoring system. Foundations for the mounting or tracking system, suitability for the module type and electrical connections, and security of the modules. Earthing and protection of the mounting or tracking system.
5.	Inverter	• 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 for the mounting system. Suitability of the module string design for the inverter. Interface with the communications for remote monitoring and input into the SCADA system.
6.	AC/DC and Communications Cabling	• Electrical contractor • Civil contractor • Communications contractor • Security contractor	Liaison with regard to cable routes, sizes, weights, attachments and strain relief requirements.
7.	Grid Interface	• Civil contractor • Electrical contractor Inverter supplier network operator	Liaison with regard to required layout of building equipment and interface with onsite cabling installed by the site

			contractor. More interface outside the site boundary for the grid connection cable/line to the network operator's facilities.
8.	Communications	• Electrical contractor • Security contractor • Communications contractor owner and Commercial operator	Interface between the security system, inverter system, central monitoring (SCADA), the monitoring company, and the owner or commercial operator of the PV plant.
9.	Commissioning	• All contractors	Commissioning of all systems will have several interface issues particularly if problems are encountered.

(Source: Adapted from IFC 2015 Project Developer's guide to utility-scale solar photovoltaic power plants)

3.7. Project Schedule

Appropriate sequencing of tasks is a vital part of the planning process. The overall sequence of works is generally: site access, site clearance, security, foundation construction, cable trenches and ducts, substation construction, mounting frame construction, electrical site works, communications, onsite grid works and then testing and commissioning. Each of these work areas should be broken down into a series of sub-tasks. Alongside, an assessment of the inputs required for each task (especially when interfaces are involved) will help develop a logical and efficient sequence.

The proposed Project is planned to be operational by the fourth quarter (Q4) of 2026. Figure 3.16 is a typical EPC Construction Phase and Handover Protocol.

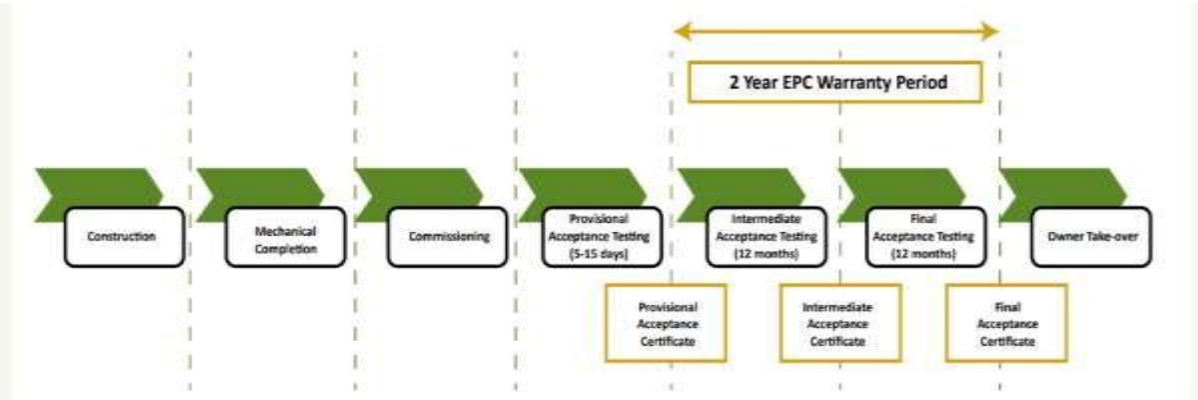


Figure 3. 16: Typical EPC Construction Phase and Handover Protocol

(Source: Adapted from IFC 2015 Project Developer's guide to utility-scale solar photovoltaic power plants)

CHAPTER FOUR: DESCRIPTION OF THE ENVIRONMENT

4.1 Introduction

The environmental characteristics of the project area were established through literature search, field sampling/measurements, laboratory analysis, stakeholder consultation and data interpretation. Gaps in environmental baseline information of the area were identified, and fieldwork activities designed to acquire additional data to fill these gaps was then planned and conducted.

Data from literature review were obtained from the existing reports of environmental studies around the proposed project area. Specifically, the environmental data for the ESIA of the proposed project covered both dry season and secondary data of wet season within the study area radius in which a waiver for one season data gathering was approved by the Federal Ministry of Environment.

A one-season fieldwork was embarked upon for the biophysical as well as social and health studies. The field sampling / measurements were carried out between 26th and 27th of April for the dry season, adopting multi-disciplinary approach. FMEnv Guidelines and Standards were strictly adhered to in the course of field sampling and measurement. The environmental components covered include topography, climate/Meteorology, air quality, and noise soil, vegetation, animal ecology, aquatic systems including ecology and fisheries, geology/geophysics/hydrogeology, socio-economics, health status assessment and waste management. The sampling points were geo-referenced using Global Positioning System (GPS). The locations of sampling points and its coordinates are shown in Figure 4.1 and Table 4.1.

Table 4.1: Soil Sampling Stations, Air Pollutants, Noise Measurements and Water Sample Coordinates

Soil ID	Air & Noise ID	Easting/Long	Northing/Lat
S1	AQ1	3.417981	8.041998
S2	AQ2	3.417867	8.040576
S3	AQ3	3.41386	8.02573
S4	AQ4	3.415749	8.038486
S5	AQ5	3.415866	8.036620
S6	AQ6	3.413514	8.037236
S7	AQ7	3.3606306	8.0170053
S8	AQ8	3.3611112	8.0180604
SCtrl1	AQCtrl1	3.381367	8.043563
SCtrl2	AQCtrl2	3.381372	8..053561

Water Samples		
BH1	3.415749	8.038486
BHCtrl	3.381491	8.04391

4.2 Methodology of the ESIA Study

The methodology of implementation was based on the Federal Ministry of Environment (FMEnv) guidelines for EIA study in Nigeria while taking into cognizance all the tenets of other regulatory guidelines such as the EIA Sectoral Guidelines for Infrastructural Project (1995), ESMP Guideline for Solar Mini Grid Project (2022) and a host of other international safeguards instruments. However, the methodology adopted for this Environmental and Social Impact Assessment (ESIA) study involved the collection of relevant baseline environmental parameters that are most likely to be impacted by the proposed project activities.

Based on the approval of the Federal Ministry of Environment (FMEnv), a one (1) season (dry season) field investigation for the ESIA study was conducted between (26th and 27th of April, 2026) while the wet season field result conducted in **June 2021 for the Special Agro-Industrial Processing Zone-SAPZ in ~~Ondo~~Oyo State** (an approved ESIA) was used to augment for the second (wet) season evaluation of the biophysical parameters of the project environment. It is however pertinent to state that the site of the augmented (approved) ESIA data has similar environmental characteristics within the proposed project environment.

Other important environmental, socio-economic and health information (such as maps, charts, articles, previous study reports, photographs, textbooks etc) of the proposed project locations were gathered during the field work while data gap analysis was carried out to identify areas where additional information was required and the results were used in planning for the field survey and sampling strategy of this ESIA project. Information was also sought from secondary data sources such as previous EIA reports on neighbouring or similar projects together with other published and unpublished studies.

However, the various activities that were carried out are extensively discussed in the sub-sections below.

4.2.1 Reconnaissance Survey and Spatial Delineation of Study Area

Reconnaissance survey and spatial delineation of the study area were carried out prior to field data collection activities of the ESIA study this was done with the view to delineating the spatial boundary of the study area. Also, visual observation within 2km radius of the project site was carried for the assessment of the resources, population, culture and tradition, landforms features, ecological characteristics, drainage pattern, infrastructure, landuse pattern and human settlements around the project environment.

4.3 Project Location

The proposed project is to be sited on 3.465 hectares of land within the temporary site of the Federal University of Agriculture and Technology, Okeho (FUNATO) – a newly established federal institution located in the Oke-Ogun area of Oyo State, Nigeria.

Located in the ancient town of Okeho, the University commenced full academic activities at its temporary site (Awoyemi Commercial High School along the Isemi-Ile Road, Okeho) in

November 2025 to further improved the access to education amongst the catchment area and Nigeria in general.

Plate 4.1: University of Agriculture and Technology, Okeho, Oyo State

Located in Okeho a historic town in the Oke-Ogun region of Oyo State. The town (Okeho) serves as the administrative headquarters of the Kajola Local Government Area (LGA) and it is often referred to as a "valley-town" surrounded by rocky mountains. Historically, Okeho originated from the union of eleven settlements that sought refuge on the hills namely, Isia, Olele, Isemi, Imoba, Gbonje, Oke-Ogun, Ogan, Bode, Pamo, Alubo and Ijo. However, agriculture remains the predominant occupation of the people of Okeiho and it is often referred to as the "food basket" of Oyo State.

Plate 4.2: Overview of Okeho Town, Oyo State

4.3.1 Climate and Meteorology

The following sub-sections draw, where relevant, on data for Oyo~~ndo~~ State obtained from the Nigeria Meteorological Agency. Data collected from the weather station as part of the field survey is also then presented where relevant, and compared to the data from NIMET.

The study area is located in the semi-arid climatic zone of Nigeria and characterized by two distinct seasons which are the hot dry season and a cool rainy season. Generally, Nigeria's climate is characterized by the dry and wet conditions associated with the movement of the Inter-Tropical Convergence Zone (ITCZ) north and south of the equator. The Inter-Tropical Convergence Zone (ITCZ) appears as a band of clouds, usually thunderstorms that circle the globe near the equator and Nigeria is located just north of the equator. When the ITCZ is to the south of the equator, the north-east winds prevail producing the dry-season and whenever it moves into the Northern Hemisphere, the south westerly wind prevails to bring rainfall and the rainy (wet) season.

Due to the latitudinal location of maximum the region within the tropics, the temperature in the study area is generally high with mean monthly minimum and maximum ranges of 24^0C and 36^0C, respectively and an annual mean of 36^0C. Usually, the highest temperature occurs in February and March, the peak of the dry season, while the lowest temperature occurs in August, the peak of the wet season.

4.3.2 Relative Humidity (R.H%) `

The mean monthly relative humidity of the project area occurs with the highest values in July (94%) and August (96%) and lowest values recorded in December (68%), January (64%) and March (75%). As expected, mean monthly relative humidity values are high for the wet season months when the influence of the moisture-laden southwester lies is greatest. The average weather trends for Oyo north (including Okeho) between 2015 and 2024 is presented below.

Table 4.2: Average Weather Trends for Oyo North (Okeho) (2015 – 2024)

S/No.	Month	Average Temp (^0C)	Rainfall (mm)	Cloud Cover (Oktas)	Pressure (mbar)	R/H (%)	Wind Speed (m/s)	Wind Direction
1.	January	32.9	17	7	1030	64	3.2	NE
2.	February	34.1	39	4	1028	92	3.7	NE
3.	March	32.7	82	6	1028	75	3.2	SE
4.	April	30.3	121	7	1031	75	3.2	SW
5.	May	28.8	221	6	1002	75	4.6	SE
6.	June	28.4	344	8	1011	90	3.1	SW
7.	July	27.7	227	7	1017	94	4.4	SW
8.	August	29.5	90	8	1014	96	4.1	SE
9.	September	27.5	148	8	1013	84	3.8	SW
10.	October	30.8	137	5	1011	89	3.3	SW
11.	November	32.5	57	7	1001	73	2.3	NE
12.	December	31.2.6	29	4	1004	68	2.2	NE

Source: NIMET

4.3.3 Rainfall

Okeho and the entire Oyo north has a mean cumulative annual rainfall of 1,100inches. The wet season lasts about six (6) to seven (7) months, while the dry season lasts between four (4) to five (5) months. A typical wet day has at least 0.04 inches of liquid or liquid-equivalent precipitation. The year's highest daily chance of a wet day is 73% in September 11, and its lowest chance is 2% on December 31^{st}.

4.3.4 Wind Speed and Direction

Okeho and the entire Oyo north has a calm weather with wind speed ranging between 1.7 m/s to 5.4 m/s. The mean surface wind speed and direction are influenced by seasonal variation. Two main air masses alternate with the season. During the dry season, the northeast winds predominate while the southwest winds are dominant during the wet season. The highest wind speed is recorded at the onset of the wet season when early rains are torrential and accompanied by squalls, lightning, and thunder. The wind speeds are lower in the nights than during the days.

4.3.5 Sunshine

The meteorological data obtained from NIMET for Okeho shows that the mean monthly sunshine period is between 4.8 hours to 7.6 hours per day. This is suitable for harnessing solar energy during day-time hours to generate electricity. Between July and October, the lowest sunshine period is recorded, while the maximum period is in November. The shortest period is in July, when there is a greater amount of cloudiness and rainfall. In November, the sunshine periods are higher due to the prevalent clear skies when the ITCZ has started its northward migration. The duration reflects the double maxima feature of the rainfall pattern. However, the measured temperature across the Stations AQ_1 to AQ_{10}ctrl (Control) ranged from 28.30^0C ($AQ_{20\ ctrl}$) to 33.3^0C AQ_5), while the measured relative humidity (R.H%) ranged from 62.5% (AQ3) to 84.60 (AQ_{20}ctrl). Also, the wind velocity ranged from 1.1m/s (AQ1) to 2.2m/s (AQ_{14}). The varying meteorological measurements are typical of similar environment in Oyo~~ndo~~ State and south-west Nigeria.

The measured meteorological data during the field work is presented below in Table 4.2.

Table 4.2: Measured Meteorological Variables for the Proposed Solar Mini-Grid Project at FUNATO, Okeho

Station Code	Location	Coordinate of Station	Ambient Temp (^0C)	Relative Humidity (%)	Wind Velocity (m/s)	Wind Direction
AQ_1	Within the Proposed Project Location	E3.417981 N8.041998	33.5	60.9	2.3	SW
AQ_2	Within the Proposed Project Location	E3.417867 N8.040576	32.3	59.9	2.9	NE
AQ_3	Within the Proposed Project Location	E3.41386 N8.02573	32.3	58.4	2.2	SE
AQ_4	Within the Proposed Project Location	E3.415749 N8.038486	33.3	54.7	1.2	SE
AQ_5	Within the Proposed Project Location	E3.415866 N8.036620	34.3	51.4	2.8	SE
AQ_6	Within the Proposed Project Location	E3.413514 N8.037236	32.3	52.6	3.3	SW
AQ_7	Within the Proposed Project Location	E3.3606306 N8.0180604	31.4	76.0	1.2	SE
AQ_8	Within the Proposed Project Location	E3.3611112 N8.0180604	30.2	53.6	1.4	SE
AQ_9	Within the Proposed Project Location	E3.381367 N8.043563	32.3	63.2	2.3	SW
AQ_1 0 Ctrl	Mesile Market, Okeho	E3.381367 N8.043563	27.1	76.0	1.2	NE

A chart showing the temperature and relative humidity is shown below in figure 4.1.

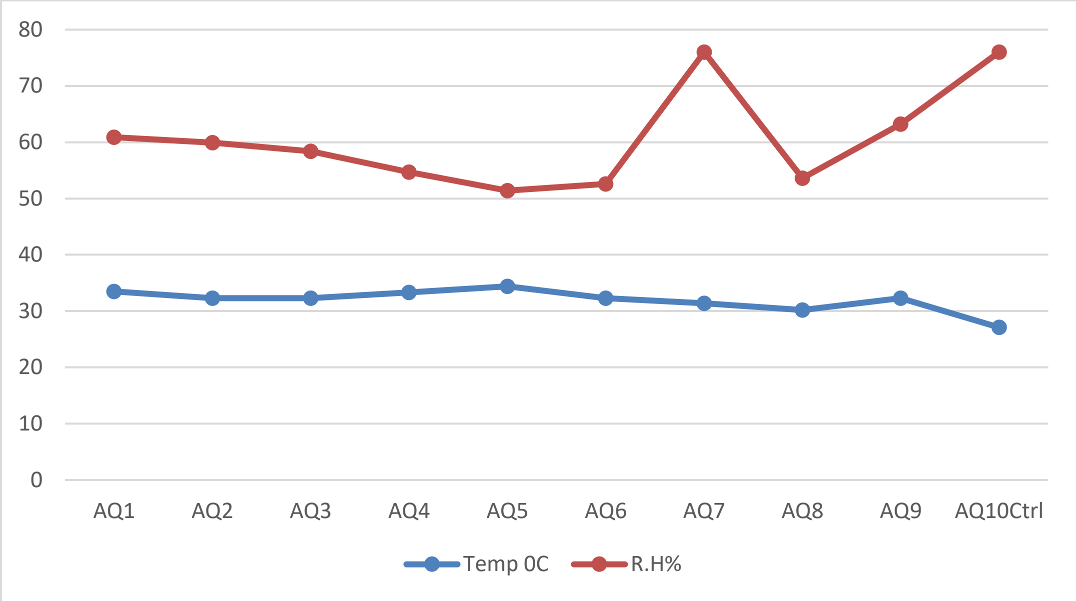


Figure 4.1: Measured Temperature and Relative Humidity of the Project Area

4.4 Air Quality

The assessment o the air quality parameters were carried out in line with the global best practice. Certain air pollutants such as CO, NO_2, SO_2, NH_3, H_2S and LEL were not detected. This could be due to the non-availability of industrial facilities/activities around the proposed project area including Volatile Organic Compound (VOC).

A summary of the findings of the ambient air quality measurements taken for the study area is presented in Table 4.3 with due reference to FMEnv standards.

Table 4.3: Air Quality Characteristics of the Study Area

Station Code	Location	Coordinate of Station	Air Quality Parameters									
			CO (ppm)	CO_2 (ppm)	NO_2 (ppm)	SO_2 (ppm)	NH_3 (ppm)	H_2S (ppm)	LEL (%)	VOC (ppm)	0_2 (%)	SPM
AQ_1	Within the Proposed Project Location	E3.417981 N8.041998	0.0	400	0.0	0.0	0.0	0.0	0.0	0.0	20.9	42.0
AQ_2	Within the Proposed Project Location	E3.417867 N8.040576	0.0	500	0.0	0.0	0.0	0.0	0.0	0.0	20.9	49.0
AQ_3	Within the Proposed Project Location	E3.41386 N8.02573	0.0	500	0.0	0.0	0.0	0.0	0.0	0.0	20.9	60.0
AQ_4	Within the Proposed Project Location	E3.415749 N8.038486	0.0	400	0.0	0.0	0.0	0.0	0.0	0.0	20.9	14.0
AQ_5	Within the Proposed Project Location	E3.415866 N8.036620	0.0	300	0.0	0.0	0.0	0.0	0.0	0.0	20.9	10.0
AQ_6	Within the Proposed Project Location	E3.413514 N8.037236	0.0	200	0.0	0.0	0.0	0.0	0.0	0.0	20.9	14.0
AQ_7	Within the Proposed Project Location	E3.3606306 N8.0180604	0.0	200	0.0	0.0	0.0	0.0	0.0	0.0	20.9	12.3
AQ_8	Within the Proposed Project Location	E3.3611112 N8.0180604	0.0	200	0.0	0.0	0.0	0.0	0.0	0.0	20.9	14.0
AQ_9	Within the Proposed Project Location	E3.381367 N8.043563	0.0	300	0.0	0.0	0.0	0.0	0.0	0.0	20.9	12.2
AQ_{10ctrl}	Mesile Market, Okeho	E3.381367 N8.043563	0.0	600	0.0	0.0	0.0	0.0	0.0	0.0	20.9	14.1

Also, the results of similar air quality assessment conducted for the Alaro Bridge Project (2016) by the Ibadan Urban Flood Project shows similarities in the measured air quality parameters as pollutants like ranged levels of suspended particulate matter were (14.0 – 56.0 µg/m3), nitrogen dioxide (0.01 -0.02ppm), sulphur dioxide (<0.01 – 0.06ppm), hydrogen sulphide (<0.01ppm) and carbon monoxide (<0.01 – 3.0ppm), were within the Federal Ministry of Environment (FMENV) permissible limits.

Table 4. 4: Noise Level of the Study Area

Sampling Station	Noise Level (dBA)
AQ1	57.7
AQ2	52.9
AQ3	58.9
AQ4	51.4
AQ5	64.7
AQ6	52.9
AQ7	59.8
AQ8	56.2
AQ9	51.3
AQ10ctrl	67.4

(Source: Ecobinder Services Limited Field Work, 2026)

The measured noise across the monitored stations AQ1 to AQ10Ctrl is presented in figure 4.2 below.

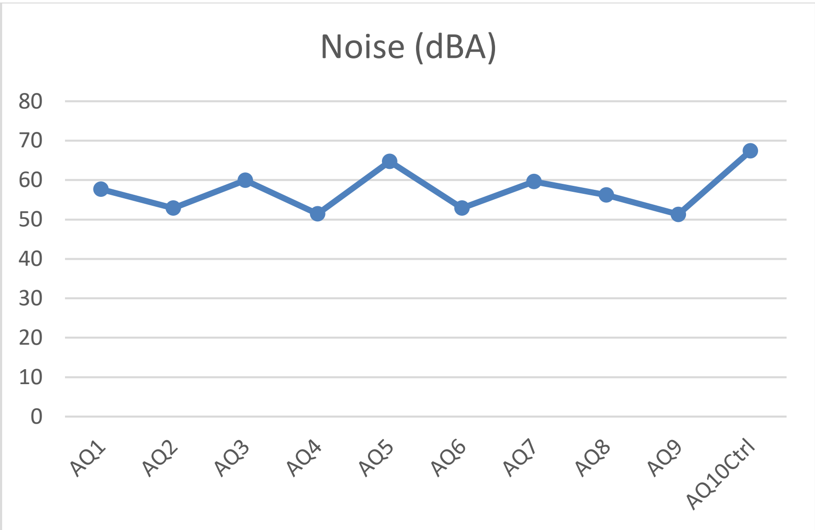


Figure 4.2: Measured ambient Noise Level of the Project Area

(Source: Ecobinder Services Limited Field Survey, 2026)

4.5 Soil and Landuse

The proposed project site is within the premises of Federal University of Agriculture and Technology, Okeho. It is a 3.465 hectares' fallow ground. Farming activity though not encouraged with signage instructions. Soil samples were taken at selected locations within and around the proposed project site. The sampling stations were pre-selected using the co-ordinates on the obtained map. The coordinates were keyed into GPS receivers which were then used to pin point the exact locations within the project site. Soil samples were collected with a Dutch auger and described. At each observation point, two composite samples from 0 – 15 cm, 15–30 cm soil depths were taken at each sampling point. The environment at each observation point was also described in terms of vegetation, land use and erosion. In all, 30 soil samples were collected for laboratory analyses. The geographical co-ordinates for the sampling points are presented in Table 4.3. All the soil samples collected were packed and preserved for onward transmission to the laboratory where they would be analyzed.

Table 4.3: Description of the Soil Sampling Stations and Coordinates

S/No.	Coordinates	
	Easting/Long	Northing/Lat
S1	3.417981	8.041998
S2	3.417867	8.040576
S3	3.41386	8.02573
S4	3.415749	8.038486
S5	3.415866	8.036620
S6	3.413514	8.037236
S7	3.3606306	8.0170053
S8	3.3611112	8.0180604
SCtrl1	3.381367	8.043563
SCtrl2	3.381372	8..053561

(Source: Ecobinder Services Limited Field Survey, 2026)

Plate 4.1: Sampling Activities During the Field Work

4.5.1.1 Geology of the Project Area

Basement Complex Setting

Geologic Province: Okeho lies within the Southwestern Nigeria Basement Complex, part of the Precambrian to Pan-African basement rocks that underlie virtually all of Oyo State. The basement in this region is dominated by crystalline igneous and metamorphic rocks such as: Migmatite-gneiss complex (dominant), comprising banded gneiss and granite-gneiss;

Metasediments including quartzite, mica schist, and other green-schist facies rocks; Pan-African granitoids (older granitic intrusions, syenites, pegmatites).

These rocks are Precambrian to early Paleozoic in age, formed through multiple tectono-metamorphic events (e.g., Pan-African orogeny) that created a structurally complex and deformed basement terrain. The crystalline basement exhibits foliation, faulting, jointing, and fracturing due to tectonic deformation. These features, along with differential weathering of various lithologies, contribute to the hilly terrain and valley landscapes found around Okeho. Okeho's subsurface foundation is typical of the Southwestern Nigerian Basement Complex — predominantly hard, crystalline igneous and metamorphic rocks with limited primary porosity but structurally complex features influencing surface and subsurface behaviour.

4.5.1.2 Local Geology and Hydrogeology

Groundwater Occurrence in Basement Terrains

In crystalline basement terrains like around Okeho, groundwater is not hosted in porous sedimentary layers. Instead, the water occurs where the rock has been weathered and fractured. The key groundwater zones are:

- Weathered overburden/regolith: A broken, altered zone near the surface with enlarged pore spaces from chemical weathering.
- Fractured bedrock: Secondary fractures, joints, and faults that create pathways for water storage and movement at depth.

The water table is typically shallow to moderate depending on topography, overburden thickness, and rainfall recharge. In many basement areas, the water table follows surface relief, being higher beneath hills and lower in valleys. Recharge is largely from direct rainfall infiltration through soil and weathered layers, with some lateral flow towards springs and streams where fractures intercept the surface.

Porosity and Permeability

- Primary Rock Characteristics: The crystalline basement rocks have low primary porosity and permeability — meaning intact rock doesn't easily transmit water.
- Secondary Features: Groundwater movement and storage almost entirely occur in: Weathered regolith/saprolite zones, Fracture networks (joints, faults) which enhance permeability locally.

Aquifer Type & Water Supply

Classically, the aquifer in this environment is described as a basement aquifer system — an unconfined aquifer where saturation occurs in the weathered and fractured rocks. Borehole Yields: The quality and volume of groundwater available from wells or boreholes are heavily dependent on:

- Thickness of the weathered zone
- Degree and connectivity of fractures
- Surface recharge from rainfall: Successful wells often tap fractured zones at depth or thicker weathered profiles.

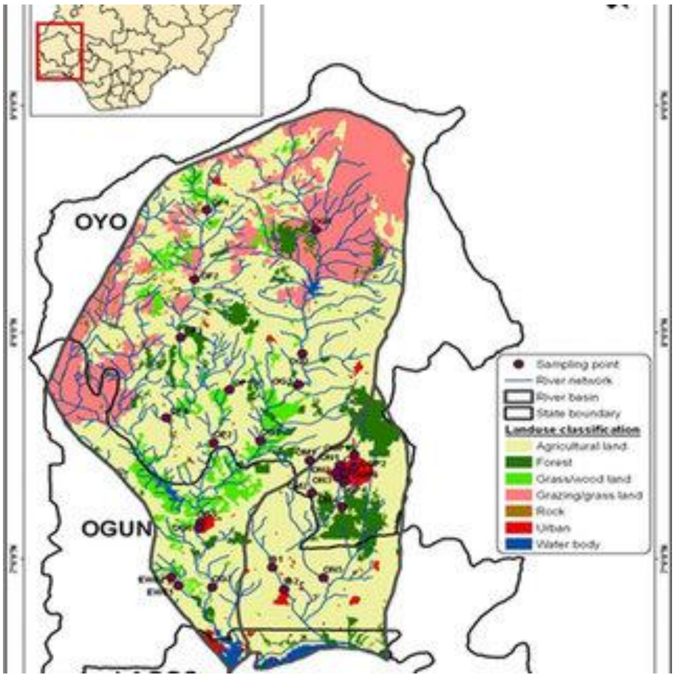


Figure 4. 8: Geological map showing Upper Benue Region

(Source: ResearchGate. Geologic map of the Ogun-osun river basin Trough with location of the studied sections.)

4.2.5.1 Soil Physico-Chemical Characteristics

Soils of the area were observed to be matured with good internal drainage. Present findings also indicated that surface soils are quite compactible, particularly if spillage occurs. This is because of the relative ease of movement, into and within the 0 – 15 cm depth, by liquids and gases. The results of the analyses undertaken in the laboratory on surface (0-15cm) and subsoil (15 - 30cm) samples were discussed. This is in accordance with the fact that the topsoil is particularly prone to impact from human activities that are part of the different phases of the Project. Discussions of soil samples results are presented in this section while detail results of findings from each sampling point is presented in Table 4.8. A physicochemical study of the soil samples is based on various parameters like soil pH, electrical conductivity (EC), organic carbon (OC), organic matter (OM) Total nitrogen (TN), available phosphorus (P), and the exchangeable cations ($Ca2+$, $Mg2+$, $K+$ and $Na+$ and the exchangeable acidity ($Al3+$. Cation exchange capacity (CEC) is a measure of the soil's ability to hold positively charged ions. It is a very important soil property influencing soil structure stability, nutrient availability, soil pH and the soil's reaction to fertilizers (Hazleton and Murphy 2007).

Table 4. 8: Physico-Chemical Analysis of Soil Samples

Sample Code		pH		Avail-P	OC	OM	TN		Exch. Bases				Exch. Al	EC	THC
								Ca	S	Mg	K	Na			
		(H_2O)	($CaCl_2$)	(Cmol /kg s	(%)			(Cmol/kg soil)							(Cmol/kg
S1	0-15	5.2	5.7	9.36	0.74	0.31	0.09	10.21	9.56	5.10	0.51	2.11	0.31	0.178	0.21
	15-30	5.5	5.8	9.34	0.73	0.30	0.10	10.19	8.74	5.08	0.49	1.81	0.30	0.179	0.23
S2	0-15	6.1	6.3	10.21	0.70	0.26	0.12	9.23	9.10	6.11	0.48	2.10	0.28	0.216	0.35
	15-30	6.2	6.5	10.17	0.72	0.28	0.14	9.20	8.10	5.20	0.48	2.09	0.26	0.219	0.34
S3	0-15	5.7	5.6	10.20	0.68	0.25	0.15	8.40	8.14	6.13	1.21	2.07	0.21	0.276	0.21
	15-30	5.6	5.8	10.25	0.69	0.27	0.17	8.42	7.16	6.12	1.23	2.10	0.22	0.283	0.20
S4	0-15	6.0	6.1	9.66	0.54	0.26	0.15	7.20	9.17	6.16	2.21	2.10	0.24	0.293	0.17
	15-30	6.1	6.2	9.62	0.50	0.30	0.13	7.18	7.19	7.01	2.19	2.17	0.24	0.321	0.19
S5	0-15	5.9	5.8	9.56	0.47	0.12	0.12	10.00	8.42	6.12	1.84	2.16	0.22	0.334	0.30
	15-30	6.2	6.1	9.50	0.45	0.10	0.10	9.10	7.87	6.13	1.80	2.18	0.20	0.321	0.27
S6	0-15	6.3	6.4	8.96	0.50	0.12	0.13	8.10	6.65	5.10	0.28	1.80	0.17	0.286	0.26
	15-30	5.6	5.7	8.91	0.48	0.14	0.11	8.14	5.98	5.20	0.30	1.84	0.15	0.284	0.24
S7	0-15	5.6	5.4	10.50	0.72	0.15	0.17	7.16	9.87	5.18	1.10	1.70	0.19	0.296	0.28
	15-30	5.5	5.7	10.18	0.70	0.17	0.14	7.17	8.01	5.16	1.12	1.72	0.18	0.292	0.30
S8	0-15	5.8	5.9	10.15	0.73	0.23	0.12	9.19	8.12	4.39	1.20	2.30	0.19	0.363	0.22
	15-30	6.3	6.4	10.20	0.75	0.25	0.10	9.21	8.54	5.26	1.17	2.28	0.21	0.360	0.21
SCtrl 1	0-15	6.1	6.0	8.90	0.56	0.28	0.17	10.06	8.34	4.17	0.51	2.16	0.22	0.298	0.43
	15-30	6.2	6.1	8.45	0.54	0.30	0.15	10.04	7.25	4.13	0.57	2.12	0.24	0.310	0.42
SCtrl2	0-15	6.0	6.2	9.30	0.62	0.19	0.18	11.20	8.19	6.10	0.63	1.78	0.26	0.280	0.34
	15-30	6.2	6.1	9.31	0.60	0.21	0.11	11.19	7.96	6.11	0.65	2.04	0.27	0.278	0.31

Source: Ecobinder Services Limited Field Study (2026)

4.2.5.1.1 Soil pH

Soil pH is an indication of the acidity or alkalinity of soil, and it is measured in pH units. Soil pH is defined as the negative logarithm of the hydrogen ion concentration. The pH scale goes from 0 to 14 with pH 7 as the neutral point. As the amount of hydrogen ions in the soil increases the soil pH decreases, thus becoming more acidic. From pH 7 to 0 the soil is increasingly more acidic and from pH 7 to 14 the soil is increasingly more alkaline or basic. Extremely and strongly acid soils (pH 4.0-5.0) can have high concentrations of soluble aluminum, iron and manganese which may be toxic to the growth of some plants. A pH range of approximately 6 to 7 promotes the readiest availability of plant nutrients in soil. pH affects transformation processes among the various forms of nutrients. The values of pH from the sampled locations ranged from 5.5 – 6.40, pH classification is presented in Table 4.9 the pH values for soil in the study area are presented in Table 4.8.

Table 4. 9: Classification of Soil pH

Class of pH	pH Range
Extremely acidic	<pH4.5
Very strongly acidic	pH4.5 – 5.0
Strongly acidic	pH5.1 – 5.5
Moderately acidic	pH5-6 – 6.0
Slightly acidic	pH6.1 – 6.5
Neutral	pH6.6 – 7.5
Alkaline	pH7.6 – 8.0
Very alkaline	pH8.1 – 8.5
Strongly alkaline	≥pH8.6

Source: Loganathan (1987)

4.2.5.1.2 Electrical Conductivity

Soil electrical conductivity, EC, is the ability of soil to conduct electrical current. EC is the most common measure of soil salinity and is indicative of the ability of an aqueous solution to carry an electric current. Plants are detrimentally affected, both physically and chemically, by excess salts in some soils and by high levels of exchangeable sodium in others. Soils with an accumulation of exchangeable sodium are often characterized by poor tilt and low permeability making them unfavorable for plant growth.

As shown in Table 4.8, value of EC in the soil ranges from 0.178 – 0.363mg/100g and 0.179 – 0.360mg/100g top and subsoil respectively.

4.2.5.1.3 Total Organic Matter

Soil total organic matter is primarily plant residue in different stages of decomposition. The accumulation of SOM within soil is a balance between the return or addition of plant residues and their subsequent loss due to the decay of these residues by micro-organisms. TOM is important because it improves both the physical and chemical properties of soil and has several beneficial effects on agricultural soil quality. As shown in Table 4.8, the soils TOM range from

0.12 – 0.31% and 0.10 – 0.30% for both top and subsoil respectively.

4.2.5.1.4 Soil Nutrient

Several essential plant nutrients are obtained from the soil. Before a nutrient can be used by plants it must be dissolved in the soil solution. Many important soil properties are dependent to some degree on the quality of organic matter present. These properties include the absorption and retention of water, reserves of exchanged bases, and the capacity to supply nitrogen, phosphorus and other elements to growing crops, stability of soil structure, adequacy of aeration and pollutants bioavailability (Margesin and Schinner, 2005). In fact, pollutant concentrations in soil are normalized with the organic matter in conjunction with clay content (DPR, 2002). Nitrogen levels in both the top and sub soil fall within 0.09mg/kg – 0.21mg/kg. Soil Nitrogen of more than 0.15% is considered optimal for most crops. Nitrogen concentrations in soils generally fall sharply with depth, with most of the nitrogen being in the top one-meter layer of soils. Over 90%, of the nitrogen in the surface layers (A-horizon, plow- depth zone) of soil is in organic matter.

Total phosphate levels in the topsoil and subsoil falls within 8.45mg/kg – 10.50mg/kg, Phosphorus in soils is present in the soil solution (plant-available), as labile phosphate precipitates and adsorbed to soil particles, mainly clay minerals (potentially available to plants), as non-labile phosphate in the form of calcium, iron, and aluminium phosphate (not plant-available), in organic form, including P in soil organic matter (released after mineralization), and in living soil biomass. Phosphorus is utilized in the fully oxidized and hydrated form as orthophosphate. Deficiency of phosphorus may limit the growth of plants and the microbial decomposition of pollutants in soil. Phosphorus is likely to be deficient in hydrocarbon-impacted soils and subsoil. Potassium and sodium level in the soil are within the ranges of 0.28 to 2.21mg/100g and 1.70 to 2.30mg/100g respectively. Sulphates detected in the study area ranged from 5.98 to 9.87mg/100g and calcium level detected in soil ranges from 7.16mg/100g – 11.20mg/100g for both top and sub soil respectively.

4.2.5.1.5 Total Hydrocarbon (THC)

THC is a mixture of chemicals, but they are all made mainly from hydrogen and carbon, called hydrocarbons. Some chemicals that may be found in THC are hexane, jet fuels, mineral oils, benzene, toluene, xylenes, naphthalene, and fluorene, as well as other petroleum products and gasoline components. However, it is likely that samples of THC will contain only some, or a mixture, of these chemicals. THC may enter the environment through accidents, from industrial releases, or as by-products from commercial or private uses and may be released directly into water through spills or leaks, with the possibility of sinking to the bottom sediments. THC in the soils ranges from 0.17 to 0.43mg/100g for both top and sub-soil.

4.2.5.1.6 Heavy Metals

The soil chemistry distinguishes heavy metals as a special group of elements because of their toxic effect exerted on plants upon their high concentration. However, there is no common opinion on the hazard degree on any heavy metals in soil. The term heavy metal is often broadly adopted to include other potentially hazardous elements, even if they do not meet the strict chemical definition. These are arsenic (As), cadmium (Cd), chromium (Cr), lead (Pb), nickel (Ni), and zinc (Zn). Soils normally contain low levels of heavy metals, however, in areas such as agricultural, industrial, or municipal wastes they are applied as fertilizer in concentrations which may be much higher. Excessive levels of heavy metals may be hazardous to man, animals, and plants. The result of the analysis in table 4.10 shows that heavy metal concentrations in the study area high, mostly exceeding the FMEnv. threshold in some sampling points.

Table 4. 10: Heavy Metals in Soil of Project Area

Sample Code	Coordinates of Sampled Locations		Description	Dept of Sample (cm)	Mn	Fe	Cu	Zn	Cr	Pb	Ni	V	Ba	Cd
	Easting/Long	Northing/Lat												
S1	3.417981	8.041998	Top Soil	0-15	7.10	5.61	7.30	3.38	6.14	0.91	0.11	0.08	1.03	0.06
			Sub-Soil	15-30	7.09	5.68	7.16	3.34	6.11	0.86	0.12	0.09	1.06	0.05
S2	3.417867	8.040576	Top Soil	0-15	8.14	4.96	6.69	3.60	5.18	0.81	0.09	0.10	0.95	0.04
			Sub-Soil	15-30	8.12	5.67	6.73	3.62	5.20	0.84	0.08	0.09	0.86	0.05
S3	3.41386	8.02573	Top Soil	0-15	10.21	4.70	7.80	4.47	5.18	0.71	0.10	0.07	0.84	0.06
			Sub-Soil	15-30	9.36	4.90	7.82	4.46	5.16	0.70	0.09	0.06	0.81	0.04
S4	3.415749	8.038486	Top Soil	0-15	8.50	5.76	6.14	4.44	5.13	0.72	0.05	0.05	0.76	0.04
			Sub-Soil	15-30	8.46	5.74	6.12	4.40	5.10	0.70	0.06	0.06	0.56	0.03
S5	3.415866	8.036620	Top Soil	0-15	7.12	6.69	5.19	5.20	5.12	0.68	0.06	0.07	0.54	0.02
			Sub-Soil	15-30	7.09	6.71	5.21	5.21	5.10	0.66	0.07	0.06	0.50	0.03
S6	3.413514	8.037236	Top Soil	0-15	8.10	7.11	6.08	5.20	5.13	0.64	0.08	0.08	0.48	0.05
			Sub-Soil	15-30	9.10	7.06	6.01	6.32	5.10	0.66	0.06	0.06	0.49	0.03
S7	3.3606306	8.0170053	Top Soil	0-15	10.20	8.12	4.15	6.20	6.17	0.72	0.07	0.07	0.44	0.03
			Sub-Soil	15-30	10.18	8.04	4.17	6.28	6.10	0.73	0.06	0.06	0.46	0.04
S8	3.3611112	8.0180604	Top Soil	0-15	8.11	6.76	5.18	6.27	2.70	0.72	0.05	0.05	0.55	0.02
			Sub-Soil	15-30	8.08	6.72	5.20	6.26	2.76	0.60	0.04	0.04	0.57	0.03
SCtrt 1	3.381367	8.043563	Top Soil	0-15	9.21	7.03	4.61	5.55	2.76	0.71	0.03	0.03	0.59	0.02
			Sub-Soil	15-30	9.17	7.08	4.50	5.50	2.60	0.82	0.02	0.02	0.56	0.04
SCtrl2	3.381372	8.053561	Top Soil	0-15	8.14	6.69	3.92	6.00	1.36	0.83	0.02	0.02	0.62	0.02
			Sub-Soil	15-30	8.16	6.64	3.81	6.10	1.26	0.78	0.04	0.04	0.66	0.03
FMEnv Limits														

Source: Ecobinder Services Limited Field Study 2026

4.2.5.1.7 Soil Texture

The texture of a soil determines the water absorption/infiltration rate, the water holding capacity and migration of pollutant down the soil strata (Margesin and Schinner, 2005). It also determines the amount of soil aeration, ease of tilling, and soil fertility (Udoh, 1986). Low clay and high sand soil is porous and will permit easy percolation of nutrients and pollutants to the groundwater table. Other parameters that determine the dynamics of pollutants in soil include bulk density and porosity. The bulk density gives a rough estimation of the aeration and permeability of a soil. The lower the bulk density, the higher is the permeability (Margesin and Schinner, 2005). Bulk density varies with structural conditions of the soil. As shown in Table 4.11, sand-sized particles of the surface soils and topsoil varied between 68% and 76%; Clay was between 1% and 10.0%; Silt was from 20.0% to 26.0% while the pattern of particle size distribution of the surface soils shows that the surface soils were well set in terms of workability with loamy soil being the dominant Soil Texture.

Table 4. 11: Soil Texture Analysis

Sample Code	Coordinates of Soil Sampling Location			Particle Size Distribution (%)			Texture
	Lat (oN)	Long. (oE)		Sand	Silt	Clay	
S1	3.417981	8.041998	0-15	75	20	5	Sandy/Loamy
			15-30	70	26	4	Sandy/Loamy
S2	3.417867	8.040576	0-15	73	24	3	Sandy/Loamy
			15-30	70	25	5	Sandy/Loamy
S3	3.41386	8.02573	0-15	73	21	6	Sandy/Loamy
			15-30	76	23	1	Sandy/Loamy
S4	3.415749	8.038486	0-15	71	21	8	Sandy/Loamy
			15-30	70	20	10	Sandy/Loamy
S5	3.415866	8.036620	0-15	75	22	3	Sandy/Loamy
			15-30	71	20	9	Sandy/Loamy
S6	3.413514	8.037236	0-15	70	23	7	Sandy/Loamy
			15-30	75	22	3	Sandy/Loamy
S7	3.3606306	8.0170053	0-15	73	21	6	Sandy/Loamy
			15-30	69	24	7	Sandy/Loamy
S8	3.3611112	8.0180604	0-15	72	22	8	Sandy/Loamy
			15-30	70	23	7	Sandy/Loamy
SCtrt 1	3.381367	8.043563	0-15	68	22	10	Sandy/Loamy
			15-30	70	24	6	Sandy/Loamy
SCtrl2	3.381372	8.053561	0-15	70	20	10	Sandy/Loamy
			15-30	69	21	10	Sandy/Loamy

(Source: Ecobinder Services Limited Field Study 2026)

Soil Microorganism

The microbiological characteristics of soil within the project area is presented in Table 4.12. TBC revealed total viable count of $1.09x10^5$ – $3.36x10^5$ cfu/g for both topsoil and subsoil. Total Bacteria constitutes 46%, Total Fungi 30%, Hydrocarbon Utilizing Bacteria 14% and Hydrocarbon Utilizing Fungi 9% in topsoil while Total Bacteria constitutes 52%, Total Fungi 35%, Hydrocarbon Utilizing Bacteria 8% and Hydrocarbon Utilizing Fungi 5%. The most predominant organisms among the isolates are the *Bacillus sp., Clostridium sp. And Pseudomonas sp.*

Table 4. 12: Soil Microbial Count of Project Area

S/n	Stations	Total Heterotrophic Bacteria cfu/g	Total Heterotrophic Fungi cfu/g	Hydrocarbon Utilizing Bacteria cfu/g	Hydrocarbon Utilizing Fungi cfu/g
1	S1 (top)	$2.0x10^5$	$6.54x10^3$	$5.25x10^2$	$3.45x10^2$
2	S1 (bottom)	$1.65x10^5$	$3.55x10^3$	$4.26x10^2$	$2.23x10^2$
3	S2 (top)	$3.36x10^5$	$4.35x10^3$	$3.34x10^2$	$2.90x10^2$
4	S2 (bottom)	$2.13x10^5$	$3.12x10^3$	$2.15x10^2$	$1.46x10^2$
5	S3 (top)	$2.23x10^5$	$3.59x10^3$	$4.65x10^2$	$3.25x10^2$
6	S3 (bottom)	$1.79x10^5$	$2.51x10^3$	$2.29x10^2$	$1.06x10^2$
7	S4 (top)	$1.62x10^5$	$1.90x10^3$	$3.65x10^2$	$2.87x10^2$
8	S4 (bottom)	$1.19x10^5$	$1.21x10^3$	$1.98x10^2$	$2.56x10^2$
9	S5 (top)	$1.50x10^5$	$3.40x10^3$	$3.05x10^2$	$2.76x10^2$
10	S5 (bottom)	$1.09x10^5$	$2.71x10^3$	$2.54x10^2$	$1.98x10^2$
11	S6 (top)	$3.36x10^5$	$4.35x10^3$	$3.34x10^2$	$2.90x10^2$
12	S6 (bottom)	$2.13x10^5$	$3.12x10^3$	$2.15x10^2$	$1.46x10^2$
13	S7 (top)	$2.23x10^5$	$3.59x10^3$	$4.65x10^2$	$3.25x10^2$
14	S7 (bottom)	$1.79x10^5$	$2.51x10^3$	$2.29x10^2$	$1.06x10^2$
15	S8 (top)	$1.62x10^5$	$1.90x10^3$	$3.65x10^2$	$2.87x10^2$
16	S8 (bottom)	$1.19x10^5$	$1.21x10^3$	$1.98x10^2$	$2.56x10^2$
17	SCtrl1 (top)	$1.50x10^5$	$3.40x10^3$	$3.05x10^2$	$2.76x10^2$
18	SCtrl1 (bottom)	$3.36x10^5$	$4.35x10^3$	$3.34x10^2$	$2.90x10^2$
19	SCtrl2 (top)	$2.13x10^5$	$3.12x10^3$	$2.15x10^2$	$1.46x10^2$
20	SCtrl2 (bottom)	$2.23x10^5$	$3.59x10^3$	$4.65x10^2$	$3.25x10^2$

(Source: Ecobinder Services Limited Field Study 2026)

4.2.6 Biological Environment

4.2.6.1 Vegetation

General Vegetation Type

Guinea Savanna woodland: Characterized by grasses with scattered drought-tolerant trees and shrubs — typical of northern parts of *Oyo State* (including Okeho) where the dense southern rain forest transitions into open woodland. Mixed agricultural landscape with crop fields, fallows, and remnant native vegetation, due to farming activities.

Vegetation Characteristics

- Seasonal deciduousness: Many trees shed leaves in the dry season to conserve water.
- Scattered canopy: Rather than a closed forest, tree cover is patchy amidst grasses and agricultural fields.
- Human influence: Much of the natural vegetation has been altered by farming, wood harvesting, and settlement expansion, leading to secondary growth and mixed farmland with forest relics.

Other Plant Life

While the main focus above is on trees, the region also supports:

- Grasses and shrubs typical of Guinea savannah, especially in open lands;
- Cultivated crops such as cassava, yam, maize, cocoa, palm, and cashew often interspersed with natural vegetation.

4.2.6.1.1 Trees

Common Tree and Woody Species in the Okeho Area

A number of studies and vegetation surveys in and around Okeho, Kajola LGA report that the area supports a range of native tree species — many of which are typical of West African savannah and secondary forest ecosystems. Some of the major tree species include:

- *Viteloria paracloxum* (locally known as *Emin*)
- *Khaya ivorensis* (*Ogano* – African mahogany)
- *Triplochiton scleroxylon* (*Arere* – African whitewood)
- *Anogeissus leiocarpus* (*Ayin*)
- *Burkea africana* (*Asapa* – wild syringa)
- *Distemonanthus benthamianus* (*Ayan*)
- *Parkia biglobosa* (*Igba* – African locust bean tree)
- *Terminalia avicennioides* (*Idi*)
- *Gmelina arborea* (*Igi Isana*)
- *Milicia excelsa* (*Iroko*)

- *Tectona grandis* (*Gedu* – teak)

These species are typical of Guinea savannah woodlands and secondary forest patches — combining both economically useful timber trees and species adapted to seasonal dry periods.

Plate 4.2: Sample of Trees in the Project Area
(Source: Ecobinder Services Limited Field Survey, 2026)

4.2.6.1.2 Grasses

Grasses and Herbaceous Flora

In Okeho and the surrounding Kajola landscape, the vegetation is characterized by an open canopy where sunlight reaches the floor, promoting a dense layer of tall grasses. Dominant species include Andropogon gayanus (Gamba grass), Hyparrhenia rufa (Jaragua grass), and the invasive Imperata cylindrica (Spear grass), which often colonizes overused farmlands. Other common grasses include Pennisetum polystachion, Cynodon dactylon, and Dactyloctenium aegyptiacum.

The shrubs Gardenia ternifolia and Protea elliottii are frequent in the fallow lands. On the rocky hills (*Oke*) that define the Okeho topography, woody climbers like Acacia ataxacantha and trees such as Bombax costatum (Red silk cotton) and various Ficus species (Figs) are abundant. In the low-lying, seasonally flooded areas (fadamas) near local streams, the palm Raphia sudanica and Borassus aethiopum (African fan palm) are dominant.

Most grasses in this region are perennial hemicryptophytes; they form thick tufts that protect their internal buds from the intense annual bush fires common between December and March. During the dry season, the ground between these tufts appears bare, occasionally occupied by geophytes like Anchomanes welwitschii (Isu-Baka). Common herbaceous weeds found in Okeho farms include Aspilia africana (Yunyun), Tridax procumbens, and Chromolaena odorata (Siam weed).

4.2.6.1.1 Economic Plants

Economic Plants

The economic trees in Okeho are a mix of preserved indigenous savanna species and introduced plantation species. The table below reflects the typical floristic composition and economic utility found in the Kajola LGA survey area.

Table 4.13: Species List, Local Name, and Economic Importance (Okeho)

S/n	Scientific Name	Local Name (Yoruba)	Frequency	Economic Importance
1.	Vitellaria paradoxa	Emin / Emi	161	Nut extraction for Shea butter; medicinal bark; fruit pulp is edible.
2.	Parkia biglobosa	Igba	135	Seeds fermented for *Iru* (locust bean); medicinal bark for toothache.
3.	Milicia excelsa	Iroko	11	High-value timber for construction and furniture; ritual significance.
4.	Anogeissus leiocarpus	Ayin	13	Excellent charcoal production; chew-sticks; very durable hardwood.
5.	Daniellia oliveri	Iya	32	Wood used for mortars and pestles; resin (gum) used for incense.
6.	Adansonia digitata	Ose (Baobab)	27	Leaves used for soup (Luru); bark for rope; medicinal fruit pulp.
7.	Tectona grandis	Gedu (Teak)	2	Widely planted in Okeho for poles and high-quality timber.
8.	Gmelina arborea	Igi Isana	14	Fast-growing timber; used for matches, paper pulp, and plywood.
9.	Mangifera indica	Mangoro	5	Commercial fruit production; shade tree; medicinal leaves.
10.	Azadirachta indica	Dongoyaro	14	Highly medicinal (malaria treatment); pesticide properties.
11.	Anacardium occidentale	Kasu (Cashew)	350	Major cash crop in Kajola; nuts for export; apples for local juice.
12.	Khaya senegalensis	Oganwo	121	African Mahogany; premium timber and medicinal bark for skin infections.
13.	Terminalia glaucescens	Idi	51	Roots used as chew-sticks; medicinal for antimicrobial purposes.
14.	Elaeis guineensis	Opipi / Ope	249	Palm oil and kernel oil; palm wine; fronds for brooms and thatch.
15.	Blighia sapida	Ishin (Ackee)	35	Edible fruit arils (when ripe); wood used for local utensils.

(Source: Ecobinder Services Limited, Field Survey, 2026)

4.2.6.2 Wildlife

4.2.6.2.1 National Overview

Nigeria has a wide variety of plant and animal species. These include about 7,895 plant species, 20,000 insects, 1000 birds, 1000 fishes, 247 mammals, and 123 reptiles. An estimated

0.36% of these are threatened or endangered. The following sections are based on observations at the project site, supported by published records for the local area where available.

4.2.6.2.2 Mammals

Mammals encountered in the project area include the medium and small-sized mammals such as Hare (*Lepus capensis*), these predators are important in maintaining the balance in the ecosystem. The common herbivores include Red Eye Monkey (*Presbitis rubicund*), Cows (*Bos primigenius*), and Goats. Rodents include Squirrel (*Alpine marmot),* Bush Rat (*Rattus fuscipes*), grass cutter, squirrels and mice while primates were mainly monkeys. Historic record cited the presence of Hyenas, Lions, Warthogs, and Bush bucks. All the species are common and widespread and are not listed as endangered in the IUCN Red list of endangered species.

4.2.6.2.3 Reptiles

The observed reptiles include lizards and snakes. The predominant species are *Varanus Albigularis* (Monitor lizard), *Agama agama* (Common lizard), *Bitis arietans* (puff Adder), (Philothamus irregularis (Bush snake), *Atractasis reticulata* (Viper) Python snake (*Python mulurus*), Cobra snakes (*Boulengerina annulata*), and Viper snake (*Crotalus basiliscus*) – seen occasionally.

4.2.6.1.1 Insects

The observed species include spiders (*Hysterocrates laticeps*), ants (*Camponotus pennsylvanius*), sand flies (*Diptera psychodidae*), Grasshopper (*Caelifera*), Wasps (*Polistes galicus*), Bees (*Anthophila*), Dragon Fly (*Anisoptera*), Green Mantis (*Sphodromatis virdis*), Termite (*Termitodae*), Ants (*Formicidae*), and long nose weevil (*Rhinotia hemistictus*).

4.2.6.1.2 Amphibians

The observed species include Flat Backed Toads (Amietophrynus macalutus), Subdesert Toads (*Amietophrynus xeros*), Grassland frogs (*Ptychadena tellinii*), Sand Frogs (*Tomopterna crytotis*), Newts (*Pleurodelinae*), Crab (*Liocarcinucinus vernalis*), Cane Toad (*Rhinella marina)* and Parsley Frogs (*Pelodytes punctatus*).

4.2.6.1.3 Birds

Birds recorded include birds of prey such as vultures, black kites, eagles, buzzards, and owls Red Eyed Doves (*Stretopelia semitorquata*), Guinea Fowl (*Numida meliagaris*), Cattle Egret (*Bubulcus igris*) which are migratory, Brown Quail (*Coturnix ypsilophora*), Village Weavers (*Ploceus cucullatus*), Canary (*Serinus canari domestica*), Curckoo (*Guira guira*), Crow (*Coryus*), African Hooded Vulture (*Necrosyrtes monachus*), Stork (*Cicconidae*) – an occasional visitor. Other species include rollers, doves, plovers, shirkes, bee-eaters, and finches. These species are classified as least concerned and are not threatened by the proposed project directly.

4.2 Socio-Economic and Health Conditions of the Study Area

Baseline socio-economic characteristics and the results of the survey carried out at the Federal University of Agriculture and Technology (FUNATO), Okeho are presented in this sub-section. The socio-economic characteristics of an area provide vital statistics on existing livelihood activities that could be explore for various purposes including employment and social intervention during construction and operation stages of projects. Socioeconomic study also describes social and economic activities that may be potentially affected by any developmental activities such as the proposed Solar Project under the phase II of the energizing education program (EEP) project by the government of Nigeria in collaboration with the donor agency. The baseline socioeconomic information will serve as a yardstick to measure the project's impact on the University community throughout the project's life cycle. Explicitly, some of the themes discussed include population characteristics, socio-cultural organization, development activities, university structure, existing facilities within the campus, employment, income distribution, and stakeholder views on the project.

Data Collection Methodology

This study employed both primary and secondary data sources. The later comprised government records, maps, information published in journals, websites and books as well as approved EIA Reports while the former included pre-coded questionnaires, key informants, focus groups, direct observation, direct measurement, specially prepared data collection formats and participatory research.

Although the questionnaires largely contained closed-ended questions for easy recording of responses, some open-ended ones were included to allow respondents freedom in structuring their responses. This permitted the researchers to obtain clearer insights into questionnaire items. Data collected on various socio-economic parameters from the project location were also analyzed using different appropriate tools.

Approach to data collection

An In-Depth Interview (IDI) was held with the key senior staff of the University (Plate 4.3). In addition, informal discussion was also held with some sampled respondents to further gather more data about the views of the stakeholders in respect of the proposed development. The verbal discussion was to augment the survey instrument (designed questionnaire). Furthermore, mixtures of data gathering approach were further engaged to acquire more information on human activities of the project/host community. These data gathering mixture approaches include:

- A review of secondary data including published articles and online materials including from the FUNATO web page;
- A reconnaissance survey to identify all human activities that are located close to the project site or that maybe affected directly or indirectly by the proposed intervention;
- Key informant interview (KII) with senior staff of the University; and

- Field observations (including photographs) was carried out for graphical presentation of features for appraisal.

The questionnaires were administered systematically to ensure that the required number of questionnaires were returned by the respondents. The sampled size was informed based on the prevailing situation at the time of the study.

Data Processing and Analysis

The retrieved questionnaires were processed using the statistical package for social sciences (SPSS) version 20. Similarly, figures/values generated from the SPSS was further plotted in MS Excel- version 2016. Generally, results of the analysis were presented in figures/values, tables, and graphs.

Background of the Study Area (FUNATO) Okeho, Oyo State

The Federal University of Agriculture and Technology, Okeho (FUNATO) is a newly established federal institution in the Oke-Ogun area of Oyo State, Nigeria. Located in the ancient town of Okeho, the University commenced full academic activities at its temporary site (Awoyemi Commercial High School along the Isemi-Ile Road, Okeho) in November 2025 while full academic session was commenced in April, 2025 to further improved the access to education amongst its catchment area and Nigeria in general.

Plate 4. 3: FUNATO Temporary Campus Main Gate, Okeho, Oyo State

University Community Administrative Structure

Administrative leadership structure of FUNATO, Okeho is shown in Figure 4.9. Administratively, the University is headed by a Vice-Chancellor (VC). The Vice Chancellor is practically the head of the school's day to day administration. The VC is joined by other principal officers in administering the school activities, these other principal officers are the Deputy Vice- Chancellor, the Registrar, the Bursar and the University Librarian.

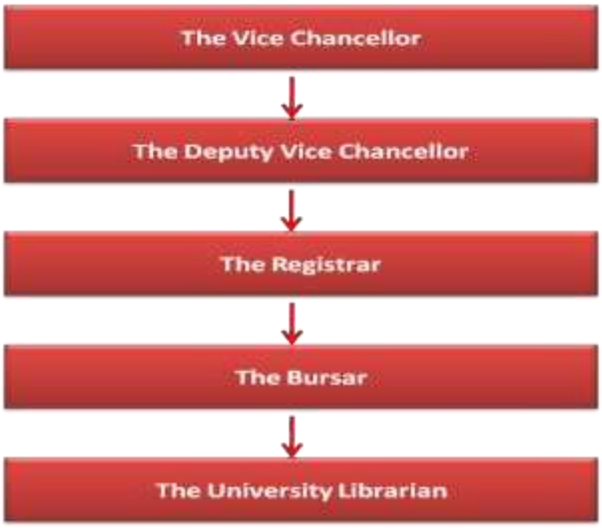


Figure 4. 9: Administrative Structure of FUNATO, Okeho

Governing Council

The governing council is the highest decision-making body of the University. The council is headed by a Chairman/Pro-Chancellor appointed by the Federal government of Nigeria through the ministry of Education. Other member of the council includes the Vice Chancellor, Deputy Vice-Chancellor, representatives from the University Senate, external members, and a representative from the federal ministry of education are member of the governing council respectively. Critical decisions about the FUNATO Okeho including the choice of the location of the proposed solar project, appointment/recruitment of principal officers among others are taken at the governing council level. However, membership of the council is tenure based.

Land Tenure and Ownership

Land means many things and the manner in which it is acquired, owned, used, and transferred is referred to as land tenure. Nigeria's Land Use Act defines people's right to land in the interest of socioeconomic development. As stipulated in Land use Act of 1978 of the Federal Republic of Nigeria, all land within the administrative boundary of a state is vested in the hand of the executive governor. In practice, a land can be owned by an individual, organization, and

community. Land tenure is the legal regime in which a land is possessed or occupied. In other words, the principal methods on land acquisition in Nigeria are inheritance, purchase, lease, pledge, exchange, and gift. Rights to land can only be exercised over when it must have been acquired in one way or another. During the survey/data gathering exercise, it was noted that the land for the proposed project is located within the allocated University land of the Federal University of Agriculture and Technology, Okeho. In other words, the FUNATO land where the proposed project is located was provided by the Oyo State Government.

~~*Governing Council*~~

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Population Characteristics of the Project Area

The FUNATO Okeho is the host to the project. Hence, the human population of the study area was limited to the students and staff of the school since the school is located at distances away from the City Centre. The population of FUnato community can be estimated at over 1500 for both staff and students. This population therefore needs electricity to work effectively. The proposed development will go a long way in improving the running of the school academic activities effectively.

Sampled Socioeconomic Characteristics

The basic socioeconomic indices of the sampled population which largely represent economic situation at the study School are presented in this section. The importance of this appraisal is to examine the economic and human dimension of the host institution particularly as regards source of power among other variables. The details discussed include gender, age distribution, marital status, ethnic group, religion, literacy level, occupation, household size, residential status with duration of stay in the project area, income level, health status etc. These vital socioeconomic traits could be used by the handler of the proposed facility in engaging with the University community during construction and operation stages of the proposed project. The information could also further be used by the beneficiary school authority for critical decisions making. Meanwhile, it was noted that respondents answered the survey largely based on their accommodation which is outside the university territorial boundary.

Characteristics Gender Distribution

Reflected in figure 4.10, Male respondents account for about 70% while the female gender represents 30% of the total sampled population.

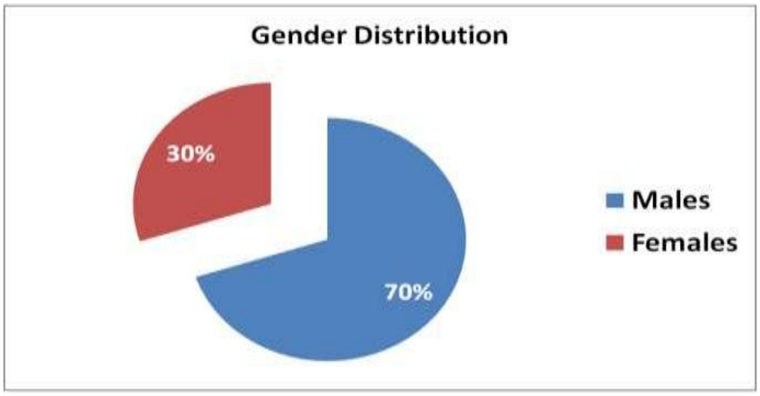


Figure 4. 10: Gender Distribution in the Project location

Age Distribution

As indicated in figure 4.11, there is the possibility of higher youth population (active age group) in the project area as the respondents in the age group of 18 to 45 years (55%) account for the highest proportion in the sampled population. This is followed by age group of 46 to 65 years (25%) while those that are above age 65 years' account for 15%. The age group below 18 years' account for only 5%. The age group distribution indicated by the respondents is expected of a university environment.

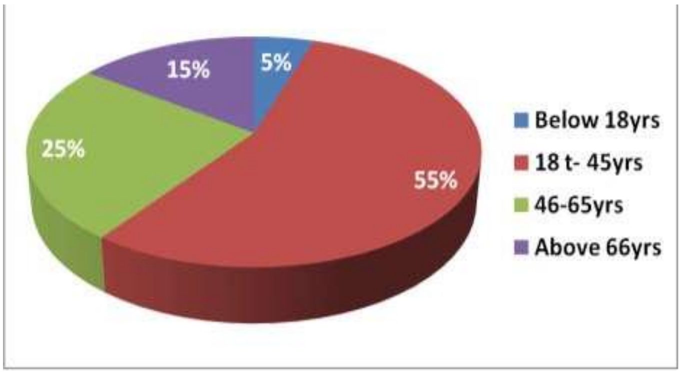
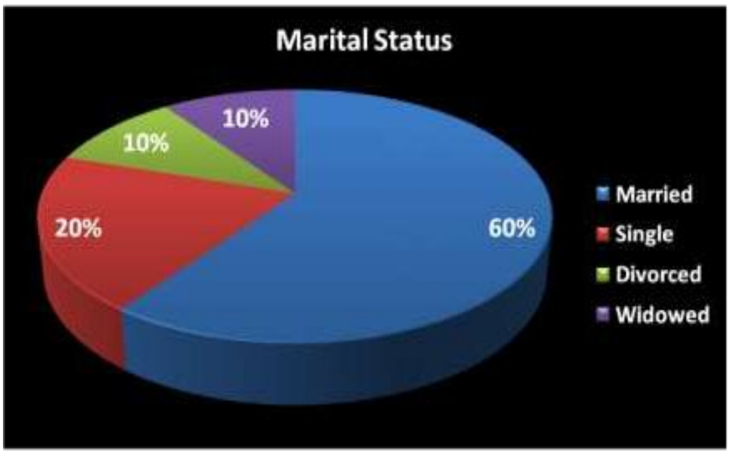


Figure 4. 11: Age Distribution in the Project L~~l~~ocation
Source: Field Survey for the proposed EEP, February 2026

Marital Status of Respondents

Married respondents account for 60% while single account for 20% followed by the divorced and the widowed which accounted for 10% each respectively of the respondents (see figure 4.12). It could therefore be envisaged that a great number of the people in the school, who are incidentally mainly staff of the FUNATO are married and have sense of commitment. Married people are presumed to be more responsible in our society.

Figure 4.12: Distribution of Marital Status of Respondents



Distribution of Employment of Respondents

Civil servants (government workers) are the dominant livelihoods indicated by the sampled population as presented in figure 4.13. This is not also unexpected due to the circumstance that surrounds the school and indeed all public Universities in Nigeria when the study was carried out. Consequently, occupations indicated respondents are civil service (35%) followed by trading/business (20%). Salary employed and each. The least respondent was the unemployed which accounted for 2% of the total respondents. Other businesses such as point of sale (POS) operators, Recharge card sellers are also found within the campus.

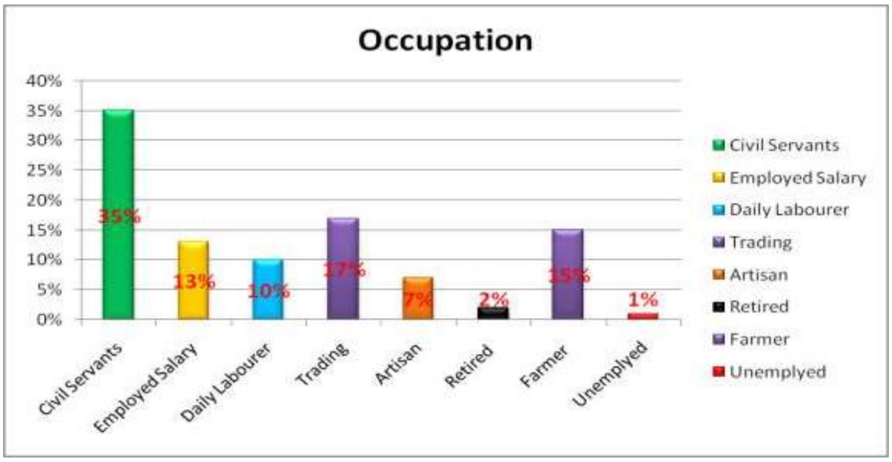


Figure 4. 13: Occupation distribution within the Project location

Source: Field Survey for the proposed EEP, February 2026

Residential Status

All of the sampled respondents indicated that the permanent residents are more in number, they accounted for 60% of the respondents and have lived there for 6-9years, this is followed by the returnee residents due to work posting or retirement back to home and they have lived there for 3-5years. The least respondents are the non-residents who are in town occasionally for lectures or other academic related activities and they have lived there for 0-2years. On the other hand, the relationship to household head was 70% self, 25% spouse and 5% Parent showing that more of the respondents were household heads while the dominant average household (HH) size indicated by the sampled respondents are 3 to 5 people showing (65%) of the respondents. Figure 4.14 shows the Percentage Distribution of Residential status within the Project location.

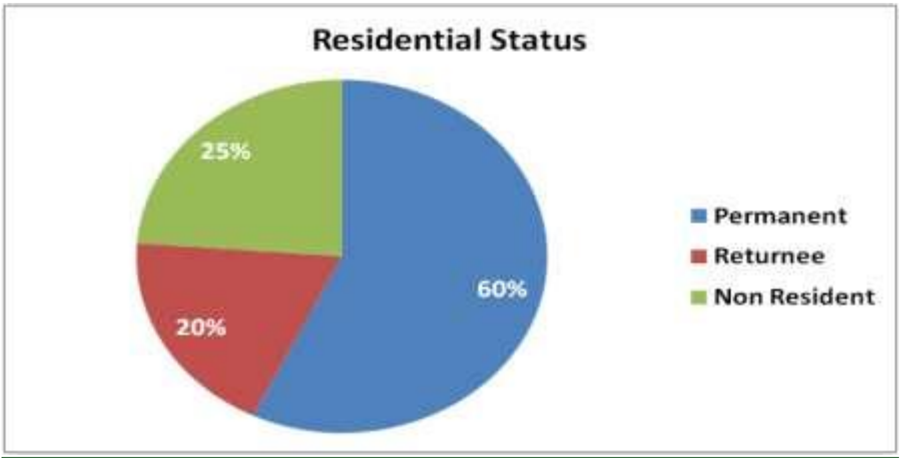
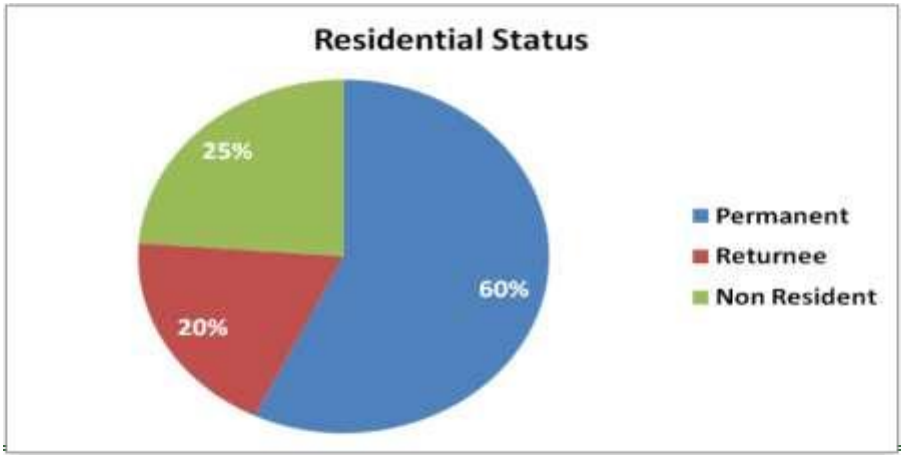


Figure 4. 14: Percentage Distribution of Residential status within the Project location

Source: Field Survey for the proposed EEP, February 2026

~~Residential Status~~

~~All of the sampled respondents indicated that the permanent residents are more in number, they accounted for 60% of the respondents and have lived there for 6-9years, this is followed by the returnee residents due to work posting or retirement back to home and they have lived there for 3-5years. The least respondents are the non-residents who are in town occasionally for lectures or other academic related activities and they have lived there for 0-2years. On the other hand, the relationship to household head was 70% self, 25% spouse and 5% Parent showing that more of the respondents were household heads while the dominant average household (HH) size indicated by the sampled respondents are 3 to 5 people showing (65%) of the respondents. Figure 4.14 shows the Percentage Distribution of Residential status within the Project location.~~



~~Figure 4. 14: Percentage Distribution of Residential status within the Project location~~

~~*Source: Field Survey for the proposed EEP, February 2026*~~

Ethnic Groups

Ethnic group by the respondents are Hausa-Fulani (5%), Kanuri (3%), Igala (5%), Yoruba (75%), Igbo (11%) and other tribes (1%), the Yoruba tribe generally constitute 90% of the respondents. The indicated ethnic groups by the respondents may not necessarily represent the real composition of the school staff or ethnic groups in Oyo state. However, a federal establishment such the FUNATO is expected to have multi-ethnic compositions.

Religious Groups

As shown in figure 4.16, those that indicated Islam are the majority which constituted 60% of the Respondents, Christianity constitute 30% while minority were the traditional religion constituting only 10% of the respondents as shown in the chart. It should therefore be noted that the study community does not discriminate or deny anyone from practicing his/her religion belief.

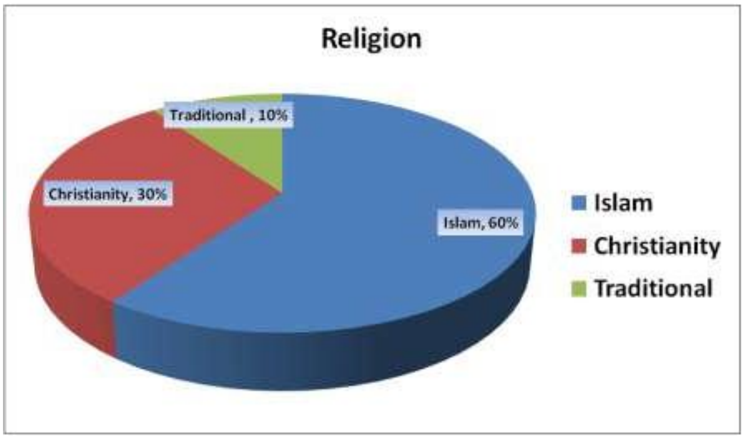


Figure 4. 16: Percentage Distribution of Religious groups within the Project location

Source: Field Survey for the proposed EEP, February 2026

Education

Respondents' dominant education attainments are University graduate (47%) and University postgraduate (25%). Others such as OND/NCE/HND account for 13%, Secondary School education is 9%, Primary School is 5% while no formal education accounted for 2% of the respondents (see figure 4.17). As expected of a university community, it could therefore be noted that there is a high level of literate people within the study area.

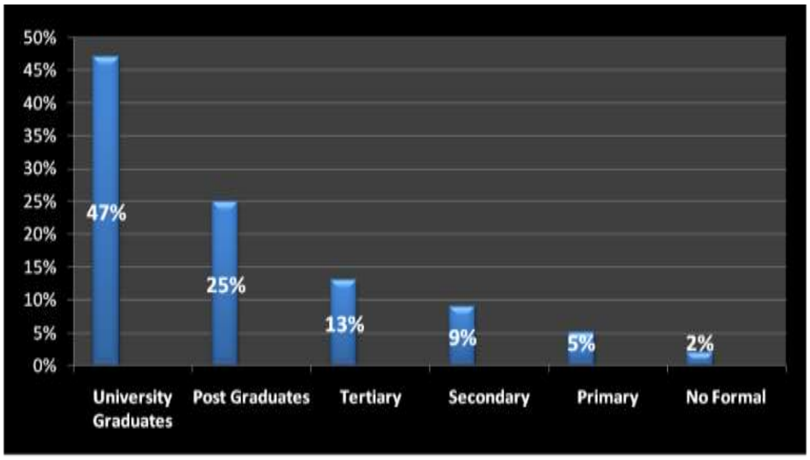


Figure 4. 17: Percentage Distribution of Educational Levels within the Project location

Source: Field Survey for the proposed EEP, February 2026

Average Monthly Income

Monthly income indicated by the respondents in figure 4.18 are: below ₦50,000 (24%),₦50,000 to ₦100,000 (37%), while those earning Above ₦100,000 accounted for 39% of the respondents. It should be noted that some of the respondents particularly the monthly non- salary earners are unable to estimate their monthly income as a result of improper financial record keeping.

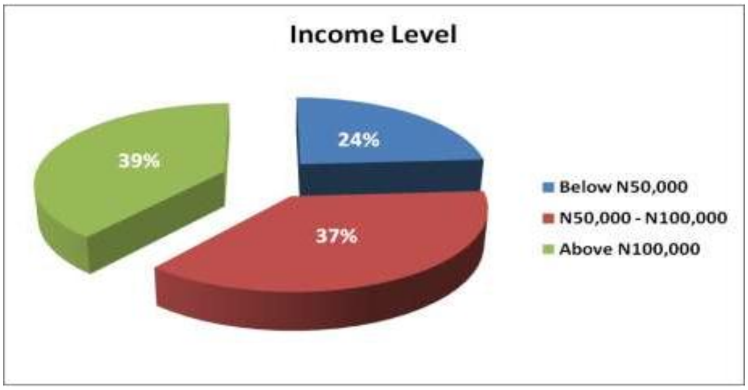


Figure 4. 18: Percentage Income Distribution within the Project L~~l~~ocation

Source: Field Survey for the proposed EEP, February 2026

Housing Characteristics

Housing types and materials used in building construction are part of the indices on the quality of housing and standard of living within a particular community. The site location is Okeho which is a community under Kajole LGA of Oyo state. The nature of building types and roof characteristics occupied by the respondents are described in this section. As indicated, all (100%) of the respondents live in cemented block houses. The roofing materials are a mixture of corrugated iron sheets (70%), aluminum (20%) and asbestos roof (10%). The floor of the houses is majorly cemented (60%) while a few used tiles (30%) and the rest was other floor types. Respondents' household number of rooms include: 1-2 rooms (47%), 3-4 rooms (48%), and above 4 rooms only (5%). The common toilet facility among the respondents is the water closet (60%). Pit latrine accounts for 25% while others are toilet outside dwelling building and they account for 15% of the respondents. Structure types within the project location are buildings, office complex structures, bungalows, shops etc. Other structures are temporary like kiosks for (POS), makeshift for local restaurants and petty traders and Umbrella stands for recharge card sellers.

Respondents Land and House Tenures

The tenure of the housing and land is presented in Figure 4.19. As shown in the figure, 43% of respondents indicated they live in rented apartments while 40% indicated they live in personal/owned apartments; in addition, 10% of the respondent indicated they live in leased tenure while only 7% indicated free house/accommodation. Similarly, the land tenure followed same pattern as that of the housing tenure.

Figure 4. 19: Respondents' Land and Housing Tenure Characteristics

Source: Field Survey for the proposed EEP, February 2026

Household Solid Waste Management

As shown in Figure 4.20, the household solid waste management methods adopted by the respondents at the study community include: Waste Collectors 42%, Burning 28%, while refuse dump is 30%. In Oyo state, solid waste is managed by an agency of the state government, nonetheless, the waste collection service of the agency is often limited to the urban areas and are usually irregular. The project location is in the Okeho community, farther from the state capital, results from the respondents shows that most of the waste are evacuated by private waste collectors or local scavengers popularly called Babanbola.

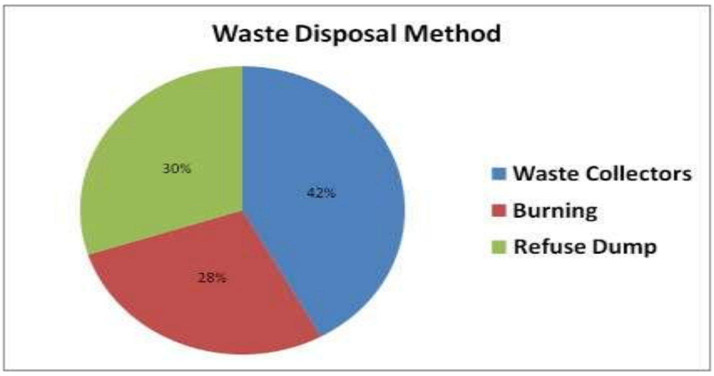


Figure 4. 20: Waste Disposal Methods ~~employed by Respondents~~

Source: Field Survey for the proposed EEP, February 2026

Sources of Energy

Sources of energy are not the same everywhere and it varies from one household to another. As indicated, primary source of energy for lighting by the respondents is electricity supply from the national grid (70%), while those that depend on power generating sets as primary source of energy account for 20%. Other sources of energy indicated are the solar power, and batteries which constitute only 10% of the respondents. Meanwhile, mix energy use is common among many people in Nigeria due to unstable power supply from the National Grid. Oyo State is connected to the Ibadan Electricity Distribution Company (IBEDC).

On the energy for cooking, main sources indicated are cooking gas (25%), firewood (30%), charcoal (25%) and Kerosene 20%. It was observed that cooking with firewood is common among the food vendors while charcoal is mostly used by those selling roasted food**.** Cooking gas remains one of the sources of clean energies use around the world.

Sources of Water

Indicated sources of water for household use in the study area is majorly Borehole which dominated about 70% of the respondents, however other sources indicated by the respondents are Well 20% and Rain harvesting 10%. Generally, households within the community depend on underground water for various uses due to the absence of Government pipe borne water specifically at the project location.

Health Impact Assessment

The baseline health condition of the people of the study area was assessed through survey. The assessment through interview and questionnaire administration revealed that malaria fever was the most common diseases (60%) while typhoid and whopping cough account for 17% and 13% respectively. Other ailments such as stomach ache, cholera, pile, eye pains and stomach ulcer jointly account for 10% of the total sampled population.

Project Location Environmental Challenge/Concern

Based on the fact that the school is located in the outskirts of the town, the major environmental concerns pointed out by the respondents are:

- Lack of good roads
- Poor Infrastructure
- Inadequate vegetation

Security

In terms of security of lives and properties, it was noted that measures have been put in place within the campus to prevent insecurity. Security measures put in place are the establishment of outpost stations for the Nigeria Police Force (NPF). Furthermore, internal (private) security is also engaged to mount some strategic locations including the University main entrance gate. There is also proposed perimeter fence within the project community for safeguard against intruders. A proper stop and check will be conducted by the internal security at main entrance gate. On the other hand, more work should be done to introduce street lights preferably solar because of power epilepsy for proper lighting at nights while close circuit cameras should also be installed to oversee events for proper monitoring.

Summary of the Socioeconomic Study and Stakeholder Consultation

Socioeconomic study for the proposed Solar Project under the phase II of the energizing education program (EEP) project by the government of Nigeria in collaboration with the donor agency has 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 FUNATOH will be sited within the university site which is located in Okeho community of Oyo State.
- Administratively, the school is headed by the Vice-Chancellor and other principal officers;
- The planned project would be located on a land that is presently not in use for any activity, consequently, no displacement of livelihoods, cultural properties, and human habitation is envisaged;
- Economic activities in the school are basically retails and include commercial tricycle operators; shops, restaurants, POS, etc.
- Site location met the necessary project technical requirements;
- There is no major environmental challenge within the project location
- No youth restiveness is associated with the school;
- 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 total dependency on the National Grid which is not sustainable and also the cost of powering the school through diesel powered generators.

4.3 Stakeholder Engagement

Stakeholder consultations were carried out with key stakeholders to obtain their comments and concerns on the proposed project with respect to the potential environmental and socio-economic issues and impacts. The key project stakeholders identified for consultations, were the members of the project team and some staff members around the campus.

Plate 4.3: FGD and Photo Session with Stakeholders at Okeho Garage

4.5 Photo Session with Some Management Staff of the Federal University of Agriculture & Technology, Okeho, Oyo State Headed by the Vice Chancellor -Prof. O. J. Babayemi (In White Face Cap), the Registrar Mr. M.O. Amuni and Other Members with the Consulting Team

Plate 4. 6: FGD with Onjo-In-Council, Okeho

The stakeholder consultation meeting was held in February 2026. A plan was developed to involve the active participation of all stakeholders in decision-making processes, to foster dialogue and reduce tensions. ESMP questionnaires were equally administered for the opinions and concerns of stakeholders.

Issues of concern were address by the university project team. The project team, chaired the engagement session and explained that the goal was to develop and maintain open and constructive relationships with all stakeholders, to facilitate the management of the project and its stakeholders, including their environmental and social effects and risks. After initial introductions, proposed project activities were also presented and discussed.

Date	28th April, 2026
Venue	University campus
Stakeholders	Project Team and University Management
Language of Communication	English
Issues Discussed	Stakeholder Responses/Views
Awareness of the proposed Solar Power Project	Stakeholders were informed about the proposed 1MW Solar Hybrid Mini-Grid Project through consultative meetings held with the University Management, representatives of Kajola Local Government, community leaders, youth representatives, market associations, and nearby residents. During the engagement sessions, the project objectives, components (solar PV farm, battery storage system, inverter system, distribution network), expected capacity, and implementation timeline were clearly explained. Visual illustrations and simplified technical explanations were used to ensure proper understanding. Stakeholders demonstrated adequate understanding of the project scope and its intended purpose to provide reliable, clean, and sustainable electricity to the University and surrounding facilities.
View about the proposed project	Stakeholders expressed strong support for the proposed solar power project. The University Management welcomed the initiative, noting that stable electricity would significantly improve academic activities, laboratory research, ICT infrastructure, and administrative efficiency. Community leaders and residents described the project as timely and progressive, particularly considering the unreliable public power supply in Okeho and surrounding communities. No opposition to the project was recorded during consultations.

Importance of the Proposed Project	Stakeholders identified the following key benefits: • Improved and reliable power supply for academic, research, and administrative operations. • Reduction in dependence on diesel generators, thereby lowering operational costs. • Reduction in greenhouse gas emissions and noise pollution. • Enhancement of security within the campus through improved lighting. • Potential employment opportunities for local youths during construction and operation phases. • Strengthening the University's image as a technology-driven and environmentally sustainable institution. The project was widely viewed as aligning with national renewable energy goals and climate change mitigation strategies
Choice of the project location	The selected location within the University premises was generally accepted by stakeholders. The site was considered suitable because: • It is within institutional land ownership, thereby minimizing land acquisition issues. • It is relatively free from dense vegetation and major physical obstructions. • It is close to the proposed load centers, reducing transmission losses. • It does not interfere with existing academic buildings or residential quarters. Community representatives confirmed that the site does not encroach on communal land or cultural heritage sites.
Concerns	Although stakeholders supported the project, the following concerns were raised: • Employment preference for local skilled and unskilled labor during construction. • Proper waste management of solar panels and batteries at end-of-life. • Security of the facility to prevent vandalism. • Transparent communication regarding power distribution and possible extension to nearby communities in the future. • Avoidance of excessive tree clearing during site preparation.

	• All concerns were acknowledged, and assurances were given that mitigation measures would be incorporated into the Environmental and Social Management Plan (ESMP).
Remarks	Stakeholders unanimously expressed optimism and encouraged timely implementation of the project. The University Management pledged institutional support to facilitate smooth implementation, while community leaders assured cooperation and peaceful coexistence throughout the project lifecycle. Overall, the stakeholder engagement process indicated strong acceptance, minimal social risk, and a high level of community readiness for the proposed 1MW Solar Hybrid Mini-Grid Project at the Federal University of Agriculture and Technology, Okeho.

CHAPTER FIVE: ASSOCIATED AND POTENTIAL IMPACTS

5.1 Introduction

The project has overall positive impacts by providing a competitive, cost-effective, pollution free reliable mode of solar power. It will certainly meet the ever-increasing demand of power and to bridge the gap between demand and supply of power. However, the proposed project may have some negative impact on the environment during site preparation, construction & operation phases. During the construction phase, the impacts may be regarded as temporary or short-term; while long-term impacts may be observed during the operation stage.

5.2 Impact Assessment Overview

The potential for an Environmental and Social impact exists where an environmental and social aspect has been identified i.e., where a project activity has been determined to have the potential to interact with the biophysical and socio-economic environment.

The assessment process was as follows:

- Identification of the various potential impacts using interaction matrix to show the relationship/ interaction between the project environmental components and planned project activities.
- A screening of potential impacts associated with each phase of the project is performed using a Risk Assessment Matrix; and
- A detailed evaluation of the individual impact producing factors that comprise each aspect of the project phases is then performed. The significances of the potential impacts are quantified using the same rationale as for the screening.

The assessment of impact significance is both in qualitative and quantitative terms. Qualitatively, the impact significance is ranked on four (4) widely accepted levels: Major, Moderate, Minor and Negligible. The impact assessment covers the entire life cycle of the Project. i.e.: preconstruction, Construction, operation, and decommissioning.

5.3 Identification of Environmental and Socio-economic Aspects and Impacts

A number of project activities would be carried out in phases. These planned activities are what would impact on the environmental components positively or negatively. The utility scale PV- based power plant project activities are grouped into four phases as follows:

Pre-Construction phase: Involves activities such as award of contract, project design and planning, consultation, recruitment, site preparation and transportation of the utility scale PV- based power plant components to site.

Construction phase: It involves activities such as mobilisation of workforce and equipment to site, digging, trenching, bulldozing, grading, soil compaction; and installation of temporary camp and power plant components. This phase is usually a short term one.

Commissioning phase: It involves the integrated application of a set of engineering techniques and procedures to check, inspect and test every operational component of the project, from individual functions, such as instruments and equipment, up to complex amalgamations such as modules, subsystems and systems.

Operational phase: This is usually 'long term', involving activities from post construction to pre-decommissioning. It commences once the power plant has been commissioned for use. Activities include use of natural resources (water for domestic uses and cleaning of solar modules), plant and equipment operations, routine maintenance of equipment and plant.

Decommissioning phase: It begins once the power plant use is discontinued or project life span has come to an end.

It should be noted that impacts can occur at any time; during these phases mentioned above i.e. pre-construction, construction and operational phases of the project. Some impacts may however occur in some or all phases of the project.

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

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

The FMEnv EIA Procedural Guidelines and the African Development Bank Integrated Safeguard Systems Operational Safeguards, and ISO 14001 approach among other references were used in the identification process. The assessment approach generally involved matching the various activities of the different stages of the proposed project (as described in chapter 3 of this report) with the components of the existing environment. Consequently, the possible changes (and extent of changes) in the environment as a result of the interactions have been identified/ evaluated, hence mitigation measures proffered in order to reduce, offset or ameliorate such changes. The potential/ associated adverse and beneficial impacts of the proposed power plant project on the existing environment were identified at this stage of the ESIA. The Risk Assessment Matrix (RAM) has been employed in determining risks posed by the identified potential/associated impacts of the project in order to proffer appropriate mitigation measures. In predicting impacts, the experiential/practical 'worst case scenario' approach has been applied to determine the extreme effects of project activities on environmental components, while 'consensus of opinions' has been made use of to determine the importance of affected environmental components. The impact evaluation results make up the pedestal for developing the ESMP of the proposed project.

5.3.1 Potential Impact Characterization

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

1. **Negative**: An impact that is considered to represent an adverse change from the baseline or to introduce a new undesirable factor.
2. **Positive**: An impact that is considered to represent an improvement to the baseline or to introduce a new desirable factor.
3. **Direct**: Impacts that result from the direct interaction between a planned project activity and the receiving bio-physical and socio-cultural environment.
4. **Indirect**: Impacts that result from other activities that are encouraged to happen as a consequence of the project.
5. **Temporary**: Temporary impacts are predicted to be of short duration, reversible and intermittent/occasional in nature
6. **Short-term**: Short term impacts are predicted to last only for a limited period but will cease on completion of the activity, or as a result of mitigation measures and natural recovery
7. **Long-term**: Impacts that will continue for the life of the project, but cease when the project stops operating.
8. **Permanent**: Potential impacts that may occur during the development of the project and cause a permanent change in the affected receptor or resource that endures substantially beyond the project lifetime
9. **On-site**: Impact that is limited to the project site.
10. **Local**: Impacts that affect locally important environmental resources or are restricted to a single (local) administrative area or a single community.
11. **Regional**: Impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries.
12. **National**: Impacts that affect nationally important environmental resources; affect an area that is nationally protected; or have macroeconomic consequences
13. **Reversible**: An impact that the environment can return to its natural state
14. **Irreversible**: An impact that the environment cannot return to its original state, e.g. the extinction of an animal or plant species
15. **Cumulative**: Potential impacts that may result from incremental changes caused by other past, present or reasonably foreseeable actions together with the project. This also includes synergy with other projects/infrastructure in the project area
16. **Residual**: Both environmental and social impacts that will remain after the application of mitigation measures to project impacts during each of the project phases.

5.3.2 Screening and Scoping for Potential Impacts

The first step in identifying impacts associated with the project is the development of an interaction matrix which shows the relationship/ interaction between the project environmental and social components and planned project activities.

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

- Knowledge of the Project activities.
- Detailed information on the environmental and socio-economic setting of the Project's area of influence.
- Consultation with relevant stakeholders.
- Review of other ESIA reports on similar projects/environments.

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

Table 5. 1: Project Activities – Leopold's Environmental and Social Interaction Matrix (Impact Significance Matrix)

Table 5. 2: EEP II Solar Power Plant Impacts Categorization

Project Activities	**Associated and Potential Impacts**	**Direct**	**Indirect**	**Adverse**	**Beneficial**	**Reversible**	**Irreversible**	**Cumulative**	**Long term**	**Short term**
Pre-construction Phase										
• Permitting • Stakeholders' engagement • Land Use • Recruitment • Mobilization to site	Employment opportunities arising from recruitment of									
	Business opportunities for local contractors through sub-activities									
	Skill acquisition and enhancements to locals and future									
	Improvement in quality of life for adequately compensated									
	Conflicts over employment issues (quotas and methods)									
	Issues/ dispute on memorandum of understanding with project									
	Influx of people (migrant workers, sub-contractors and suppliers) and increased pressure on existing social infrastructure									

Project Activities	Associated and Potential Impacts	Direct	Indirect	Adverse	Beneficial	Reversible	Irreversible	Cumulative	Long term	Short term
• Land and clearing	Increase in social vices (like theft, prostitution) resulting from number of people in the area									
	Agitations over land disputes, wrong stakeholder leadership tussles, etc									
	Loss of vegetation covers and forest products (fuel wood, medicinal plants) due to site clearing and preparation									
	Increased risks of accidents leading to injury/ death and during mobilization									
	Risks of armed robbery attack and hostage taking leading death of personnel									
	Nuisance (noise and vibrations) from movement of equipment and vehicles affecting site workers and wildlife									
	Dust particles and vehicular emissions from increased									
	Generation of wastes such as scrap metal, wood, sand, domestic waste etc.									
Commissioning and Operational Phases										
• Testing and commissioning	Generation of electricity supply									
	Increased opportunities and quality of life (small, medium, large scale) due to enhanced power delivery									
Power plant maintenance servicing	Improvement in air quality due to reduced emission from owned diesel or petrol generators									
	Reduced demand on petrol and diesel used for power									
	Injuries/ fatalities of personnel due to incidents/ operating the power plant									
	Soil/ groundwater contamination from accidental petrol during refueling of vehicle									
	Workplace accidents/ incidents (cuts, trip, falls etc) leading death of personnel during operations									
	Acquisition of skills by individuals to be employed to operate									
	Depletion of groundwater resources for washing solar									
Decommission Phase										
• Mobilization of personnel equipment	Loss of employment, business opportunities and decreased activity									
	Reduced power generation to the University and low power									
• Power plant decommissio	Risks of injuries from possible collision with abandoned									
• Abandonment / restoration	Risk of accident and injury to workers during demolition of									
	Increased dust and vehicular emissions from decommissioning									
	Traffic obstruction on major roads from movement of decommissioned process									
	Availability of land for alternative uses									
	Loss of site aesthetic qualities due to abandoned and structures									

~~Key~~

	~~Activity interacts~~ with ecological or social component
	Activity does not interact with ecological or social component

5.4 Determination of Impact Significance

The significance of impacts that could occur due to the implementation of the project's activities were established based on three steps which are:

- Impact Magnitude which combines the extent, duration, scale and frequency of an impact
- Value/ Sensitivity/ Fragility and importance of the relevant Receptor;
- Identification of the impact significance, which is the cumulative indicator of both of the above two key variables.

The magnitude of an effect requires quantifying the sources of potential environmental and socio-economic effects from routine and non-routine project activities such as the extent of land take or predicted change in noise levels. On the other hand, the receptor sensitivity is derived from factors such as:

- Legislative controls;
- Designated status within the land use planning system;
- Number of affected individual receptors;
- Ability of the resource or receptor to absorb change; and
- Public perception about the criticality or sensitivity of the receptor

The determination of impact significance also entails considering compliance with environmental policies, quality standards and set pollution limits.

~~5.4.1~~5.3.3 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~~5.3.3.1 Defining Magnitude Levels for Biophysical Impacts

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.

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.

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.

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~~5.3.3.2 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 5. 3: Event Magnitude Rankings

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	• Negative outcome • 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

Importance	Attributes
	• 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~~5.3.4 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 5. 4: Receptor Sensitivity Ranking

Sensitivity	Criteria
Low	Receptor sensitivity is considered low when there is a moderate to high capacity and means to adapt to a given change and maintain / improve quality of life. Receptors of low sensitivity may include: • Individuals who are able to quickly adapt to temporary disruption in their living conditions, livelihood status or a change in the status of public infrastructure (such as a road closure). • Businesses with a robust economic model that are able to adapt easily to any restrictions placed upon their activities, or who are able to gain economically from such changes.
Medium	Receptor sensitivity is considered medium when there is limited capacity and means to adapt to a given change and maintain / improve quality of life. Receptors of medium sensitivity may include: • Individuals who rely heavily on their livelihood to maintain their socio-economic status and have a limited ability to adapt to change. • Businesses that have a limited ability to adapt to change and are sensitive to any reduction in economic revenue or reputation.
High	Receptor sensitivity is considered high in the case of vulnerable receptors, who have little capacity and means to adapt to a given change and maintain / improve quality of life (e.g. homeless people, Internally Displaced Persons community in temporary accommodation, people with low access to recourse (e.g. no land titles), people with no or low representation (e.g. migrants, seasonal herders with no permanent assets in the area). Receptors of high sensitivity may include: • Individuals with a marginal livelihood, low socio-economic income or poor-quality living conditions. • Individuals who are vulnerable due to their age, disability or other reason and who may require special assistance during engagement activities associated with the 3D seismic survey. • Businesses with a marginal economic existence which are not able to easily adapt to change.

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 5. 5: 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.

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

Table 5. 6: Leopold's Activity-Receptor Interaction Matrix (Impact Significance Matrix)

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~~5.4 Impacts Discussion

~~5.5.1~~5.4.1 Potential Positive Impacts

The proposed Project seeks to provide independent and reliable power supply to Federal University of Agriculture and Technology, Okeho through a solar energy source and thus, improve the quality of educational and other services within the institution as there will be longer hours available with better illumination for studying. Ultimately, the activities of the project will contribute to the achievement of Nigeria's carbon emission reduction targets (20% reduction by the year 2030) in fulfilment of the nation's Nationally Determined Contributions (NDC) to climate change. Within the project area, there will be reduced noise and pollutants from generator sets, and natural habitats and human health will be protected from pollution arising from the use of fossil fuels.

The renewable energy training centre constructed during the project implementation will provide capacity development through learning of renewable energy technologies and practices in the University and consequently, the certification of trained individuals.

The installation of streetlights as part of the proposed Project will improve safety by reducing hazards associated with flammable fuels and candles and enhance security within the University. In addition, the project will improve social cohesion and community development and generated new income as it would stimulate economic activities, and offer new opportunities for small businesses in the University premises. The employment opportunities for skilled, semiskilled and unskilled labour associated with the project will multiply job creation especially during construction to facilitate overall socioeconomic development.

~~5.5.2~~5.4.2 Potential Negative Impacts

The potential adverse impacts from project activities are grouped into the following subjects and discussed further according to the different applicable phases – Preconstruction, Construction, Operation and Decommissioning phase:

Land use

- Impacts from equipment, personnel and plant material movement;
- Impact on traffic;
- Impact on air;
- Impacts from noise and vibration;
- Impacts on terrestrial flora and fauna;
- Impact on water resources
- Impacts on waste generation;
- Impact on soil quality;
- Visual/ aesthetic impact;
- Social economic impacts;
- Health impacts; and
- Impacts from workplace hazards.

~~5.5.2.1~~5.4.2.1 Preconstruction/ Mobilization Phase

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

- Site selection

- Site clearing and preparation
- Mobilization of equipment, materials and personnel to site

Site selection

Approximately 3.465ha of land within the FUNATO property has been earmarked and allocated by the University management for the proposed 1.0 MW solar-hybrid power plant and the training center. No additional land either from private or public property outside the University campus will be expropriated for the Project.

The Project site is characterized by fallow lands and vegetation which includes grasses, shrubs, and a few trees. There are no physical structures on the site. There is occasional seasonal farming cultivated by nonacademic staff of FUNATO.

The University management specifies that land is always available within the University for use by staff to farm, and the land uptake will not pose a risk to the secondary income or food source for the staff, Thus, the impact significance of site selection for the proposed Project on the existing land use is rated **negligible**.

Site Clearing and Preparation

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

Potential Impact on Terrestrial Flora and Fauna

Site clearing activities associated with the proposed Project will lead to loss of terrestrial flora on the Project site. The potential impact on the terrestrial flora is considered to be negative, direct, site specific and largely irreversible. The impact magnitude is considered to be medium considering that not all the land area (3.465ha) will be cleared for the Project. However, the sensitivity /importance of the receptor is regarded as low since the Project site is a modified habitat, and none of the plant species identified within the Project site during the baseline survey was found to be endangered or threatened based on the International Union for Conservation of Nature (IUCN)-2018 classification scheme. Also, the local community has no direct or indirect ecosystem services that they benefit from the site. Furthermore, there are no protected/conservation areas within the site. The significance of the potential impact of site clearing on the existing terrestrial flora species of the Project site is therefore regarded as **minor**.

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

With regard to the clearing of the Project site prior construction phase, the potential impact on terrestrial fauna species may include loss of individual or localized population of fauna species or disturbance to avifauna species. This is unlikely to lead to a change in conservation status of the species since none of the fauna species (including avi-fauna) encountered or reported in the project site belongs to the IUCN classification of threatened animal species which include those classified as critically endangered, endangered or vulnerable. The sensitivity of the fauna species recorded on the Project site is thus regarded as **low**. The impact magnitude is considered to be **low** given that the site clearing activities would cover approximately 3.465 of land allocated for the Project. The potential impact is direct, irreversible, short term and localized. The impact significance is thus considered **minor**.

Potential Impact on Soil

The proposed site clearing and preparation activities could potentially impact the soil environment of the Project site. The potential effects on soil include degradation due to site preparation e.g. compaction of soil as a result of the movement of earth moving equipment. Soil degradation is the removal, alteration, or damage to soil and associated soil forming processes, usually related to human activities. The stripping of vegetation or disturbance to the natural ground level over disturbance areas will negatively affect soil formation, moisture levels, soil density, soil chemistry, and biological activity. Uncontrolled site clearance of vegetation could lead to direct surface soil exposure and hence erosion of soil which could be significant. The impact magnitude is considered as **medium** as the extent of soil erosion could be high, especially if the site clearing activities are carried out in the wet season. However, based on the results of laboratory analysis conducted on soil samples from the Project area, the Project site is not considered to be significantly prone to land-based erosion. Thus, the impact significance of site clearing on soil environment of the study area is considered **minor**.

Potential Impact on Air Quality and Ambient Noise

The pollutants which could impair air quality during site clearing activities are particulate matter in form of dust, and NOx, CO, Total Suspended Particulates (TSP), SOx from combustion engines of the earth moving equipment that will be used for clearing. Intermittent noise emissions could also occur from the operation of the machinery. The impact magnitude is considered to be low since the activities will be short-termed, intermittent, localized and reversible. The site clearing activities will take less than 1 week. The sensitivity of the air shed of the Project area is also regarded as low based on the results of air quality measurements conducted in the area during the field data gathering. The impact significance of site clearing on the ambient air environment of the Project site is considered to be **minor**.

Potential Impact on Workers Safety

Site clearing and preparation are potentially hazardous activities. Accidents may occur especially when those involved are unskilled. Such accidents may result in loss of man-hours which may ultimately affect the schedule date of completion of the Project development especially if the man-hour losses are high. The site clearing activities will take about 1 week and the number of workers required would be less than 10. The impact significance is considered to be **minor**.

Mobilization of equipment, materials and personnel to site

In executing the proposed project, a great deal of haulage/ movement would be undertaken all through the phases of the project. Movements would include: transportation of equipment and personnel for construction and operational phases; and movement of plant components to project site for construction and installation. Anticipated impacts during the mobilization of equipment and personnel to site will include:

Potential Impact on Air Quality and Ambient Noise

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

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

Potential Impact on Infrastructure (Road)

Regarding safety along the project route, the mobilization activities during the pre-construction phase of the Project could increase the traffic volume in the Project area (and potential for road accident) as a result of movement of vehicles in and out of the Project site. The social aspects of these activities could lead to accident, traffic congestion and annoyance from other road users in the area. The magnitude of the impact is considered low since the mobilization activities would be within 1 week. The sensitivity of the receptors is adjudged as medium given that the existing vehicular movement in the University environment is high. The prominent means of transportation are cars, motorcycles/tricycles, and buses/trucks. The impact significance is considered to be **minor**.

Potential Impact on Workers Safety

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

Table 5. 7: Summary of Potential Negative Impacts Associated with the Pre-Construction Phase of the proposed Project

Activity	Receptor	Associated Impact	Significance
Site Selection/ land	Existing crop farming on site	• Loss of land for farming activities due to land take for the Project	Moderate
Site clearing and preparation	Terrestrial flora and fauna	• Vegetation loss • Direct impacts on vegetation and soil-dwelling organisms; indirect impacts on fauna species in the immediate surroundings of the Project site	Minor
	Soil	• Loss of top soil • Soil compaction and degradation • Increased erosion potential • Reduction in structural stability and percolative ability of soil	Minor
	Air Quality and Noise	• Air quality impacts due to emission from site clearing equipment • Increase in ambient noise levels	Minor
	Workers Safety	• Injuries and accidents to workers during site clearing and preparation.	Minor
Mobilization of construction equipment and materials to site	Air Quality and Noise	• Air quality impacts from vehicular emissions (TSP, NOx, CO, SOx) • Increase in noise levels	Minor

	Infrastructure (road)	• Increase in vehicular movement and traffic including potential for road accident	Minor
	Workers Safety	• Injuries and accidents to workers during loading and offloading of construction materials.	Minor

~~5.5.2.2~~5.4.2.2 Construction Phase

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

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

Equipment, Personnel and Plant Material Movement

As part of the construction phase, personnel and materials would be transported to site on need basis. Transportation could be from workers or visitors to the site. Vehicles to be deployed for construction purposes would include saloon, SUVs and heavy-duty vehicles (such as trucks, excavators, etc).

Movement of vehicles during this phase is important and cannot be avoided as such would impact significantly on the environment as well as on people living within the area in the following ways:

- Vehicular emission of pollutant gases (such as CO, SO_2 and NO_2) from vehicle exhaust;
- Contribution to global gas warming and ozone layer depletion from pollutant gases emitted from vehicles;
- Increased traffic movement of heavy-duty truck en-route project site;
- Potential accident to personnel and asset from vehicle movement during construction; and
- Dust emission arising from construction activities at the project site.

The impact from equipment, personnel and plant material movement on surrounding receptors is therefore considered to be of moderate significance prior to mitigation and steps will be taken to minimize the effects.

Civil and Electrical Works, and Installation of Plant Facilities

Potential Impact on Air Quality

At installation and construction phases of the project, the potential sources of emissions would include dust, particulate matter (PM), emissions from heavy trucks and earthmoving equipment that will be operated on the project site. Exhaust emissions during material transportation, stockpiling and equipment transfer during construction activities. It is proposed that the construction phase of the Project would take up to 12 months. These emissions will be localized to the construction site area and will be short-term, the extent of impact would therefore be **medium** and its significance is rated **minor**

Potential Impact on Noise Levels

The primary short-term noise and vibration impacts are associated with construction and decommissioning activities. During construction activities, work equipment will result in increased noise level and vibration in the area, although noise would not cause a major disturbance to its surroundings. The potential source of noise during the construction phase of the Project includes civil work and installation activities, vehicular movement and operation of construction equipment may lead to elevated noise levels beyond the baseline concentration. Noise may cause a major disturbance to fauna species such as birds and mammals in the area. These would move further into the forest to avoid the disturbance.

The noise levels from construction activities would be intermittent and localized and are not envisaged to result in a maximum increase in background levels of 3 dB(A) at the nearest receptor location. The potential impact magnitude is regarded as low due to the envisaged low extent of its effect. The overall impact significance is considered minor.

Potential Impact on Soil

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

Soil environment of the Project site could be impacted in terms of removal of topsoil and soil compaction, reduction in structural stability and percolative ability of soil, loss of soil dwelling organisms resulting from compaction during excavation activities, installation of PV panels, mounting structures, and 11kv underground cable. These activities also have the potential to increase siltation as a result of accelerated erosion. The impact magnitude is considered to be **medium** considering the number of PV panels to be installed and the distance for burial of the proposed underground cable from the Power Plant to the switchyard. The sensitivity of the soil environment in the Project area is regarded **medium** as the soil in the area is prone to erosion especially during the rainy season. Therefore, the impact significance is considered to be **moderate**.

Potential Impact on Terrestrial Flora and Fauna

The project would require the removal of clearing of vegetation to accommodate the power plant and ancillary structures. Increase in human activity, noise level, creation of areas of bare soil would create a resulting effect which would be the altering of the composition and diversity of flora species in the site as well as migration of fauna species that make use of the plants for food and shelter further away into the forest. Also, the disturbance associated with noise and movement of construction equipment and personnel at the Project site may deter bird species from the area and disrupt the breeding of avifauna. It may also lead to increased risk to species such as snakes, rodents and mammals. The sensitivity of the receptor is adjudged to be **low**. Based on desktop reviews and field observation, the project area is not known as a migratory route for avifauna species. The impact significance is regarded as **minor**.

Potential Impact on Groundwater

The construction activities for the Project could lead to potential impacts on Groundwater of the Project area. These include increased sediment load in the drainage channels as a result of erosion; increased stormwater runoff from a decrease in infiltration; increased runoff from hard standing areas which could result in creation of drainage lines. Groundwater may be impacted as a result of infiltration of contaminants associated with spills or leaks of fuels, oils and lubricants from construction vehicles or storage tanks. There could also be decrease in amount of groundwater as a result of groundwater abstraction for project activities. It is planned that at least one borehole will be dug onsite to serve as source of water supply for the project activities. Currently, though there are boreholes within the University, there is no borehole on the project site. Also, the quality of the existing groundwater resources in the study area is considered to be good. It is not anticipated that construction activities will have any direct impacts on the underground aquifer in the project area. Therefore, the potential for groundwater contamination as result of construction activities is rated **minor.** The potential impact on the existing underground aquifer (water reserve) of the study area as a result of water abstraction for construction activities such as concrete mixing and washing of construction equipment is considered to be negligible because the activities are very minimal. There are several boreholes within the University campus as noted during the site visit. During the rainy season, the underground water aquifer increases; thus, boreholes yield improves significantly.

Potential impact on Gender

During construction activities, women may experience discrimination as most employment and training opportunities may be provided to men, while women will be left with menial jobs. This may result in marginalization thereby reinforcing gender stereotypes and gender pay gaps. In attempts to reduce the gender knowledge gaps, select female students will undergo end-to-end on-the-job training and capacity building participating in the full construction activity. Furthermore, there is the possibility that the proposed Project may increase the risk of GBV, as a result of shifting existing power dynamics and financial relationships. This is considered a minor risk as many women in the community are engaged in economic activities.

Potential Impact on Socio-economic and Health

Impacts associated with the construction phase of a project are usually of a short to medium term in nature, but could have long term effects on the surrounding environment. During construction, the proposed Project has the potential to affect the University community and the nearby community. With regard to the presence of construction workers on site, the manner in which the workers conduct themselves can affect the University environment and local community in terms of disruption of existing structures due to influx of people. The potential behaviour of workers, most especially male construction workers, may lead to an increase in levels of crime and drug and alcohol abuse, and an increase in incidence of casual sexual relations, which may result in increase in sexually transmitted disease (such as HIV/AIDS infections) and unwanted pregnancies. Additional pressure may also be placed on existing social infrastructure. Considering that the proposed number of workers for the construction phase of the Project may be relatively high, the potential risk to social structures is regarded as high. However, given that the majority of the construction workers, especially unskilled labour force would be drawn from the local community, the impact significance is considered to be **moderate**.

Potential Impact on Infrastructure (Road)

It is envisaged that movement of personnel and equipment along the road leading to the University would increase once the project commences. The road is slightly busy during the day and as such may lead to intermittent traffic build up which may not last long with proper coordination. Construction activities may result in a significant increase in movement of vehicles for the transport of construction materials and equipment increasing the risk of traffic-related accidents. Also, the installation of street lights along the University Internal Road corridors could pose obstruction to vehicular traffic movements along that corridor.

The impact magnitude is considered as **low** due to the minimal number of Project vehicles and trucks to be used during the construction phase. Therefore, the impact significance is considered **minor**.

Potential Impact on Construction Workers Safety

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

Waste Generation and Disposal

Wastes from the project are grouped into solid wastes, liquid (wastewater) and air emissions. Solid wastes would include; wood, metals, food remains, glass, and refuse etc. Liquid wastes include sewage, while gaseous air pollutants (NO_X, SO_X and CO) would be from exhausts of vehicles. It should be noted however that during their normal operation PV systems emit no gaseous or liquid pollutants, and no radioactive substances.

Potential Impact on Soil

The proposed construction activities will lead to the generation of wastes. Improper handling of these wastes or their discharge into the surrounding environment without proper treatment would increase the level of micro-organisms (bacteria, viruses and fungi) that could be pathogenic to staff working in the area. The potential construction wastes to be generated include scrap metals, electrical cables, spent oils, wood/planks, paper waste, leftover sand and gravel, etc. The impact magnitude of the wastes on the soil is considered to be **low**. Thus, the impact significance is considered to be **minor**.

Potential Impact on Groundwater

Groundwater may be impacted as a result of infiltration of contaminants associated with liquid wastes especially from spent oils. The impact magnitude is considered low. The impact sensitivity is **medium** because the groundwater is a major source of potable water within the Project Area of Interest (AoI). The potential for groundwater contamination as result of waste disposal is rated **minor**.

Potential Impact on Infrastructure (Waste Management Facility)

Construction waste can potentially have impact on the existing waste management facility of the University. Domestic wastes in FUNATO are collected in the University and disposed through the State's waste collection system. Construction wastes such as scrap electrical components, batteries, damaged/defective panels and electrical cables (e-waste) cannot be disposed of in such manner. These wastes shall be returned to the manufacturers based on a take-back scheme or recycled as appropriate. The quantity of domestic wastes designated for the dumping site will thus be **low**. The impact of the waste on the waste management facility of the project area is considered **negligible**.

Table 5. 8: Summary of Potential Negative Impacts Associated with the Construction Phase of the proposed Project

Activity	Receptor	Associated Impact	Significance
Impacts from Equipment, Personnel and Plant Material Movement	Air Quality	• Vehicular emission of pollutant gases (such as CO, SO2 and NO2) from vehicle exhaust; • Contribution to global gas warming and ozone layer depletion from pollutant gases emitted from vehicles; • Dust emission arising from construction activities at the project site.	Minor
	Social system (road)	• Increased traffic movement of heavy-duty truck en- route project site.	Minor
	Health & Safety	• Potential accident to personnel and asset from vehicle movement during construction.	Minor
Civil and Electrical Works/ Installation Activities	Air Quality	• Air quality impacts due to emission from construction equipment (SPM, NOx, CO, SOx) • Increase in dust from cleared land and windblown stockpiles	Minor
	Ambient Nosie	• Increase in noise level due to construction activities	Minor
	Soil	• Increased erosion potential as a result of construction activities such as excavation • Reduction in structural stability and percolative ability of soil resulting from compaction during civil works and installation activities	Moderate
	Terrestrial Flora and Fauna	• Loss of plant species as a result of introduction of alien plants which may prevent the natural recovery of the natural vegetation on the site and power evacuation route. • Loss of fauna as a result of increased human activity and associated noise.	Minor
	Groundwater	• Decrease in groundwater aquifer as a result of groundwater abstraction for construction activities e.g. concrete mixing, equipment washing, etc. • Increased sediment load in the stream beside the Project site as a result of erosion; increased stormwater runoff from a decrease in infiltration; • increased runoff from hard standing areas could result in creation of drainage lines	Minor
	Gender	• Discrimination of women during employment GBV	Moderate
	Socio-economic and health	• Influx of people, increase in sexual transmitted diseases.	Moderate

	Infrastructure (road)	• Road damage, traffic and safety impacts.	Minor
	Construction workers safety	• Injury to construction workers during construction activities.	Moderate
Waste Generation and Disposal	Soil	• Soil contamination from solid and liquid construction waste streams.	Minor
	Groundwater	• Groundwater contamination of liquid construction waste streams.	Minor
	Infrastructure (waste management facility)	• Disposal of construction wastes to existing waste management facility in the project area.	Negligible

~~5.5.2.3~~5.4.2.3 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 5.9 summarizes the potential negative impacts associated with the commissioning phase of the proposed Project.

Table 5. 9: Summary of Potential Impact Associated with the Commissioning Phase of the proposed Project

Activity	Receptor	Associated Impact	Significance
Plant testing	Ambient noise	• Increase in ambient noise level	Minor
	Workers	• Occupational health and safety hazards (e.g. injuries, electrocution, etc.) as a result of any wrong electrical connection.	Moderate
	Campus Occupant's safety	• Wrong electrical connection leading to electrocution	Minor
	Population influx	• Increase in population during commissioning	Negligible
	Infrastructure (road)	• Road traffic and risk of accidents	Negligible

~~5.5.2.4~~5.4.2.4 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**.

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

Table 5. 10: Summary of Potential Negative Impacts Associated with Operational Phase of the proposed Project

Activity	Receptor	Associated Impact	Significance
Power Generation and distribution	Noise	• Noise from batteries and inverters during power generation and evacuation	Negligible
	Gender	• Discrimination of women during employment. • GBV (sexual harassment, assault and poor working condition)	Minor
	Socio-economic (Visual prominence)	• Landscape alterations resulting in unpleasant changes in the visual character of the area	Negligible
	Socio-economic (health issues)	• Community health and safety impact due to electromagnetic field (EMF) radiation from the Solar Power Plant	Negligible
	Health, safety and welfare of staff during Plant operation	• Electric shock, injuries to personnel associated with the Power Plant operations. • Work related issues such as discrimination, denial of rights, unfair treatment, poor working conditions	Moderate
Routine Maintenance, Waste	Soil	• Soil contamination from spent batteries and inverters	Minor
	Groundwater	• Groundwater abstraction from cleaning of PV panels	Minor
Generation and Disposal	Soil Groundwater	• Groundwater and soil contamination	Negligible
	Health, safety and welfare of staff during maintenance	• Electric shock, injuries to personnel during maintenance	Minor

~~5.5.2.5~~5.4.2.5 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. The nature of the activities associated with the proposed Project and the existing activities around the project area, the potential cumulative impacts of the Project on road traffic, ambient noise levels and groundwater availability is considered **low**.

~~5.6~~5.5 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 5. 11: Risk Assessment Matrix

0 - 5 = Low Risks 6 - 10 = Moderate Risk 11 - 15 = High Risk 16 – 25 = Extremely high		Severity of the potential injury/damage				
		Insig nifican t damage to Property, Equipme	Non-reportable injury, minor loss of Process, or slight	Reporta ble Injury, moderate loss of Process or limited	Major injury, Single Fatality, critical loss of Process/	Multiple Fatalities, Catastrophic Loss of Business
Likelihood of the hazard	Almost Certain	5	10	15	20	25
	Will probably occur 4	4	8	12	16	20
	Possible occur	3	6	9	12	15
	Remote possibility	2	4	6	8	10
	Extremely unlikely	1	2	3	4	5

(Source:Adapted from Adelaide Hills council- Example Risk Assessment Template)

~~5.6.1Project Speci~~

~~fireRisks and Hazards~~

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

~~5.6.1.1~~5.5.1.1 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, deep 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~~5.5.1.2 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~~5.5.1.3 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~~5.6 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 5. 12: Summarized Environmental and Social Impacts of Solar Power Plant

Direct Impacts	Indirect Impacts	Cumulative Impact
Environmental Impacts		
• Reduce noise and odours from gen sets • Protect natural habitats against deforestation • Reduce annual global fuel consumption and associated greenhouse gas emission as well as carbon emission • Land use and land use change • Land use / land filling • Localized air, water and soil pollution • Battery waste pollution • Flood/ Erosion Hazards • Occupational, Health and safety impacts on workers and communities	• Improve safety by reducing hazards associated with flammable fuels • Reduce indoor air pollution with significant effects on consumers' health • Material production • Fuel source production • End-user industry • Equity of access	• Improve quality of educational and health care services • Waste production • *Greenhouse gas (GHG) emissions* reduction • Population effects on threatened biodiversity
Social impacts		
Direct Impacts	**Indirect Impacts**	**Cumulative Impact**
• Longer hours and better illumination for studying • Social cohesion and development • Safety and equitable development for women • Improve access to information and communication technologies (ICTs as radio, TV, mobile phone, internet), i.e. news, business information, and distance education • Temporary access restrictions to properties/ land use	• Reduces expenditures on fuels – petrol, kerosene, candles, gasoline or dry cells, and increases savings up to 10 to 15 %. • Free up resources spent annually on fuel to be invested in more profitable businesses • Generate new income, stimulate economic activities, and offer new opportunities for small businesses by lengthening the day • Multiply trade activities and job creation to increase state income and facilitate overall socioeconomic development	• potential social conflicts with local/ host population regarding way leaves, land use (agriculture) and access to the water (irrigation) or mining sites.

CHAPTER SIX: MITIGATION MEASURES

6.0 INTRODUCTION

This chapter presents the mitigation measures proffered for the associated and potential impacts of the proposed 1MW solar based power plant project in Federal University of Agriculture and Technology, Okeho. A comprehensive risk assessment matrix, as indicated in Figure 6.1, was used to determine the mitigation requirements for each of the impacts identified. The frequency, severity, sensitivity, scale, longevity, political, economic, legal, reputation/ image and communication/complaints were factors taken into consideration during these assessments.

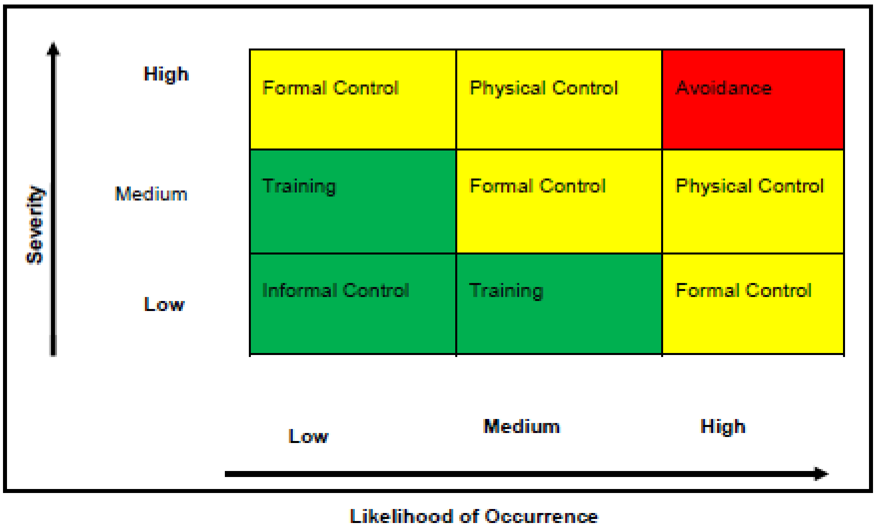


Figure 6. 1: Matrix for Determination of Mitigation Measures
(Source: www.researchgate.net/risk assessment matrix)

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 6. 1: Summary of mitigation approaches for the University Solar Hybrid Power Projects

Project Phase	Mitigation hierarchy	Approach
Project design phase	Avoidance and minimization	• Micro-siting: changing the layout of project infrastructure to avoid sensitive areas • Re-routing, marking or burying powerlines to avoid collision risks and barrier effects
Construction phase	Avoidance	• Scheduling: changing the timing of construction activities to avoid disturbing biodiversity during sensitive periods
	Minimization	• Abatement controls to reduce emissions and pollutants (noise, erosion, waste) created during construction • Operational controls to manage and regulate contractor activity, such as exclusion of fencing around sensitive areas, designated machinery and lay-down areas, minimizing vegetation loss and disturbance to soil
	Restoration and rehabilitation	• Repair of degradation or damage to biodiversity features and ecosystem services from project-related impacts that cannot be completely avoided and/or minimized by revegetating of temporary-use and lay down areas as soon as reasonably practicable after construction activities are complete
Operational phase	Minimization	• Physical controls involving modification to infrastructure, or its operation, to reduce impacts (e.g. modifications to solar technology and their associated foundations, and modifying security perimeter fencing and overhead transmission lines) • Abatement controls including wastewater management and water conservation measures • Operational controls to manage and regulate contractor activity such as managing the timing of vegetation control activities at suitable intervals
End-of-life	Avoidance	• Scheduling: changing the timing of decommissioning activities to avoid disturbing biodiversity during sensitive periods (e.g. during breeding seasons)

	Minimization	• Abatement controls to reduce emissions and pollutants (noise, erosion, waste) during decommissioning and repowering • Operational controls to manage and regulate contractor activity through, for example, exclusion fencing around sensitive areas, designated machinery and lay-down areas)

Project Phase	Mitigation hierarchy	Approach
	Restoration and rehabilitation	• Repair of degradation or damage to biodiversity features and ecosystem services from project-related impacts that cannot be completely avoided and/or minimized by revegetating temporary-use and lay down areas as soon as reasonably practicable after construction activities are complete • Reinstatement of original vegetation, as far as feasible, following decommissioning

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 6. 2: Mitigation Measures for the Potential Negative Impacts of the P~~p~~roposed Project

~~Project Activities~~	~~Receptors~~	~~Summary of Potential Impacts~~	~~Potential Impact Significance (before mitigation)~~	~~Mitigation Measures~~	~~Residual Impact (after implementation of mitigation measures)~~
~~Pre-construction Phase~~					
~~Site selection~~	~~Existing farm on site~~	• ~~Loss of existing farmlands and crops on site due to land take for the Project~~	~~Moderate~~	• ~~The affected persons shall be informed of the land take and allowed to harvest their crops before commencement of construction activities.~~ • ~~In conditions where farmers are unable to harvest their crops prior to the commencement of site clearing, a Resettlement Action Plan/ abbreviated Resettlement Action Plan shall be developed and implemented (in accordance with the AfDBs OS 2 - Involuntary Resettlement, land acquisition, population displacement and compensation) for the affected persons~~ • ~~All affected persons shall be provided with alternative land within the University campus to continue their farm demonstration activities.~~ • ~~The commitment for the provision of alternative land for the affected students shall be documented in a letter signed by the University's Vice Chancellor.~~	~~Minor~~

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
Site clearing and preparation	Terrestrial flora and fauna	• Vegetation loss • Direct impacts on vegetation and soil dwelling organisms; indirect impacts on fauna species in the immediate surroundings of the Project site and faming land	Minor	• Vegetation clearing shall be limited to the areas within the site needed for the Project. • The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited. • Bush burning shall be avoided. • Use of herbicides for site clearing shall be avoided. • Any cleared areas which are not used will be re- vegetated using plants or seeds of locally occurring species. • Workers shall be sensitized on ecological protection.	Negligible
	Soil	• Removal of top soil and soil compaction associated with site clearing • Loss of top soil • Increased erosion potential • Reduction in structural stability and percolative ability of soil	Minor	• Removal of vegetation and soil cover shall be restricted to the areas required for the Project. • Soil conservation measures shall be implemented such as stockpiling topsoil or for the remediation of disturbed areas. • Disturbed areas will be rehabilitated as soon as possible to prevent erosion. • The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited.	Negligible

				• Use of silt traps or similar systems to reduce discharge of silt shall be ensured.	
	Air quality and noise	• Air quality impacts due to emission from site clearing equipment	Minor	• Site clearing equipment / machinery shall be operated and maintained under optimum fuel-efficient conditions.	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
		• Increase in ambient noise levels		• Noise suppression equipment shall be fitted on machinery. • Site clearing equipment shall be turned off when not in use. • Equipment/ machinery with lower sound power levels shall be selected and used for site clearing.	
	Workers Safety	• Injuries and accidents to workers during site clearing and preparation.	Minor	• Site clearing shall be limited to the day time as much as possible. • Unregistered labourers and touts shall not be engaged for off-loading materials • Provision of adequate personal protective equipment (PPE) such as nose masks shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Negligible
Mobilization of personnel, materials and equipment to site	Air quality and noise	• Air quality impacts from vehicular emissions • Increase in ambient noise levels	Minor	• Construction vehicles with efficient engine performance and with minimal noise and air emissions shall be selected and used. This can be achieved through regular servicing and maintenance. • All materials with potential to result in dust emissions shall be covered during transport. • Onsite vehicle speed on unhardened roads and surfaces shall be limited to about 15 –	Negligible

				20km/h so as to reduce dust generation.	
	Infrastructure (road)	• Increase in vehicular movement and traffic around the project site; • Potential for road accident.	Minor	• A traffic management plan (TMP) shall be developed by the EPC Contractor and implemented. • Appropriate signage and safety measures (barrier, formalized crossing points) to reduce the risk of accidents in the Project area shall be provided.	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				• Project related vehicles shall be regularly serviced and maintained. • Drivers' competency shall be assessed and where required; appropriate training shall be provided. This will include training on safe driving measures such as adherence to speed limits (of less than 10 km/h) in the Project area. • A procedure for recording traffic incidents/ accidents associated with the Project shall be developed and implemented. This will include date/time, location, reason for accident, corrective measures, etc. • Alternative access routes to the Project with less traffic and environmental footprints shall be assessed and used.	
	Workers Safety	• Injuries and accidents to workers during loading and off-loading construction materials.	Minor	• Mobilization of materials shall be limited to the day time as much as possible. • Provision of adequate PPE especially gloves and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Negligible

				• Unregistered labourers and touts shall not be patronised for off-loading materials. • The site shall be secured with perimeter fencing and/or security. • Sanitary amenities and potable water shall be provided.	
Construction Phase					

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
Civil and Electrical Works/ Installation Activities	Soil	• Increased erosion potential as a result of construction activities such as excavation • Reduction in structural stability and percolative ability of soil resulting from compaction during civil works and installation activities	Moderate	• Excavation works shall not be executed under aggressive weather conditions. • Stockpiles shall be appropriately covered to reduce soil loss as a result of wind or water erosion. • Disturbed areas shall be rehabilitated with erosion control plants (using native plant species) as soon as possible to prevent erosion. • Work areas shall be clearly defined and where necessary demarcated to avoid unnecessary disturbance of areas outside the development footprint. • Installation of palisade fence during the construction phase to reduce any erosion potential	Minor
	Air Quality	• Air quality impacts due to emission from construction equipment • Increase in dust from cleared land and windblown stockpiles	Minor	• Regular maintenance and servicing of construction equipment /machinery shall be ensured. • Only modern and well-maintained equipment and machinery shall be used for construction activities. • Routine water sprinkling shall be carried out to minimize dust generation during construction.	Negligible

	Ambient Noise	• Increase in noise level due to construction activities; • Disturbance to local environment for neighbouring community	Minor	• Construction activities shall be limited to day- time (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr). In the event that noisy activities are undertaken outside of the specified working hours, all noise receptors in the Project area shall be informed of such activities in advance.	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				• Construction machinery shall be turned off when not in use. • Machinery/equipment to be used for construction work shall meet industry best standard in relation to noise attenuation. • Construction equipment shall be properly maintained and serviced. • Noise complaints related to the construction activities shall be assessed and appropriately addressed. • Noise monitoring at locations with persistent noise complaints shall be maintained.	

	Groundwater	• Increased sediment load in the stream beside the site as a result of erosion • Increased runoff from hardstanding areas could result in creation of drainage lines, which could impact on site infrastructure. • Groundwater may be impacted as a result of infiltration of contaminants associated with spills or leaks of fuels, oils and lubricants from construction vehicles or storage tanks. • Decreased amount of groundwater as a result of groundwater abstraction for project activities.	Minor	• The EPC Contractor will be required to design appropriate drainage system that takes due regards of the natural drainage system; • Where roads intersect natural, defined drainage lines, suitably sized pipe culverts or drive through causeways shall be installed or constructed; • Fuel, oil and used oil storage areas will be contained in bunds of 110 per cent capacity of the stored material; • The potential groundwater reserve of the project site will be further assessed by the EPC contractor prior to construction activities; • Spill containment and clean up kits will be available onsite and clean-up from any spill will be appropriately contained and disposed of at a registered landfill site. • Waste receptacles shall be provided within a secured area for collection of solid waste.	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				• Construction vehicles and equipment will be serviced regularly, and will be serviced off site.	
	Terrestrial Flora and Fauna	• Loss of plant species as a result of introduction of alien plants which may prevent the natural recovery of the natural vegetation on the site. • Loss of fauna as a result of increased human activity and associated noise.	Minor	• Construction workers shall be provided with appropriate training on ecological awareness, as appropriate to their work activities. • All construction equipment shall be cleaned (mud and soil removed) at source before being brought to site to minimise introduction of alien species. • Regular monitoring will be undertaken to ensure that alien plants are not increasing as a result of the disturbance that has taken place. • Hunting or deliberate killing of animals by construction workers shall be prohibited and monitored. • In order to reduce collision of vehicles with fauna, a 10 km/hr speed limit by construction- related vehicles shall be enforced in the Project area.	Negligible

	Infrastructure (road)	• Road damage, traffic and safety impacts.	Minor	• A TMP shall be developed by the EPC Contractor and implemented. • Speed limits for all construction-related vehicles shall be established and enforced. • Construction related vehicles shall be regularly serviced and maintained. • Appropriate barriers and signage shall be provided to demarcate areas in which construction traffic is active. • Drivers' competency shall be assessed and where required training shall be provided. • A procedure for recording all construction related traffic incidents/accidents shall be	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				developed and implemented. This will include date/time, location, reason for accident, corrective measures, etc. • A Grievance Redress Mechanism (GRM) shall be implemented for receiving complaints arising from damage to infrastructure and private property during construction activities. The EPC contractor shall receive the complaints and repair damages as quickly as possible.	
	Gender	• Discrimination during employment and training opportunities • GBV (sexual harassment, intimate partner violence, poor working)	Minor	• Equal treatment of workers shall be ensured. • The GBV Action Plan shall be implemented for the Project • All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/Sexual Exploitation and Abuse (GBV/ SEA) • GBV sensitive channels for reporting in GRM shall be implemented for the Project • The EPC Contractor shall be required to hire a Gender/GBV officer. • Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be ensured.	Negligible

				• All workers shall be required to undergo regular training and refreshers on GBV • The EPC Contractor shall provide separate facilities for men and women and add GBV- free signage at the project site. • All gender-based violence incidents shall be reported and dealt with as per the law.	

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
	Construction workers safety	• Injury to construction workers during construction activities.	Moderate	• Health and Safety Plan shall be developed and implemented. The plan shall provide for recording, reporting, and investigating accidents and near misses, and developing measures to prevent recurrence • Construction workers shall be sensitized and monitored on the need to be safety conscious. • Daily toolbox talks prior to commencement of work activities shall be carried out. • Construction activities shall be limited to daytime as much as possible. • Onsite safety officer shall be engaged to monitor the compliance of workers to safety rules. • Proper safety signs and signage shall be placed at strategic locations within the site. • PPE such as safety boot, coverall, eye google, safety helmets, reflective vests, etc. shall be provided to construction workers and the level of PPE compliance shall be monitored. • Safety training focused on safe working practices, information on specific hazards, first aid and fire- fighting shall be included in the induction programme for workers. • A mechanism procedure for receiving and addressing the concerns of workers shall be put in place and implemented.	Minor

				• The site shall be secured with perimeter fencing and/or security. • Sanitary amenities and potable water shall be provided	

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
	Socio-economic and health	• Influx of people, increase in sexual transmitted diseases.	Moderate	• Construction workers (e.g. semi-skilled and unskilled craftsmen) shall be drawn from the local community as much as possible. • No person under the age of 18 shall be engaged to work on the project. The EPC Contractor shall ensure that children and minors are not employed directly or indirectly on the project • An induction and sensitization programme, including a Code of Conduct (CoC), for all construction workers shall be carried out prior to construction activities. This will increase sensitivity to local norms and customs, provide awareness to construction workers of appropriate and acceptable behaviours, and will govern worker interactions with the local community. • Awareness education about GBV/SEA/HIV/AIDS and other sexually transmitted diseases shall be created among the workforce and extended to the local community. • The CoC shall include provisions to prohibit any form of Gender Based Violence/Sexual Exploitation and Abuse by workers within the local community.	Minor

				• Public access shall be restricted to construction area via security fencing and appropriate signage. • Substance abuse prevention and management programs shall be implemented for workers. Sanctions (e.g., suspension and dismissal) shall be introduced for workers involved in criminal activities	

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				• Procedure for receiving and addressing community concerns shall be developed and implemented.	
Waste Disposal and Generation	Soil	• Soil contamination from solid and liquid construction waste streams.	Minor	• Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hardstanding and adequate secondary containment. • Portable spill containment and clean-up kits shall be available onsite. • Construction workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Negligible
	Infrastructure (waste management facility)	• E-waste generation • Disposal of construction wastes to existing waste management facility in the Project area.	Minor	• The Waste Management Plan (Annex 3) shall be implemented by the EPC Contractor and reviewed regularly • Training shall be provided for workers on safe storage, use and handling of e-waste on site. • E-wastes generated shall be stored in appropriate locations prior to recycling and/or disposal • Waste receptacles shall be provided within a secured area for collection of solid waste. • Construction vehicles and equipment shall be serviced regularly.	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
	Groundwater	• Groundwater contamination of liquid construction waste streams.	Minor	• Training shall be provided for workers on safe storage, use and handling of hazardous materials (e.g. fuel, lubricating oil) on site. • Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hardstanding and adequate secondary containment. • Portable spill containment and clean-up kits shall be available onsite. • Waste management plan (WMP) implemented. • Waste bins shall be provided at designated locations on site for temporary storage of different waste streams. • Construction waste, as much as practicable, shall be reused or recycled. • Waste that cannot be reused or recycled shall be disposed of at an approved dumpsite.	Negligible
Commissioning Phase					
Plant Testing	Ambient noise	• Increase in ambient noise level	Minor	• The Power Plant components shall be installed in line with the pre-established standards and as per manufacturer recommendations. • Strict compliance to the Standard Operating Procedures shall be ensured.	Negligible

				• The inverters and batteries to be used for the Project shall meet industry best standard in relation to noise attenuation.	

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
	Workers	• Occupational health and safety hazards (e.g. injuries, electrocution, etc.) as a result of any wrong electrical connection.	Moderate	• Plant testing shall be carried out by experienced personnel. • Adequate PPE shall be worn. • The Project components shall be installed in line with the pre-established standards and as per manufacturer recommendations. • The EPC contractor shall develop Standard Operating Procedures (SOPs) for the operational phase of the Project. • Strict compliance to the Standard Operating Procedures (SOPs) shall be ensured. • Prior to the Plant commissioning, appropriate emergency equipment (such as first aid box, fire extinguishers) shall be provided onsite. • Plant testing shall be restricted to the daytime. • The site shall be secured with perimeter fencing and/or security. • Sanitary amenities and potable water shall be provided.	Negligible

	Campus Occupants' safety	• Wrong electrical connection leading to explosion/fire.	Minor	• Plant testing shall be carried out by experienced personnel. • Strict compliance to the SOPs shall be ensured. • Prior to the Plant commissioning, appropriate emergency equipment (such as first aid box, fire extinguishers) shall be provided onsite. • Plant testing shall be restricted to the daytime.	Negligible
Operational Phase					

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
	Health, safety and welfare of staff during Plant operation	• Electric shock, injuries to personnel associated with the Power Plant operations, • Work related issues such as discrimination, denial of rights, unfair treatment, poor working conditions	Moderate	• Appropriate PPE shall be provided for workers. • Training shall be provided to employees on emergency preparedness and responses. • Provision of medical insurance scheme for employees shall be ensured. • Appropriate safety signage shall be placed at strategic locations within the site. • Strict compliance to the SOPs / code of conduct shall be ensured. • A grievance mechanism procedure for receiving and addressing the concerns of employee shall be put in place and implemented.	Minor

	Gender	• Discrimination during employment and training opportunities • GBV (sexual harassment, intimate partner violence, poor working)	Moderate	• Equal treatment of workers shall be ensured. • Continuous implementation of the GBV Action Plan shall be sustained for the Project • All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA) • GBV sensitive channels for reporting in GRM shall be implemented for the Project • The O&M Contractor shall be required to hire a Gender/GBV officer. • Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be sustained. • All workers shall be required to undergo regular training and refreshers on GBV • The O&M Contractor shall provide separate facilities for men and women and add GBV- free signage at the project site.	Minor

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
				• All gender-based violence incidents shall be reported and dealt with as per the law.	
Routine Maintenance, Waste Generation and Disposal	Soil	• Soil contamination from spent batteries and inverters	Minor	• General housekeeping to ensure the site is not overgrown with grasses shall be maintained • Waste bins shall be provided at designated locations on site for temporary storage of different waste streams. • General waste that cannot be reused or recycled shall be disposed of at an approved dumpsite. • WMP shall be developed by the O&M Contractor and implemented. • Burning of waste shall be prohibited. • Damaged/ expired Lithium-ion batteries, solar panels, inverters and electric components shall be returned to the manufacturer based on the EPR model. Prior to returning them to the manufacturers, they will be stored on impermeable surfaces within the site.	Negligible
	Health, safety and welfare of staff during maintenance	• Electric shock, injuries to personnel during maintenance	Minor	• Appropriate PPE shall be provided for workers. • Maintenance workers shall imbibe the workplace safety rules via proper sensitization procedures. • Strict compliance to the SOPs shall be ensured.	Negligible

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (before mitigation)	Mitigation Measures	Residual Impact (after implementation of mitigation measures)
	Groundwater	• Groundwater abstraction from cleaning of PV panels	Minor	• Water management plan shall be implemented • Manual cleaning of the PV panels with water shall be regulated as much as practicable. The frequency of cleaning of PV panels with water is dependent on the rainfall pattern in the project area. • Periodic monitoring of groundwater resources in the Project's area of influence shall be implemented.	Negligible

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 7.4.

Table 7.1a: Environmental Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requirements /	Frequency	Performance	Implementation	Monitoring	
Site Clearing and Preparation							
Vegetation loss; impacts on and soil-dwelling organisms; impacts on fauna species	Vegetation clearing shall be limited to the areas within the site needed for the Project. Use of herbicides for clearing shall be avoided. Site clearing and preparation shall be done mechanically.	Inspection	Daily	Adherence measures	EPC Contractor	REA (PMU) FUNATO Engineer)	-
	Bush burning shall be avoided.	Inspection	Daily	Adherence measures			
	The extent of vegetation to be cleared be clearly identified and demarcated. Clearing exceeding approved working corridor shall be	Inspection	Monthly the site activities	Adherence measures			
	Hunting or deliberate killing of workers shall be prohibited monitored. Workers shall be sensitized on	Inspection	Daily before the site clearing	Adherence measures			
	Any cleared areas which are not used will be re-vegetated using plants or	Inspection	Monthly the site clearing	Re- land			
Removal of top and soil loss of top increased potential; reduction in percolative soil	Removal of vegetation and soil cover shall be restricted to the areas required for the Project. Soil conservation measures shall be implemented such as stockpiling topsoil or for the remediation	Inspection	Daily	Re- land	EPC Contractor	REA (PMU) FUNATO Engineer)	200
	Use of silt traps or similar systems to reduce discharge of silt shall be	Inspection	Monthly the site clearing	Re- land			
Air quality due to emission site	Site clearing equipment / machinery shall be operated and maintained	Maintenance records; consumption	Daily	Adherence measures			

Summary of Potential Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requirements /	Frequency	Performance	Implementation	Monitoring	
equipment; ambient noise		records					
	Noise suppression equipment shall be fitted on machinery.	Inspection	Daily	Adherence measures			
	Site clearing activities shall be carried out only during the daytime (08.00hr to	Inspection	Daily	Adherence measures			
Mobilization of Materials and Equipment to Site							
Air quality from emissions; Increase in ambient	Project vehicles with efficient engine performance and with minimal noise and air emissions shall be selected and used. This can be achieved through regular servicing and maintenance	Inspection; Maintenance records	Once vehicle commences journey	Adherence measures	EPC Contractor	REA (PMU) FUNATO Engineer)	500
	All materials with potential to result in dust emissions shall be covered during transport.	Inspection	Once vehicle commences journey	Adherence measures			
	Onsite vehicle speed on unhardened roads and surfaces shall be limited to about 15	Inspection	Daily	Adherence measures			
	Unnecessary engine idling avoided.	Inspection	Daily	Adherence measures			
	Site roads and access roads shall be sprinkled as needed to prevent dust entrainment	Inspection	Daily	Adherence measures			

Table 7.1b: Social Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requirements /	Frequency	Performance	Implementation	Monitoring	
Site Clearing and Preparation							
Stakeholders' Engagement	- Stakeholders' Engagement Plan	OP 4.12, -	Prior to mobilizatio site / site	Involuntary Resettlement	FUNATO Management	REA (PMU)	2,000

Summary of Potential Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requirements /	Frequency	Performance	Implementation	Monitoring	
		Resettlement					2,000
		OP 4.12, Annex A - Involuntary Resettlement	Prior to mobilizatio site / site clearing constructio	Alternative farmlands the affected farmers	FUNATO Management EPC	REA (PMU)	
Exposure to diseases (e.g. 19)	The EPC contractor shall implement the Nigeria Centre for Disease Control (NCDC) safety Guidelines during site clearing works.	Implementat of NCDC guidelines	Prior to mobilizatio site / site clearing constructio	Adherence measures	FUNATO Management EPC Contractor	REA (PMU) FUNATO Engineer)	500
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during site clearing works	Hygiene facilities and implementat of infection prevention measures	Prior to mobilizatio site / site clearing constructio	Adherence measures			
Vegetation loss; impacts on and soil-dwelling organisms; impacts on fauna species	Vegetation clearing shall be limited to the areas within the site needed for the Project. Use of herbicides for clearing shall be avoided. Site clearing and	Inspection	Daily	Adherence measures	EPC Contractor	REA (PMU) FUNATO Engineer)	-
Mobilization of Materials and Equipment to Site							
Injuries and to workers during loading and off-construction materials.	Provision of adequate PPE especially gloves and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability PPE	Daily	PPE compliance	EPC Contractor	REA (PMU) FUNATO Engineer)	1000
	Unregistered labourers and touts shall not be patronised for off-loading	Employment records of all staff on site	Once before commence of	Labour Act	EPC Contractor		
Increase in movement and including potential	A TMP shall be developed by the EPC contractor and implemented	TMP implementat records	Daily	Benchmarks stated in the TMP	EPC Contractor	REA (PMU) FUNATO	500

Summary of Potential Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requiremen ts /	Frequency	Performanc e	Implementat ion	Monitoring	
road accident	Appropriate signage and safety measures (barrier, formalized crossing points) to reduce the risk of accidents in	Safety signs and barriers	Before and during mobilizatio n	Adherence measures	EPC Contractor	Engineer)	
	Speed limit around community areas shall be limited to a maximum of 20 km/hr	Evidence of consultation with local community	Before and during mobilizatio	Adherence measures	EPC Contractor		
	Drivers' competency shall be assessed and where required, appropriate training shall be provided.	Drivers' competency assessments; training	Once before commence of	Passing of competency assessment training completion certificates	EPC Contractor		
	A procedure for recording traffic incidents/accidents associated with the Project shall be developed and implemented.	Incident forms	Daily	Completed incident forms	EPC Contractor		
	Employee violations of speed limit and other traffic rules will result in disciplinary action ranging from	Incident GRM	Daily	Completed incident forms	EPC Contractor		

Table 7.2a: Environmental Management Plan for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requiremen ts /	Frequency	Performanc e	Implementat ion	Monitoring	
Civil and Electrical Works/ Installation Activities							
Air quality due to emission construction equipment; Increase in dust cleared land windblown	Regular maintenance and servicing of construction equipment /machinery shall be ensured.	Maintenance records	Monthly constructio phase	Adherence measures	EPC Contractor	REA (PMU) FUNATO Engineer)	500
	Routine water sprinkling shall be carried out to minimize dust generation during construction.	Inspection	Daily civil activities				
Increase in noise	Construction activities shall be	Inspection	Daily				

Summary of Potential Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requirements /	Frequency	Performance	Implementation	Monitoring	
	day-time (08.00hr to 17.00hr weekdays; and weekends 13.00hr).		constructio phase				
	Construction machinery shall be turned off when not in use.	Inspection	Daily constructio phase				
	Construction equipment shall be properly maintained and serviced.	Maintenance records	Monthly constructio phase				
	Noise complaints related to construction activities shall be and appropriately addressed.	Complaint records	Weekly constructio phase				
	Noise monitoring at locations persistent noise complaints maintained.	Noise monitoring records	Monthly constructio phase	World Good Note Addressing Grievances	EPC Contractor	REA (PMU) FUNATO Engineer) FMEnv OYSEPA	500
	Machinery/equipment to be used for construction work shall meet industry best standard in relation to noise attenuation	Inspection	Before commence of phase	FMEnv limit World Noise Limit	EPC Contractor	REA (PMU) FUNATO Engineer) FMEnv	
Increased soil potential; structural and percolative of soil	Excavation works shall not be executed under aggressive weather conditions.	Inspection	Daily excavation activities	Adherence measures	EPC Contractor	REA (PMU) FUNATO Engineer)	-
	Stockpiles shall be appropriately covered to reduce soil loss as a result of	Inspection	Daily civil activities	Adherence measures			
Loss of plant as a result introduction of plants; loss of a result of	Construction workers shall be provided with appropriate training on ecological awareness, as appropriate to	Training records	Once start constructio phase	Certificates Training	EPC Contractor	REA (PMU) FUNATO Engineer)	1000
	All construction equipment	Inspection	Daily	Adherence			

Summary of Potential Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requirements /	Frequency	Performance	Implementation	Monitoring	
human activity associated noise.	cleaned (mud and soil removed) at source before being brought to site to minimise introduction of alien species. If sand or other natural materials for building are required and brought onto site, the stored heaps will be monitored for the growth and germination of alien		constructio phase	measures		FMEnv OYSEPA	
	Regular monitoring will be undertaken to ensure that alien plants are not increasing as a result of the disturbance	Monitoring records	Monthly constructio phase	Adherence measures	EPC Contractor	REA (PMU) FUNATO Engineer)	
Waste Disposal and Generation							
Soil from solid and construction streams.	Hazardous substances and materials shall be stored in appropriate locations with impervious hardstanding and adequate secondary containment. Portable spill containment and clean-up kits shall be available onsite	Inspection	Daily constructio phase	Adherence measures World General Guidelines	EPC Contractor	REA (PMU) FUNATO Engineer) FMEnv OYSEPA	1000
	Construction workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Once commence of construction	Certificates completion trainings			
Groundwater contamination liquid waste streams.	Training shall be provided for workers on safe storage, use and handling of hazardous materials (e.g. fuel, lubricating	Training records	Once commence of	Certificates completion trainings	EPC Contractor	REA (PMU) FUNATO Engineer) FMEnv OYSEPA	1000
	Hazardous substances and materials shall be stored in appropriate locations with impervious hardstanding and adequate secondary containment. Portable spill containment and clean-up kits shall	Inspection	Daily constructio phase	Adherence measures World General Guidelines			
	Waste management plan (WMP) shall be developed and implemented.	WMP implementat records	Daily constructio phase	Benchmarks stated in World			

Summary of Potential Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requirements /	Frequency	Performance	Implementation	Monitoring	
				General Guidelines			

Table 7.2b: Social Management Plan for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requirements	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
GBV harassment, partner violence, working	The EEP GBV Action Plan shall be implemented for the Project	Implementa by the Contractor	Once start constructio	Evidence to implementati of EEP action plan	EPC Contractor	REA-PMU FUNATO Engineer) FMEnv OYSEPA	2000
	All workers shall be required to undergo regular training and refreshers on GBV	Organize regular training refreshers	Monthly constructio phase	Records regular and	EPC Contractor		
	All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based	Develop forms workers	Once start constructio n	Signed CoC forms	EPC Contractor		
	GBV sensitive channels for reporting in GRM shall be implemented for the Project	Establish accessible reporting channels	Monthly constructio	GRM records	EPC Contractor		
	The EPC Contractor shall be required to hire a Gender/GBV officer	Employ Officer	Once start constructio	Employment records and description	EPC Contractor		
	Collaboration with government institutions or GBV providers on potential GBV management shall be ensured	Engagement GBV provider	Once start constructio	Records ongoing engagement consultation GBV providers	EPC Contractor		
	The EPC Contractor shall provide separate facilities for men and women	Erection separate convenience	Once start constructio	Inspection facilities ensure	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requirements	Frequency	Performance Indicator	Implementation	Monitoring	
		facilities display of GBV					
Influx of increase in transmitted	Construction workers (e.g. semi-skilled and unskilled craftsmen) shall be drawn from the local community as much as possible and Labour management plan	Employmen records	Once start constructio	Adherence measures	EPC Contractor	REA (PMU) FUNATO Engineer) FMEnv OYSEPA	3000
	An induction and programme, including a Code of for all construction workers shall be carried out prior to construction activities. This will increase sensitivity to local norms and customs, provide awareness to construction workers of appropriate and acceptable behaviours, and will govern worker interactions /	Induction records training on the code of conduct	Once start constructio n	Adherence measures	EPC Contractor		
	Awareness education GBV/SEA/HIV/AIDS and other transmitted diseases shall be among the workforce and extended to the	Training records	Once start constructio	Adherence measures	EPC Contractor		
	Public access shall be restricted to construction area via security	Inspection	Daily constructio phase	Adherence measures	EPC Contractor		
	All workers on the project shall be required to sign a code of conduct to prohibit any form of Gender Based	Signed code of conduct records	Once start constructio n	Adherence measures	EPC Contractor		
	Procedure for receiving and addressing community concerns shall be developed and implemented.	Consultatio and records	Weekly constructio phase	World Good Note Addressing Grievances	EPC Contractor		
Road damage, and safety impacts	TMP shall be implemented.	TMP implementa	Daily constructio	Benchmarks stated in the	EPC Contractor	REA (PMU)	1000

Summary of Potential Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requirements	Frequency	Performance Indicator	Implementation	Monitoring	
		records	phase			FUNATO Engineer)	
	Speed limits for all construction-related vehicles shall be established and	Inspection	Daily constructio phase	Adherence measures			
	Appropriate barriers and signage shall be provided to demarcate areas in	Safety signs and barriers	while constructio activities	Adherence measures			
	Drivers' competency shall be where required training shall provided.	Drivers' competency assessments training	Once commence of	Passing competency assessment training completion certificates		`	
	A procedure for recording all construction related traffic incidents/accidents	Incident forms	Daily constructio phase	Completed incident			
	The EPC contractor shall promptly repair damage to public infrastructure and repair or compensate for damage to	Incident GRM	Daily constructio phase	Completed incident			
Injury to workers construction	Health and Safety Plan shall be developed and implemented.	Health Safety implementa records	Daily constructio phase	Benchmarks stated in and Safety	EPC Contractor	REA (PMU) FUNATO Engineer)	3000
	Construction workers shall be and monitored on the need to be conscious. Daily toolbox talks commencement of work activities shall be	Daily records	Daily constructio phase	Benchmarks stated in and Safety	EPC Contractor		
	Onsite safety officer shall be engaged to monitor the compliance of workers to	Qualified dedicated officer	Once commence of	Adherence measures	EPC Contractor		
	PPE such as safety boot, coverall, eye google, safety helmets, reflective vests, etc. shall be provided to construction workers and the level of PPE	Availability PPE	Daily constructio phase	PPE compliance	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requirements	Frequency	Performance Indicator	Implementation	Monitoring	
	Safety training focused on safe working practices, information on specific hazards, first aid and fire-fighting shall be	Training records	Once commence of construction	Certificates completion trainings	EPC Contractor		
	A mechanism procedure for receiving and addressing the concerns of workers	Completed grievance	Weekly constructio phase	Adherence measures	EPC Contractor		
Exposure to diseases (e.g. 19)	The EPC contractor shall implement the NCDC "Guidelines for employers and businesses in Nigeria" during	Implementa of guidelines	Prior operations	Adherence measures	EPC Contractor	REA (PMU) FUNATO Engineer)	500
	A risk assessment of the occupational exposure to infectious diseases during construction shall be conducted, and appropriate control mechanisms shall be implemented.	Hygiene facilities implementa of prevention measures	Continuous during operations	Adherence measures			
	The EPC contractor shall develop policies and procedures for the identification and isolation of people with symptoms, as	Conduct assessment, implement controls	Continuous during operations	Adherence measures			
	Provision of functional hygiene wearing of nose masks implementation of basic prevention measures during	Policies procedures	Continuous during operations	Adherence measures			

Table 7.3a: Environmental Management Plan for Commissioning Phase

Summary Potential f Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requirements /	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Increase in noise level due to testing	Strict compliance to the Operating Procedures (SOPs) ensured.	SOPs	Once commission	Adherence measures	EPC Contractor	REA (PMU) FUNATO Engineer Director of	500
	The EPC contractor shall develop Standard	SOPs	Once commission	Adherence measures	EPC Contractor		

Summary Potential f Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollars
		Requirements /	Frequency	Performance Indicator	Implementation	Monitoring	
	operational phase of the Project					Physical Planning)	
	The Power Plant components shall be installed in line with the pre-established standards and as per	SOPs	Once commissioning	Adherence measures	EPC Contractor	FMEnv OYSEPA	

Table 7.3b: Social Management Plan for Commissioning Phase

Summary Potential f Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollar
		Requirements /	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Wrong connection explosion/fire	Plant testing shall be carried out by experienced personnel.	Qualified dedicated Engineer	Once commission	Adherence measures	EPC Contractor	REA (PMU) FUNATO Engineer Director of Physical Planning)	-
Occupational and safety (e.g. electrocution, etc.) result of any electrical	Plant testing shall be carried out by experienced personnel.	Qualified dedicated Engineer	Once commission	Adherence measures	EPC Contractor	REA (PMU) FUNATO Engineer Director of Physical Planning)	200
	Adequate PPE shall be worn	Availability PPE	Once commission	Adherence measures	EPC Contractor		
	Prior to the Plant appropriate emergency equipment.	Availability emergency response equipment	Once commission	Adherence measures	EPC Contractor		

Table 7.4a: Environmental Management Plan for Operational Phase

Summary Potential f Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollar
		Requirements /	Frequency	Performance Indicator	Implementation	Monitoring	
Power Generation and Evacuation							
Air emissions diesel generators	Strict compliance to the operating procedures for the diesel	Inspection	Monthly operations	Adherence measures	O&M Contractor	FUNATO Engineer)	-
	Regular maintenance of diesel generators shall be ensured as required by the	Inspection	Monthly operations	Adherence measures	O&M Contractor		
	A cleaning schedule shall be developed and implemented for cleaning the panels installed at the project site	Inspection	Monthly operations	Adherence measures	O&M Contractor		
	The solar panels shall be inspected regularly for dust and rain damages and maintained according to	Inspection	Monthly operations	Adherence measures	O&M Contractor		
Noise from generators inverters power generation evacuation	Inverters shall be maintained as manufacturer's recommendations operated as per original	Inspection	Monthly operations	Adherence measures	O&M Contractor	FUNATO Engineer)	-
	The diesel generators shall be operated with the sound proof covers at all	Inspection	Monthly operations	Adherence measures	O&M Contractor		
	Project personnel shall use appropriate PPE (e.g. ear muffs) to reduce	Inspection	Monthly operations	Adherence measures	O&M Contractor		
Landscape resulting in unpleasant changes in the visual character of the area	All lighting will be kept to a minimum within the requirements of safety and efficiency. Where such lighting is deemed necessary, low-level lighting, which is shielded and directed downward, to	Inspection	Monthly operations	Adherence measures	O&M Contractor	FUNATO Engineer)	-
Routine Maintenance, Waste Generation and Disposal							
E-waste and disposal	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	At new staff , in refresher	Certificates completion trainings	O&M Contractor	FUNATO Engineer) FMEnv	2000

Summary Potential f Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Dollar
		Requirements /	Frequency	Performance Indicator	Implementation	Monitoring	
			training			NESREA OYSEPA	
	E-wastes generated shall be stored in appropriate locations prior to recycling; consignment notes will be maintained	Waste consignment notes, receptacles site	Continuous during operations	Adherence measures	O&M Contractor		
	Waste receptacles shall be provided within a secured area for collection of solid waste.	Waste consignment notes, receptacles site	continuous during operations	Adherence measures	O&M Contractor		
Soil from spent and inverters	Waste that cannot be reused or recycled shall be disposed of at an approved dumpsite. Spent batteries and inverters shall be sent to manufacturers in line with the Extended Producer Responsibility	Consignmen notes for batteries manufacture for recycling	Yearly	World General Guidelines	O&M Contractor	FUNATO Engineer) FMEnv NESREA OYSEPA	1000
	WMP shall be implemented.	WMP implementat records	Quarterly during operation phase	Benchmarks stated in World General Guidelines	O&M Contractor		
Groundwater abstraction cleaning of PV	Water management / conservation plan shall be implemented	Implementat records of management plan	Quarterly during operations	Benchmarks water conservation plan World General Guidelines	O&M Contractor	FUNATO Engineer) FMEnv NESREA OYSEPA	500

Table 7.4b: Social Management Plan for Operational Phase

Summary Potential f Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Doll
		Requiremen ts /	Frequency	Performance Indicator	Implementatio n	Monitoring	
Power Generation and Evacuation							
GBV harassment, partner violence, working	The EEP GBV Action Plan shall be implemented during operations	Implementati by the Contractor	Continuousl during operations	Evidence show implementat of EEP action plan	O&M Contractor	FUNATO Engineer) FMEnv OYSEPA	2000
	All workers shall be required to undergo regular training and refreshers on	Organize onsite and	Monthly operation	Records of attendance	O&M Contractor		
	All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/Sexual Exploitation and Abuse	Develop CoC forms for workers	Once start operations	Signed CoC forms	O&M Contractor		
	GBV sensitive channels for reporting in GRM shall be implemented for the	Establish GRM reporting channels	Once start operations	GRM records	O&M Contractor		
	The EPC Contractor shall be required to hire a Gender/GBV officer	Hire GRM Officer	Once start operations	Employment records and description	O&M Contractor		
	Collaboration with government institutions or GBV providers on potential GBV management shall be ensured	Engagement GBV provider	Once start operations	Records ongoing engagement consultation with GBV service	O&M Contractor		
	The EPC Contractor shall separate facilities for men and and add GBV-free signage at the site	Erection separate convenience facilities display of GBV	Once start operations	Inspection facilities ensure	O&M Contractor		
Health, safety welfare of staff Plant operation	Provision of medical insurance scheme for employees shall be ensured.	Employment forms of employees	Quarterly during operations	Adherence to measures	O&M Contractor	FUNATO Engineer) FMEnv	4000
	Appropriate safety signage	Safety signs	Quarterly	Adherence to	O&M		

Summary Potential f Impact	Mitigation Measures	Monito			Responsible Party		Cost (US Doll
		Requirements /	Frequency	Performance Indicator	Implementation	Monitoring	
	placed at strategic locations within the		during operations	measures		NESREA OYSEPA	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence measures	O&M Contractor		
	A grievance mechanism procedure for receiving and addressing the concerns of employee shall be put in	Completed grievance forms	Monthly operations	Adherence measures	O&M Contractor		
Exposure to diseases (e.g. 19)	The O&M contractor shall Nigeria Centre for Disease (NCDC) safety Guidelines operations.	Implementati of guidelines	Prior operations	Adherence measures	O&M Contractor	FUNATO Engineer)	500
	Provision of functional hygiene wearing of nose masks implementation of basic prevention measures during	Hygiene and implementati of prevention measures	Continuous during operations	Adherence measures	O&M Contractor	FUNATO Engineer)	
	A risk assessment of the occupational exposure to infectious diseases during construction shall be conducted, and appropriate control mechanisms	Conduct assessment, implement controls	Continuous during operations	Adherence measures	O&M Contractor	FUNATO Engineer)	
	The O&M contractor shall policies and procedures for identification and isolation of people with symptoms, as well as testing	Policies procedures	Continuous during operations	Adherence measures	O&M Contractor	FUNATO Engineer)	
Routine Maintenance, Waste Generation and Disposal							
Electric shock, to personnel maintenance	Appropriate PPE shall be provided for workers.	Availability PPE	Quarterly during operations	Adherence measures	O&M Contractor	FUNATO Engineer) NESREA OYSEPA	500
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence measures			

7.4 Roles, Responsibilities and Accountabilities

The successful implementation of this ESMP depends largely on the commitment and capacity of various institutions and stakeholders to implement the ESMP. The arrangement as well as the roles and responsibilities of the institutions and persons that will be involved in the implementation, monitoring and review of the ESMP are presented in Table 7.5 below.

Table 7.5: Institutional Arrangement for ESMP and Monitoring Plan

Institution	Responsibility
REA Project Management Unit	• Disclosure of the ESIA • Overall monitoring of the ESIA implementation
REA Safeguards Unit	The implementing department and it has the mandate for the; • Supervision and monitoring of project sites to ensure compliance. • Ensure this ESIA comply with Bank's ISS and other relevant laws in Nigeria • Review the ESIA report and other document prior to sending to the Bank • Carry out smooth and efficient implementation of the project • Implementation of this ESIA and other safeguard instruments developed for each subproject.
Federal Ministry of Environment	• To review ESIA reports (in collaboration with the Ogun State Ministry of Environment), receive comments from stakeholders including public hearing of the project proposals and social liability investigations, monitoring and evaluation process and criteria. • Grant approval for public disclosure of the instrument (ESIA).
~~Ondo~~ Oyo State Ministry of Environment	• Collaborate with the FMEnv and participate in the review of the ESIA processes and in decision support for the prevention and mitigation and also ensure conformity with statutory standards including monitoring and evaluation etc.
Oyo~~ndo~~ State Environmental Protection Agency (OSEPA)	• Ensure that environmental protection regulations as defined in the ESIA are complied with including air quality, sanitation, solid waste, hazardous waste management plans.
Ministry of Women Affairs and Social Development	- Oversee GBV issues through identified GBV Service providers - Provide personnel or services to the University E&S Team - Provide access to State Assault Referral Centre services in the management of GBV cases using the survivor-centered approach. - Awareness creation exercises on prevention of Gender Based Violence (GBV).
Oyo~~ndo~~ State Waste Management Authority	• Ensure that all generated solid wastes during the construction phase are well managed in line with extant rules and regulations. • Oversee the signed MoU with the University on Waste Management.
Federal Ministry of Education/NUC	• Ensure that implementation of mitigation measures are carried out in line with specification, quality and timelines within the school premises.
University Management	• Daily monitoring of Contractors' compliance to mitigation measures on-site • Trigger issues of non-compliance to the PMU-REA

AfDB	• Provision of technical support and clearance of the ESIA
Contractors	• Implement all mitigation measures in the ESIA • Compliance to BOQ specification in procurement of material and construction.
Supervising Consultants	● Provides an independent oversight ensuring contractor adheres strictly to the engineering specifications ● Provide supports in monitoring provisions of the ESIA ● Ensure contractors meet safeguards requirements ● Supervise contractor performance of implementation of the Construction Campsite/Staging area Camp Management Plan/C-ESMP ● Report any incidents or non-compliance with the C-ESMP to the Environmental & Social Safeguard Unit-PMU (REA) ● Ensure adequate training of all staff involved in environmental and social safeguard supervision. ● Prepare monthly safeguards reports including recommendations to the REA regarding ESIA performance as part of an overall commitment to continuous improvement.
Other Stakeholders/Unions with the University	● Support and create an enabling environment for project implementation through environmental awareness and mobilization. ● Coordinate and support the availability of local content. ● Participate in stakeholders' engagement and encourage amicable resolution of grievances.
NGOs/CBOs	• Provides support for all stakeholders.

The main responsibility for overseeing the implementation of the ESMP lies with the REA PMU throughout the project life span. However, conformance with the specific environmental measures detailed in Chapter Six of this report will be ensured by the EPC contractor during the construction phase and Operations and Maintenance (O&M) Contractor at the operational phase of the Project.

7.4.1 Pre-construction Phase

The key personnel and institutions with major roles in the implementation of the ESMP during pre-construction phase are:

FUNATO Director of Physical Planning

- o Select the land for the proposed Project
- o Appoint a Site Engineer
- o Arrange and ensure adequate training is carried out for the Site Engineer
- o Review the ESMP from the consultant
- o Ensure the University's commitment to the ESMP implementation

REA-PMU

- o Assist the University in selecting sufficient and suitable land for construction of power plant and training center
- o Appoint an EPC contractor
- o Supervise the activities of the EPC contractor
- o Review the ESMP from the consultant
- o Ensure REA's commitment to the ESMP implementation

FUNATO Site Engineer

- o Attend adequate training on ESMP implementation
- o Supervise the activities of the EPC contractor and ensure compliance ESMP with mitigation measures
- o Report to FUNATO Director of Physical Planning on ESMP compliance and non-compliance issues

EPC Contractor

- o Familiarize with ESMP requirements
- o Ensure that all personnel are made aware of the management measures/plans that are to be implemented
- o Report to the REA-PMU and FUNATO Site Engineer on ESMP compliance and non-compliance issues
- o Implement ESMP requirements relevant to work being undertaken

7.4.2 *Construction Phase*

The key personnel and institutions with major roles in the implementation of the ESMP during construction phase are:

FUNATO Director of Physical Planning

- Supervise the activities of the Site Engineer by reviewing reports on ESMP issues
- Suggest ESMP improvements to REA-PMU to address non-compliance and upcoming issues

REA-PMU

- Supervise the activities of the EPC contractor by reviewing reports on ESMP issues
- Discuss ESMP improvements with FUNATO Director of Physical Planning to address non-compliance and upcoming issues
- Monitors the implementation of the ESMP

FUNATO Site Engineer

- Supervise the activities of the EPC contractor and ensure compliance ESMP with mitigation measures
- Report to FUNATO Director of Physical Planning on ESMP compliance and non-compliance issues

EPC Contractor

- Implement ESMP requirements relevant to work being undertaken
- Hire a Gender/GBV officer
- Report to the REA-PMU and FUNATO Site Engineer on ESMP compliance and non-compliance issues

FMEnv Representatives

- Monitor the implementation of ESMP requirements (impact mitigation monitoring) relevant to work being undertaken
- Discuss ESMP improvements with FUNATO Director of Physical Planning and REA-PMU to address non-compliance and upcoming issues

Ministry of Women Affairs and Social Development and GBV/SEA service provider

- Monitor the implementation of Gender mitigation measures relevant to work being undertaken

- Discuss ESMP improvements with the Gender/GBV officer, FUNATO Director of Physical Planning, and REA-PMU to address non-compliance and upcoming issues
-

7.4.3 *Operational Phase*

FUNATO Director of Physical Planning

- Supervise the activities of the Site Engineer by reviewing reports on ESMP issues
- Suggest ESMP improvements to O&M Contractor and PMU to address non-compliance and upcoming issues

REA PMU

Appoint a O&M Contractor

- Supervise the activities of the O&M Contractor by reviewing reports on ESMP issues
- Discuss ESMP improvements with FUNATO Director of Physical Planning to address non-compliance and upcoming issues

FUNATO Site Engineer

- Supervise the activities of the O&M Contractor and ensure compliance ESMP with mitigation measures
- Report to FUNATO Director of Physical Planning on ESMP compliance and non-compliance issues

O&M Contractor

- Implement ESMP requirements relevant to work being undertake
- Hire a Gender/GBV officer
- Report to the REA-PMU and FUNATO Site Engineer on ESMP compliance and non-compliance issues

FMEnv Representatives

- Monitor the implementation of ESMP requirements (environmental compliance monitoring) relevant to work being undertaken
- Discuss ESMP improvements with O&M Contractor, FUNATO Director of Physical Planning and REA-PMU to address non-compliance and upcoming issues

NESREA Representatives

- Monitor the implementation of ESMP requirements (environmental compliance monitoring) relevant to work being undertaken
- Discuss ESMP improvements with FUNATO Director of Physical Planning and REA-PMU to address non-compliance and upcoming issues

Ministry of Women Affairs and Social Development and GBV/SEA service provider

- Monitor the implementation of Gender mitigation measures relevant to work being undertaken
- Discuss ESMP improvements with the Gender/GBV Officer, FUNATO Director of Physical Planning, and REA-PMU to address non-compliance and upcoming issues

7.5 Additional Management Plans

This section provides a framework for the contents of additional management plans to be developed and implemented, in support of this ESMP, for the proposed Project. As the Project progresses, the management plans will be expanded to include specific procedures to guide implementation by the relevant Project personnel including contractor and subcontractors. The documents will be prepared strictly in line with the requirements set out in the relevant international standards and guidelines such as the World Bank General EHS Guidelines as well as other applicable national and local regulations and guidelines.

7.5.1 Stakeholder Engagement Plan

A Stakeholder Engagement Plan (SEP) shall be developed and implemented throughout the lifecycle of the proposed Project. The objectives of developing SEP for the proposed Project include the following:

- Ensuring stakeholder inclusion and involvement across the various phases of the project;
- Ensuring clarity and understanding through an open, inclusive and transparent process of culturally appropriate engagement and communication undertaken to ensure that stakeholders are well informed about the proposed Project;
- Building and maintaining productive relationship between REA and its various stakeholders through supporting open dialogue;
- Engaging vulnerable groups through an open and inclusive approach to consultation, thereby increasing the opportunity for stakeholders to provide comment and voice their concerns on the proposed Project;
- Managing expectations to ensure that the proposed Project does not create or allow unrealistic expectations to develop amongst stakeholders about proposed Project benefits. The engagement process will serve as a mechanism for understanding and managing stakeholder and community expectations, where the latter will be achieved by disseminating accurate information in an accessible way.
- Ensuring compliance with both local regulatory requirements and international best practice.
- Ensuring stakeholders are free of external manipulation or coercion.

REA is committed to implementing stakeholder management as part of its operations. As such REA will ensure that the responsibility for implementing the SEP is duly assigned and all components of the plan are well-defined within its organizational processes. REA shall also commit to providing the necessary support to implement the SEP. In line with the Environmental and Social Management framework (ESMF) for NEP, an effective SEP should:

- Describe regulatory, lender, company, and/or other requirements for consultation and disclosure.
- Identify and prioritize key stakeholder groups, focusing on Affected
- Communities.
- Provide a strategy and timetable for sharing information and consulting with each of these groups.
- Describe resources and responsibilities for implementing stakeholder engagement activities.
- Describe how stakeholder engagement activities will be incorporated into the
- company's management system.

A sample SEP is outlined in the Environmental and Social Management framework

(ESMF) for NEP (NEP ESMF, 2019).

7.5.1.1 Grievance Redress Mechanism

A Grievance Redress Mechanism (GRM) has been developed for NEP. The proposed solar-hybrid power plant and associated infrastructure in FUNATO is part of the NEP. The GRM provides a framework for addressing Project-related complaints, including logging, tracking, and grievances resolution. The GRM will be communicated to all stakeholders in the course of Project development and implementation and will make publicly available a record documenting the responses to all grievances received. The GRM shall be maintained throughout the project life cycle.

7.5.2 *Emergency Preparedness and Response Plan (EPRP)*

An Emergency Preparedness and Response Plan (EPRP) shall be developed and implemented for the proposed Power Plant. As part of the EPRP, the fire protection system for the Project will be designed to meet the requirements of the local fire codes under the National Fire Protection Association. Also, the grounding and lightning strike protection systems for the Project shall be installed in a manner that will limit the effect of ground potential gradients to such voltage and current levels that will not endanger the safety of people or equipment under normal and fault conditions. Lightning arrestors and surge protectors shall also be installed with the grounding systems to protect electronic equipment by absorbing electrical surges in the event of lightning strikes.

The EPRP shall include procedures for addressing all reasonably foreseeable and possible emergencies such as: fire, spill or release of hazardous wastes, medical and weather-related emergencies (e.g. lightning strikes). It shall address the following aspects, amongst others:

- Identification of the emergency scenarios and the development of appropriate and specific emergency response procedures for each scenario;
- Training of emergency response teams on the appropriate procedures and the use of emergency response equipment;
- Identification of emergency contacts and support services and the development of effective communication systems / protocols;
- Emergency equipment and facilities must be provided (e.g., first aid stations, fire-fighting equipment, personal protective equipment);
- Development of decontamination / clean-up procedures and identify critical remedial measures to contain, limit and reduce pollution;
- Identification of potential risk relating the uncontrolled release of hazardous materials and the preparation of a spill prevention, control, and response plans including:
- Training of operators on spill prevention.
- Implementation of inspection programmes to confirm the integrity of secondary containment structures and equipment.
- Development of standard operating procedures for filling containers or equipment and the transfer of hazardous materials.
- Identification and availability of the appropriate personal protective equipment and equipment.

7.5.3 *Waste Management Plan (WMP)*

The primary purpose of the WMP is to ensure that wastes (hazardous/non- hazardous) are avoided or minimized, and any wastes that are generated are properly managed and disposed in an environmentally sound manner

7.5.4 Occupational Health and Safety (OHS) Plan

The OHS plan must include the following elements, amongst others:

- Identification of potential hazards and development of responses to eliminate
- sources of risk or minimize workers' exposure to hazards;
- Provision of Personal Protective Equipment (PPE) to workers at no cost;
- Provision of training to all workers on all relevant aspects of occupational health and safety issues associated with their daily work, including emergency arrangements;
- Third parties (visitors and external service providers) must be briefed on the relevant aspects of health and safety and emergency response when accessing the site premises;
- Documentation and reporting of occupational injuries, illnesses and fatalities.
- It is recommended that a process for reporting near misses and unsafe
- behaviour be developed as a proactive approach to occupational health and safety risk management;
- Adequate access to first aid and medical assistance in cases of work related
- accidents or injuries must be provided;
- Designation of onsite Health and Safety officer with required experience;
- The overall site management system must be designed with adequate capacity for oversight of occupational health and safety matters.

7.5.5 Local and Employment Management Plan (LEMP)

The LEMP should aim to promote employment opportunities and training for local people in the Project's area of influence and include, amongst others:

- Targets for employing local labour;
- Targets for work experience opportunities;
- Notification of all employment and training opportunities prior to them being advertised elsewhere;
- Measures to provide verifiable monitoring information regarding training and employment. The training status for all workers must be recorded;
- Measures to provide training opportunities in respect of any new jobs created;
- Commitment to up-skilling existing employees;
- Measures to promote local procurement of goods and services;
- Recruitment and selection process for local employment;
- Measures to ensure the contractors work directly with local employment and training agencies;
- Measures to enhance and grow diversity in the workplace.

7.5.6 Erosion and Sediment Control Management Plan

This Plan should aim to control soil erosion and the transport of sediment in the Project area. The timing of works and the installation of control measures has a major influence on the management of storm water.

7.5.7 Water Conservation Plan

The Plan will address the appropriateness of water conservation, and efficient use of groundwater for construction activities and cleaning of PV panels during the operational phase of the Project.

7.5.8 EEP Gender-Based Violence (GBV) Action Plan

The GBV action plan shall be implemented throughout the project lifecycle. The components of the plan include:

- A GBV risk assessment; which has been conducted as part of the ESIA.
- Integration of GBV risk management in the ESMP
- REA-PMU shall define GBV requirements in the contractor bid documents including the hiring of a Gender/GBV officer.
- REA-PMU shall evaluate GBV response protocol of the contractors before finalizing engagement contract.
- Contractors shall ensure that there are GBV-sensitive channels for reporting in GRM.
- Contractors shall inform Project affected communities about GBV risks.
- Contractors shall ensure code of conducts (CoC) forms are signed and understood by all workers. Workers shall be trained on CoC including regular training and refreshers

- Contractors shall ensure separate facilities for men and women and install
- GBV-free signage at the Project site.

Timely implementation of the EEP GBV action plan shall reduce GBV/SEA risks that may arise during Project development and operation.

7.5.9 Livelihood Restoration Plan (LRP)

The LRP will be developed and implemented to manage the potential impacts of the Project on the local farmers that will be economically displaced. The LRP will be prepared and implemented in line with the requirements of the World Bank. At a minimum, it LRP will provide:

- a census survey of displaced persons and valuation assets;
- description of compensation and other assistance to be provided;
- engagement with displaced people about acceptable alternatives;
- institutional responsibility for implementation and procedures for grievance redress;
- implementation schedule;
- costs and budget;
- monitoring, evaluation and reporting

The LRP will be developed and implemented prior to the commencement of construction activities.

7.5.11 Summary of Additional Management Plans

Table 7.5 summarizes the additional management plans required for the Project, including the cost estimate for developing each of the plans.

Table 7.5: Additional Management Plans and Timing for Development

S/n	Plan	Timing for Development	Cost Estimates US$
1.	Emergency Preparedness and Response Plan	Pre-construction	2,000
2.	Waste Management Plan	Pre-construction	3,000
3.	Occupational Health and Safety	Pre-construction	2,000
4.	Local and Employment Management Plan	Pre-construction	1,500
5.	Erosion and Sediment Control Plan	Pre-construction	2,000
6.	Water Conservation Plan	Pre-construction	1,000
7.	EEP Gender Action Plan	Pre-construction	2,000
8.	Livelihood Restoration Plan	Pre-construction	2,000
Total			15,500

7.6 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. Table 7.6 summarizes the environmental monitoring programme for the Project.

Table 7.6: Environmental Monitoring Programme for the proposed Project

Environmental Components/ Matrix	Sampling Locations	Sampling Method	Environmental/ Social Parameters be monitored	Compliance Requirement	Frequency of Monitoring	Responsib Party	Project Development Phase	Estimat Cost Dollars
Atmosphere Quality & Noise)	Project Site Power evacuation route	Air Quality Monitoring Equipment Sound level meter	TSP, CO, NO_X, SO_X, Noise Level (dBA)	FMEnv/ World Bank	Monthly Monthly reporting	EPC Contractor	Construction Phase	1,000
Groundwater Quality	Borehole within the University	Thermomete sampler, meter, pH etc.	Temperature, pH, salinity, TDS, conductivity, DO, TOC, COD, NO_3, PO_4, Chloride, sulphate, Microbiology,	FMEnv/ WHO	Quarterly and reporting	EPC Contractor	Constructi Phase Operation Phase	4,000
Soil	Unpaved sections of the Plant	Composite samples laboratory	pH, Moisture, TOC, THC, TPH, NO_3, PO_4, Chloride, sulphate,	NESREA/ Bank	Quarterly and reporting	EPC Contractor	Constructi Phase Operation Phase	4,000
Solid Waste	Operational areas	Monitor the handling and disposal of solid wastes	Operational solid wastes including packaging waste.	FMEnv/NESRE World Bank	Monthly Quarterly reporting	EPC Contractor	Constructi Phase Operation Phase	2,000
Health and Safety	Workers and Operational areas	Observe to PPE and working	Health and Safety Plan	FMEnv/NESRE World Bank	Daily monitoring; Quarterly reporting	EPC Contractor	Constructi Phase Operation Phase	2,000
Training	Workers	Observe with existing plan	Training plan and records	FMEnv/NESRE World Bank	Quarterly and reporting	EPC Contractor	Constructi Phase Operation Phase	2,000
General Housekeeping	Construction sheds and operational areas	Observe and Plant	Cleanliness and aesthetics of Plant	FMEnv/NESRE World Bank	Daily monitoring; Quarterly reporting	EPC Contractor	Constructi Phase Operation Phase	2,000
Stakeholder Engagement	Local community Regulatory agencies	Observe evidence of stakeholder consultations	Stakeholder Engagement Plan	FMEnv/NESRE World Bank	Quarterly and reporting	EPC Contractor	Constructi Phase Operation Phase	2,000

7.7 ESIA Capacity Building Plan

The need to build the capacity of personnel of the beneficiary institution and other statutory stakeholders for the successful implementation of the proposed project.

Thus, effective implementation of the ESIA may be jeopardized due to limited technical capacity and resource constraints.

However, some of the identified institutional capacity gaps are as follows,

1. The ~~Ondo~~Oyo State Environmental Protection Agency (OSEPA) requires institutional capacity support and it will be provided by Ministry of Environment.

2. The agency needs assistance in the enforcement of development control regulations;

3. ~~Ondo~~Oyo State Ministry of Environment OSEPA will be supported by the REA-PMUU Safeguards Team.

Therefore, effective implementation of the ESIA necessitates the need for technical capacity in the human resource base of implementing institutions as well as logistical facilitation.

The table below outlines the capacity building plan for the ESIA and will be implemented by the Project Monitoring Unit (PMU) of the Rural Electrification Agency (REA).

Table 7.6: Capacity Building Needs on Environment and Social Impact Assessment (ESIA)

Events	**Activities**	**Participants**	**Types of Training**	**Duration**	**Cost (US$)**
Capacity Building	• Basic Training on the AfDB ISS ~~policies~~ • Project monitoring, reporting, ESIA and its implementation • Environmental Management • Labour influx, GBV/SEA, Code of Conduct, vulnerable people etc. • Environmental Performance Monitoring Environmental Reporting	PMU staff and supporting MDAs (Ministry of Environment, OSEPA, ~~Ondo~~Oyo State Waste Management Authority, University's Project Monitoring Unit	To enhance competence in environmental sustainability and regulatory practice	1 day	2,000.00
Module: Training on Construction HSE	• Introduction to Construction HSE • Overview of Health and Safety Hazards in Construction • Incidents: Causation,	PMU (REA) Team and supporting MDAs including University Team (University's Project Monitoring Unit)	To ensure completion of project with zero fatalities, zero Lost Time Injuries (LTI) or occupational illness by promoting safe &	1 day	1,000.00

Events	Activities	Participants	Types of Training	Duration	Cost (US$)
	Investigation & Reporting • Excavation Safety • First Aid, Defensive Driving etc. • Project/Site Specific OHS • Construction Site Inspection • Personal Protective Equipment		healthy working conditions for workers and monitoring officers		
Total				2 days	3,000.00

~~**Training, Awareness and Capacity Building**~~

~~REA shall identify, plan, monitor, and record training needs for personnel whose work may have a significant adverse impact upon the environmental or social conditions. The Project recognizes that it is important that employees at each relevant phase of the Project are aware of the potential impacts of their activities; and roles and responsibilities in achieving conformance with the management measures documented in this ESMP. This will be achieved through a formal training process.~~

~~In addition, training for local community on general environmental awareness and ESMP mitigation measures pertaining to community health, safety and security shall as be provided as indicated in Table 7.7 below.~~

~~**Table 7.7: Institutional Capacity Strengthening Plan**~~

~~**Target Audience**~~	~~**Training Overview**~~	~~**Cost US$**~~
~~Site Engineer, EPC Contractor and their sub Contractor, OEM contractors~~	~~In depth understanding of the mitigation measures mitigation measures proffered by the ESMP. Training on implementation of all emergency emergency response procedures; HSE and Management Plan~~	~~2,000~~
~~Local community~~	~~General environmental awareness and mitigation measures proffered by the ESMP pertaining to community health, safety and security.~~	~~1,000~~
~~**Total**~~		~~3,000~~

7.8 Implementation Schedule and Reporting

The implementation of the ESMP will take place from the planning stages to ensure quality equipment and support services are sourced, through construction, commissioning to operation phases. Once monitoring of the ESMP begins the officers responsible will report all issues identified to respective authorities in REA and corrective/remedial actions taken without delay to ensure optimal performance of the Project while promoting environmental sustainability.

Also, REA shall keep the regulatory authorities (FMEnv, NESREA, OYSEPA) informed of the Project performance with respect to E&S related matters through reports that will be made available to the regulators when required. REA will provide appropriate documentation of HSE related activities, including internal inspection records, training records, and reports to the relevant authorities.

7.8 ESMP Costing

Table 7.8 below provides the summary of cost estimate required to effective and efficiently implement the recommended mitigation measures and management plans required to address the potential and associated impacts of the proposed Project.

Table 7.8: ESMP Costing

S/n	**Description of ESMP Activities**	**Cost Estimates (US$)**
1.	Pre-construction phase E&S management activities	4,700.00
	Construction phase E&S management activities	13,500.00
	Commissioning phase E&S management activities	700.00
	Operational phase E&S management activities	11,000.00
2.	Preparation of additional management plans	15,500.00
3.	Institutional Capacity Strengthening Plan	3,000.00
4.	Monitoring and Evaluation Programme	19,000.00
Total		**67,400.00**

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 FUNATO, 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:

a. 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:

i. Description of the site and components to be decommissioned.

ii. Description of the decommissioning scope, objectives, end state and strategy;

iii. Activities to be performed during the decommissioning;

iv. Schedule of decommissioning activities;

v. Estimate of the decommissioning cost;

vi. Estimated inventory of waste streams to be generated during the decommissioning and handling techniques;

b. Decommissioning team (qualifications, roles and responsibilities)

i. 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.

ii. 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.

iii. Hazard identification and analysis shall be conducted to determine special safety concerns to be addressed.

iv. 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

v. Third party notifications shall be carried out before any demolition and shall be conducted in a phased sequence.

vi. 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:

vii. Ensuring that employees are fully informed about the decommissioning and how it will affect them before the project finally closes.

viii. Building community capacity to manage opportunities and impacts arising from the decommissioning and post-decommissioning phase of the Project.
ix. Providing training to build local skills tailored to project decommissioning and post-decommissioning activities (e.g. equipment dismantling, rehabilitation activities, monitoring, etc.).
x. 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 FUNATO, the Federal Ministry of Environment and the Oyo State Ministry of Environment. The abandonment process shall be carried out as follows:

a) Relevant stakeholders shall be duly informed;
b) Physical Asset Verification (PAV) of the facilities shall be carried out;
c) 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.

d) 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 FUNATO to address non- compliance and upcoming issues.

C. Federal University of Agriculture and Technology Site 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 FUNATO on contractor's performance regarding the implementation of environmental and social measures.

D. Director of Works and Physical Planning Department in FUNATO

- 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/Oyo State Ministry of Environment Representatives

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

CHAPTER NINE: STAKEHOLDERS' 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 Introduction

For a hitch-free project implementation, extensive engagements of varying stakeholders through consultations were held between the 24th and 25th of April, 2026 to ensure that relevant stakeholders within University community are adequately and timely informed about the proposed construction and installation of beyond 1MW solar hybrid project and also ensure that all the concerns of the stakeholders are addressed.

Suffice it to mention that the stakeholders' consultations provided the platform to ascertain the nature of impacts of the project from the perspectives of stakeholders within the beneficiary institution including the impact of the proposed project teaching-learning, research, improved security and operational efficiency cum livelihood-based issues.

Also, all stakeholders consisting of students (male and female), academic and non-academic staff and the Management of the University were engaged during the stakeholders' meetings. It is important to mention that notable unions such as the AFUE chapters of the Academic Staff Union of Universities, Non-Academic Staff Union (NASU), Senior Staff Association of Nigerian Universities (SSANU), Students' Union and the University management were consulted. The identified vulnerable groups during the stakeholders' consultation are the students especially the females and other physically challenged members of the University community. However, these strata of stakeholders were consulted separately.

However, the summary of the proceedings and outcome of stakeholders' engagement meetings are documented in Section 9.2.

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 EEP 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 State Ministry of Environment,
- Federal University of Agriculture and Technology, 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 9. 1: Stakeholder Engagement and Disclosure Methods

Stakeholder Group	Project Information Shared	Means of Communication/ Disclosure
• Project Beneficiary	• ESIA report; • RAP/ ARAP • Regular updates on Project development.	• Public/Disclosure notices at university (FUNATO) • Electronic publications and press releases on the Project web-site. • Disseminationof hard copies at designated public locations. • Press releases in the local media. • Consultation meetings.
• AfDB	• ESIA Report; • RAP/ aRAP; • Regular updates on Project development.	• Electronic publications and press releases on the AfDB's web-site. • Submission of hard copies.
• Non-governmental Organizations	• ESIA Report, • Regular updates on Project development.	• Public notices. • Electronic publications and press releases on the project web-site. • Disseminationof hard copies at designated locations. • Press releases in the local media.

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 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.

9.4.1 Grievance Redress Mechanism Process

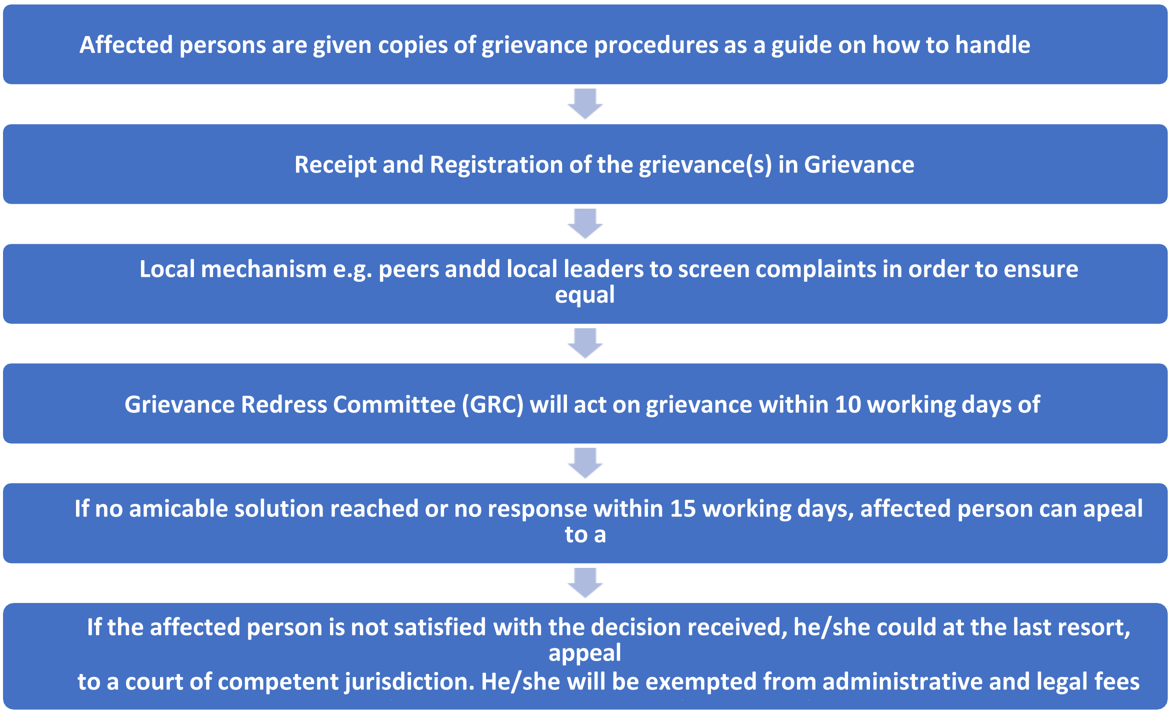


Figure 9. 1: GRM Process

(Source: AFDB- Nigeria Electrification Project (NEP) Hawthorne Valley Farmscape Ecology Program).

9.5. Publicizing and Disclosure of the GRM

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

9.6. 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 9.1) 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 9. 2: Grievance Recording Form

GRIEVANCE REGISTRATION	
Case No.:	Date:
Name:	
Office Location:	Unit:
Phone no:	
Details of grievance:	
Name of person recording grievances:	
Designation of recording person:	
Proposed date of response to grievance:	
Signature of recording person	Signature of complainant
GRIEVANCE REDRESSAL RESPONSE	
Decision of GO (give full details):	
Claimant accepts the outcome:	
Accepted	Not accepted
Signature of claimant:	
Signature of GO:	

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 Standard Officer/Manager 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.

9.6.1 Maintaining a Grievance Register

Each grievance thus received, shall be recorded in a grievance register. The format for the grievance register shall be as follows. 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.

9.5.1 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.

Box 9.1: Acknowledgement Receipt for Claimants

This receipt is acknowledgement of grievance registration by____________, resident of --- community/staff of -------- department ____ on date ____________. His/Her case number is __________________ and the date for response is _______________. **Full name & signature of recording person**

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.

9.5.2 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/ Manager. 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 the table 9.3.

Table 9. 3: Classification and Categorization of External Grievances

S/n	Nature of Grievance	Categorisation
1.	Compensation	Environmental and Social Safeguard Officer
2.	Resettlement implementation related	Project Management, Social Safeguard Officer and Contractor,
3.	Compensation on account of damage to community forest / property/.	Contractor, Social and Environmental Safeguard Officer
4.	Environmental impact, Community health, culture and customs / access to site etc	Project Management, Environmental and Social Safeguard Officer
5.	Migrant worker related issues	Contractor, Social Safeguard Officer
6.	Sexual harassment / GBV	Human Resource Executive of Contractor/ Social Safeguard Officer of PMU
7.	Others	Contractor, Environmental and Social Safeguard Officers, Project Manager

9.5.3 Resolution, Escalation, and Closure

Based on the understanding thus developed, the social safeguard officer/ manager, 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/ manager, 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 endeavor 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-center 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.

9.5.4 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 registers 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) of the proposed 1MW based solar power Plant in Federal University of Agriculture and Technology project has been conducted to meet government, financiers, regulators policies, laws & regulations, and stakeholders views, that proactive environmental and social actions be incorporated into project design/ plan. The study was carried out in line with regulatory requirements for environmental and social management in Nigeria. One of such regulation is the Nigerian EIA Act Cap E12 LFN 2004, which stipulates that an EIA is compulsory for projects of this magnitude that have potential for significant environmental impacts. Also, the ESIA has been carried out to meet the African Development Bank's operational safeguards.

The ESIA process aims at providing detailed information for decision-making and to contribute to environmentally and socially sound and sustainable development. Consultations with the relevant stakeholders have been carried out and shall continue throughout the project lifecycle. Consultation and engagement meeting ensured that all answers to questions concerning the proposed project were provided to the satisfaction of stakeholders.

Environmental and social baseline conditions (biophysical and socio-economic) as well as sensitive components of the study area were established through field data gathering/ sampling and complemented with information from literature/ desktop research, maps and information from articles on the area. The established baseline data will serve as future reference and for monitoring purposes. Interactions between the biophysical and socio-economic components of the existing environment and the solar power plant project environmental aspects were used to identify, characterize and evaluate the potential and associated impacts of the proposed project. Thereafter, mitigation measures/ recommendations to ensure the sustainability of the project based on best industry practices, available technology and HSE considerations were developed for the significant impacts. An Environmental Social Management Plan (ESMP) was developed in the course of this study to ensure that procedures for managing adverse impacts of the power plant operations as well as the implementation of the environmental and social commitments made are maintained throughout the duration of the project. The ESMP also contains the environmental monitoring programme that would be used to monitor future changes to the environment from project activities. As a result, REA would ensure that air pollutants, noise and groundwater are monitored in line with FMEnv and AfDB's standards.

Finally, it is hoped that all necessary information/ evidence contained in this report is sufficient in the development of an Environmental Impact Statement (EIS) and acquisition of necessary permits for the operation of the solar power plant project.

10.1 Recommendation

The ESIA study recommends the following:

- Continuous monitoring of the performance of the solar project by the PMU (Project Management Unit)

- Close monitoring that the project is carried out within the recommendations of ethical allowance with regards to the populace.
- The monitoring committee should ensure that there are no security disruptions to the personnel's carrying out the solar project/installations.

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ANNEX 1

Annex 1: Terms of Reference for the preparation of Environmental and Social Impact Assessment in Federal University of Agriculture and Technology, Okeho, Oyo State.

INTRODUCTION/ BACKGROUND

The Federal Government of Nigeria (FGN), through the Rural Electrification Agency (REA), is implementing the Nigeria Electrification Project Phase II (Desert-to-Power) with financial support from the African Development Bank (AfDB). The project's primary objective is to accelerate Nigeria's electrification efforts by deploying sustainable, off-grid and grid-connected solar-powered renewable energy solutions. By leveraging Nigeria's vast solar energy resources, the initiative aims to provide clean, reliable, and long-lasting electricity to Federal Universities and their affiliated teaching hospitals. The broader goal is to enhance academic performance, support research initiatives, and improve healthcare service delivery.

As part of the Energizing Education Programme, the REA intends to electrify 24 Federal Universities and Teaching Hospitals through solar-hybrid mini-grid systems exceeding 1 MW per site. The Government intends to apply part of the proceeds toward engaging a qualified Environmental and Social Consulting Firm to prepare Environmental and Social Impact Assessments (ESIAs) for 13 universities proposed under the AfDB-financed component.

The ESIAs shall be prepared in accordance with the African Development Bank's Integrated Safeguards System (ISS, effective 31 May 2024), the Environmental Impact Assessment (EIA) Act Cap E12 LFN 2004, relevant FMEnv Procedural Guidelines (2017), Nigerian Climate Change Act (2021), other relevant and associated Nigerian regulations, and international good practice (IFC Performance Standards, ISO 14001, ISO 45001).

Table 1: List of Federal Universities Under the AfDB Desert-to-Power Programme for ESIA Study

S/N	NAME OF INSTITUTION	STATE	GEO-POLITICAL ZONE	CATEGORIZATION INTO LOT
1	Federal University, Birnin-Kebbi	Kebbi	North West	LOT 1
2	Federal University of Education, Kano	Kano	North West	
3	Federal University of Education, Zaria	Kaduna	North West	
4	Federal University of Health Sciences, Azare	Bauchi	North East	LOT 2
5	Federal University of Agriculture, Mubi	Adamawa	North East	
6	Federal University of Technology, Minna	Niger	North Central	
7	University of Jos	Plateau	North Central	
8	Adeyemi Federal University of Education	~~Ondo~~Oyo	South West	LOT 3
9	Federal University of Health Sciences, Ila Orangun	Osun	South West	

10	Federal University of Agriculture and Technology, Okeho	Oyo	South West	
11	Federal University Otuoke	Bayelsa	South-South	LOT 4
12	Federal University of Technology, Ikot Abasi	Akwa-Ibom	South-South	
13	Federal University of Health Sciences Kwale	Delta	South-South	

1 DESCRIPTION OF THE PROJECT

The Desert-to-Power (DtP) project builds on lessons from NEP-I, focusing on three main components:

1. *Energizing Education Programme: Electrification of 24 Federal Universities and Teaching Hospitals with solar-hybrid mini-grids exceeding 1 MW capacity per site.*
2. *Energizing Healthcare Facilities: Deployment of reliable energy to health centres in underserved regions.*
3. *Interconnected Mini-Grids for Cooperatives: Supporting local electricity cooperatives via Minimum Subsidy Tenders and Performance-Based Grants.*

Each university system will include solar PV arrays, battery energy storage systems, control systems, distribution infrastructure, and backup generation, with appropriate operation and maintenance plans.

The ESIA will consider the full lifecycle — design, construction, operation, and decommissioning — including waste management (solar panels, batteries, oils, packaging, etc.), community safety, and resilience to climate risks.

2 STATUTORY LEGAL AND ADMINISTRATIVE FRAMEWORK

The statutory (legal and administrative) frameworks within which the consultancy activities shall be executed are provided in the following regulations, guidelines and standards (Note: these regulations are not exhaustive):

- African Development Bank's Integrated Safeguards System (2024)
- The regulations, guidelines and standards of the Federal Ministry of Power as it concerns high voltage power transmission in Nigeria.
- Environmental Impact Assessment Act Cap E12 LFN 2004
- FMEnv EIA Procedural Guidelines (2017)
- The regulations, guidelines and standards of the Federal Ministry of Environment concerning power generation and transmission activities in Nigeria.
- National Environmental (Solar Energy) Regulations (2017)
- NESREA Act (2007) and sectoral guidelines
- Labour Act (2004) and Employee Compensation Act (2010)
- Land Use Act (1978) and Urban and Regional Planning Act
- Climate Change Act (2021);
- Occupational Safety and Health (Factories) Regulations (2010)
- National Gender Policy (2006) and Discrimination Against Persons with Disabilities Act (2018)

- All International Conventions/Treaties on Environmental Protection/Social Welfare to which Nigeria is a party: Paris Agreement (2015), Convention on Biological Diversity, ILO Conventions, and the UN Guiding Principles on Business and Human Rights
- The regulations, guidelines and standards of the various State Ministries of Environment and Social Welfare.

The Consultant shall ensure all studies align with FMEnv, relevant State Environmental Protection Agencies, and Local Government Authorities.

3 OBJECTIVES OF THE ASSIGNMENT

The objective of this consultancy is to conduct site specific ESIAs for the proposed power systems and associated infrastructure to:

- Establish environmental and socio-economic baselines for each site;
- Identify, predict, and evaluate environmental, social, health, and safety impacts (positive and negative);
- Recommend mitigation and enhancement measures;
- Ensure compliance with AfDB and Nigerian E&S standards;
- Develop site-specific Environmental and Social Management Plans (ESMPs); and
- Facilitate environmental approvals, and stakeholder acceptance.
- Support REA in securing FMEnv ESIA certification and AfDB no-objection;
- Conduct inclusive stakeholder engagement (including women, youth, and persons with disabilities); and
- Build local institutional capacity for ESMP implementation.

Special attention shall be given to vulnerable groups, gender equality, disability inclusion, resettlement risks, occupational health and safety, and climate resilience.

This must be in line with the requirements of the Federal Government of Nigeria and the African Development Bank's Integrated Safeguards System to ensure that any adverse effects on the environment and wellbeing of people are properly identified and mitigated.

Each university represents a unique ecological, social, and institutional context — from arid North-West terrains to humid South-South coastal areas. Therefore, individual (modular) ESIA studies are required to capture site-specific risks, localized stakeholder concerns, and regulatory obligations under Nigeria's Environmental Impact Assessment Act (Cap E12 LFN 2004).

This modular approach ensures:

- Tailored mitigation and management measures suitable for each region and site;
- Independent FMEnv certification and public disclosure;
- Alignment with AfDB Category 2 project requirements under the Integrated Safeguards System (ISS);
- Easier monitoring and adaptive management during implementation.

4 SCOPE OF THE ASSIGNMENT – METHODOLOGY AND GENERAL APPROACH

The Consultant, who shall be duly registered with the Federal Ministry of Environment, towards achieving the objectives noted under section 4 above, shall carry out the following activities:

Phase 1 – Desk Review and Scoping

- Review prior NEP documentation, feasibility studies, conceptual project design and maps.
- Conduct preliminary stakeholder identification and risk screening.
- Prepare forms and register the project with the FMEnv.
- Prepare and submit detailed work plans

  Phase 2 – Baseline Studies (within at least 5km radius)
- Biophysical: Air, water, soil, noise, flora, fauna, hydrology.
- Socio-economic: Demography, livelihoods, gender, land tenure, cultural heritage, transport/traffic studies.
- Laboratory analysis shall be performed by FMEnv-accredited laboratories.
- GIS and remote sensing tools shall be used for mapping and sensitivity analysis.

  Phase 3 – Impact Assessment
- Identify and evaluate direct, indirect, and cumulative impacts.
- Assess greenhouse gas emissions and pollution pathways.
- Use AfDB's and FMEnv's risk rating methodology (high, moderate, low).
- Develop mitigation hierarchy (avoid, minimize, mitigate, offset).

  Phase 4 – Stakeholder Engagement
- Conduct Free, Prior, and Informed Consultations (FPIC) with communities, institutions, and Federal/ state agencies.
- Ensure inclusive participation of women, youth, and persons with disabilities.
- Maintain engagement logbooks with signatures, photos, and feedback.
- Establish and operationalize a multi-tier costed Grievance Redress Mechanism (GRM).
- Develop a costed stakeholder engagement plan.

  Phase 5 – ESMP Development: Each ESMP shall include:
- Mitigation measures and performance indicators;
- Roles, responsibilities, and institutional arrangements;
- Monitoring framework and schedule;
- Capacity-building plan;
- Estimated costs and financing sources;
- Integration strategy into EPC contracts.

  Phase 6 – Reporting and Disclosure
- Submit inception, draft, and final ESIA reports all in soft and hard copies
- Facilitate public disclosure in line with FMEnv procedures (public notice, hearing, gazette publication).
- Ensure AfDB disclosure on its website and InfoShop portal via the PMU E&S Unit.
- Payment of Final access charge and IMM fees.
- Issuance of ESIA Approval Letters and certificates by the FMEnv

NOTE: The successful consultant for this assignment is responsible for the payment of Federal Ministry of Environment's regulatory fees. Hence, all costs related to this should be factored as part of reimbursable expense in its financial submission.

5 DELIVERABLES AND PAYMENT SCHEDULE

The successful consultant shall work closely and report to the Head, Project Management Unit (HPMU) of the Nigeria Electrification Project through the Environmental & Social (E&S) team of the NEP Project Management Unit (PMU). The Consultant is expected to work closely with the E&S unit of the PMU towards successfully executing the assignment.

Schedule: The following reports shall be submitted by the Consultant to the Rural Electrification Agency and FMEnv:

S/N	Deliverables	Timeline *(After contract signing in weeks)*	*Payment (%age of Total Remuneration)*
1.	A. Inception Report: - This should include methodology and work plan with clearly defined strategy for carrying out the assignment with timelines for the various outputs. The report should include: • Detailed Project including plan for the on-site activities • Complete Work plan document • Draft Survey Tools • Evidence of registration of project sites (by state) with the Federal Ministry of Environment. The Consultant must submit (3) hard copies and a soft copy of the inception report. B. Progress Report: An update on the progress of the Baseline survey and plans for completion of the survey and next activities. The consultant must submit electronic copies of this progress report	2 weeks	20%
2.	Draft ESIA Report: - A draft report containing detailed assessment and survey information in line with the approved reporting outline of the FMEnv to be reviewed by the AfDB and PMU. The consultant shall submit electronic copies of the draft ESIA report to the PMU and Bank for internal reviews.	Week 2-14	30

3	Resubmission of Draft ESIA Report: Upon completion of review by the PMU and incorporation/finalization of recommended changes, the revised Draft Report shall be resubmitted to the REA, Bank and FMEnv for review and disclosure	Week 14-16	20
4.	A. In house Panel Review: - Presentation of the ESIA at a Panel to be held by the Federal Ministry of Environment (as required) B. Review of the draft report in line with the comments from the FMEnv. C. Draft Final ESIA report as approved by the FMEnv will be produced for each of the institutions as covered in the TOR. The consultant shall submit the required number of copies to the FMEnv, and one hard copy and one soft copy (in a flash drive) of each final ESIA reports D. ESIA approval letters and certification from the FMEnv for each of the project sites shall be obtained by the Consultant	Week 16-20	30

Note: Each site must be registered separately, and standalone reports must be prepared for each of the sites.

sReport Structure: The Environmental and Social Impact Assessment (ESIA) report for the project will be structured in line with FMEnv and AfDB guidelines, including all necessary management plans and supplementary documentation. The report must include detailed analysis, mitigation measures, and management strategies for addressing environmental and social impacts. Below is a sample structure for the ESIA report, to be considered, and improved on as necessary.

1. Executive Summary

- Purpose of the Project: A concise overview of the project, its objectives, scope, and alignment with sustainable development goals.
- Key Findings: Summary of the significant environmental and social impacts identified, including proposed mitigation measures.
- Recommendations: A summary of the recommended actions for project implementation and ongoing compliance with environmental and social safeguards. In addition, the consultant shall provide summary of cost of the measures and the institutional arrangements for implementation.

2. Introduction

- Project Background: Description of the project's goals, location, and key stakeholders.
- ESIA Purpose and Scope: The specific objectives of the ESIA, focusing on identifying, assessing, and mitigating the environmental and social impacts of the project.
- Regulatory Framework: Reference to the relevant Nigerian regulations (e.g., EIA Act Cap E12 LFN 2004), AfDB's Integrated Safeguards System (ISS), Nigerian Climate Change Act (2021), and international standards (e.g., IFC Performance Standards, ISO 14001, ISO

45001).

3.1 Project Description

- Project Components: A detailed description of the project components, including all infrastructure and technologies (e.g., solar-hybrid mini-grid systems, energy storage, etc.). Also, the consultant shall describe the proposed project and its geographic, environmental, social, and temporal context, including associated facilities, third parties, and any offsite investments that may be required.
- Project Phases: Explanation of all phases of the project lifecycle, including planning, construction, operation, and decommissioning.
- Project Activities: A breakdown of project activities and their potential environmental and social implications.
- Includes a map of sufficient detail showing the project site and the area that may be affected by the project's direct, indirect, and cumulative impacts.
- Presents the basis for selecting the project design proposed, including for applying the mitigation hierarchy.

3.2 Analysis of Project Alternatives

- Evaluates a reasonable range of feasible project alternatives to meet the project's purpose and needs (e.g. location, technology options, or timing) and their E&S implications, including a no project alternative.
- During the project scoping process, Borrowers shall consult stakeholders and the public and allow for their participation in the identification of feasible project alternatives through public consultation meetings and the opportunity to comment.
- Assesses the alternatives' feasibility of mitigating the E&S impacts, the capital and recurrent costs of alternative mitigation measures, and their suitability under local conditions, and the institutional, training, and monitoring requirements for the alternative mitigation measures.
- Evaluates a reasonable range of feasible project alternatives to meet the project's purpose and needs (e.g. location, technology options, or timing) and their E&S implications, including a no project alternative.
- During the project scoping process, Borrowers shall consult stakeholders and the public and allow for their participation in the identification of feasible project alternatives through public consultation meetings and the opportunity to comment.
- Assesses the alternatives' feasibility of mitigating the E&S impacts, the capital and recurrent costs of alternative mitigation measures, and their suitability under local conditions, and the institutional, training, and monitoring requirements for the alternative mitigation measures.

4. Legal and Institutional Framework

- National Legislation: Overview of Nigerian laws, including the EIA Act, Nigerian Climate Change Act (2021), and other FMEnv regulations. In addition, the E&S institutional and regulatory framework is comprehensively analyzed, not focusing only on environmental and land laws but including social protection policies/strategies, and the project's sector relevant standards/norms related to E&S health and safety.
- AfDB Safeguard Policies: Summary of the AfDB's Integrated Safeguards System (ISS),

including the environmental and social safeguard policies that must be adhered to.

- International Standards: Reference to IFC Performance Standards, ISO 14001, and ISO 45001, which guide the ESIA process.
- Permits and Approvals: A list of the necessary permits and clearances required by local authorities and the relevant ministries for the project.
- Analyses the legal and institutional framework for the project within which the ESA is carried out, consisting of:
    - the host country's applicable policy framework, national and local laws and regulations, and the respective institutional capabilities (including implementation) concerning E&S issues;
    - national environmental or social action plans or strategies, and obligations of the country directly applicable to the project under relevant international and regional treaties and agreements;
    - applicable requirements under the OSs and the African Development Bank's Integrated Safeguards System (ISS) Guidance Notes;
    - the identification of differences between the Borrower's existing Environmental and Social Framework, and requirements relating to the project that may affect how the project is carried out in a manner consistent with the OSs;
    - a description of how any deficiencies in the host framework can be addressed through administrative, legislative or regulatory change, institutional strengthening, and capacity building.

5. Baseline Environmental and Social Conditions

- Environmental Baseline: The environmental baseline should:
    - Describe how climate change is affecting or likely to be affecting the project area and how this may influence the nature of project risks and impacts.
    - Describe how the project may be affecting or contributing to climate change and its associated risks and impacts.
    - Overview of climate, topography, hydrology, land use, and vegetation.
    - Assessment of biodiversity, water quality, and air quality.
    - Identification of sensitive environmental receptors (e.g., protected areas, species of concern).
- Social Baseline:
    - Overview of local communities, demographics, socio-economic conditions, and existing infrastructure.
    - Description of land tenure, livelihoods, cultural heritage, and public health.

6. Stakeholder Engagement

The consultant shall identify and characterize individuals and groups that are, due to circumstances, vulnerable, discriminated against, and underserved in, or excluded from, mainstream society. Disaggregated data on all such social groups should be provided to the extent that personal and group safety and data confidentiality and privacy are not compromised.

In addition, the consultant shall describe contextual risks (e.g. the political economy) that may affect the ability of the project to be carried out in a manner consistent with the AfDB OSs and other requirements such as international human rights obligations.

Other aspect to consider include:

- Stakeholder Identification: A comprehensive list of key stakeholders, including local communities, governmental bodies, NGOs, and other interested parties.
- Stakeholder Consultation Process: Description of consultation methods (e.g., meetings, surveys, public hearings), frequency, and topics discussed.
- Stakeholder Concerns: Summary of key concerns raised by stakeholders and how these concerns have been addressed in the ESIA process.

7. Impact Assessment

To the extent demonstrable, characterize residual impacts in terms of their magnitude, extent, duration, reversibility, and significance. The levels of impacts will be assessed using the following key tools:

- Methodology: A thorough impact analysis (*quantitative NOT generic*) and identification of feasible measures addressing each significant and moderate impact and risk.
- Environmental Impacts: Analysis of potential environmental impacts (e.g., land degradation, water and air quality, noise, waste generation, etc.).
- Social Impacts: Evaluation of potential social impacts, including displacement, changes to local livelihoods, public health, and community wellbeing.
- Cumulative Impacts: Assessment of how the project may interact with other projects or activities in the region, and the cumulative impacts on the environment and society.

8. Environmental and Social Risks and Opportunities

- Risk Assessment: Identification of key risks to the environment and local communities, including legal, environmental, social, and economic risks.
    - Potential environmental risks (e.g., habitat destruction, resource depletion)
    - Social risks (e.g., community resistance, displacement, health impacts)
    - Legal and regulatory non-compliance risks
    - Economic risks, including project delays or cost overruns
- Opportunities: Identification of potential benefits arising from the project, such as:
    - Job creation and local employment
    - Community development (e.g., infrastructure, healthcare, education)
    - Improved energy access and sustainability
    - Contribution to local and national economic growth

9. Mitigation and Management Plans

- Mitigation Measures: Identify avoidance, minimization and mitigation measures and significant residual impacts that cannot be mitigated and, to the extent possible, assesses the acceptability of these residual impacts. This should also include specific actions to mitigate the identified environmental and social impacts, including design modifications, operational best practices, and technological solutions. Other measures to note are thus:
    - Identify measures to enhance positive impacts and opportunities.

• Identify differentiated measures so that adverse impacts do not fall disproportionately on the vulnerable.

• Assess the feasibility of mitigating the E&S impacts, the capital and recurrent costs of proposed mitigation measures, and their suitability under local conditions, and the institutional, training, and monitoring requirements for the proposed mitigation measures.

Specify issues that do not require further attention, providing the basis for this determination.

- Environmental and Social Management Plan (ESMP): A detailed plan to monitor and manage the implementation of mitigation measures, including roles and responsibilities, timelines, and resources.
- Climate Change Mitigation and Adaptation: Address the project's approach to mitigating climate change impacts and adapting to potential climate risks.

10. Monitoring and Evaluation

- Monitoring Plan: Framework for monitoring the implementation of the mitigation measures and ESMP, including frequency, parameters, and responsible entities.
- Performance Indicators: Identification of key performance indicators (KPIs) to track the effectiveness of the mitigation measures and the overall environmental and social performance of the project.
- Adaptive Management: Plans for adjusting project activities based on monitoring results and feedback from stakeholders.

11. Conclusions and Recommendations

- Summary of Findings: A concise summary of the key environmental and social impacts, along with the proposed mitigation measures.
- Project Justification: Justification for the project's viability and positive outcomes relative to its environmental and social risks.
- Further Actions: Recommendations for additional studies, monitoring, or mitigation measures that may be necessary.

Appendix: Detailed Management Plans and Supporting Documentation

The following plans and documents must be included as part of the ESIA report to ensure comprehensive environmental and social management throughout the project lifecycle:

- Labour Management Plan (LMP): A detailed plan for managing labor-related impacts, including workforce accommodation, health and safety, working conditions, and grievance mechanisms for workers.
- Waste Management Plan (WMP): A strategy to manage waste generated by the project, detailing waste minimization, segregation, storage, transportation, and disposal procedures.
- Grievance Redress Mechanism (GRM): A clear culturally appropriate and accessible process for receiving, addressing, and resolving grievances from local communities and other stakeholders throughout the project.
- Stakeholder Engagement Plan (SEP): A plan outlining how stakeholder engagement will be carried out throughout the project lifecycle, including consultation methods and feedback loops.

- Biodiversity Management Plan (BMP): A strategy for managing impacts on biodiversity, including mitigation measures for habitat loss, species protection, and ecosystem restoration.
- Health and Safety Plan (H&S Plan): A plan to ensure the health and safety of workers, local communities, and other stakeholders, covering site safety procedures, emergency response protocols, and health monitoring.
- Climate Change Adaptation and Mitigation Plan: A plan for assessing and addressing climate risks, reducing the project's carbon footprint, and enhancing resilience to climate change.

In addition, the following supporting documentation shall be included in the report:

- A list of the individuals or organizations that prepared or contributed to the ESA.
- References listing the written materials, both published and unpublished, that have been used.
- A record of meetings, consultations, and surveys with stakeholders, including those with affected people and other interested parties. The record specifies the means of stakeholder engagement that were used to obtain the views of affected people and other interested parties.
- Tables presenting the relevant data referred to or summarized in the main text.
- A list of associated reports or plans.

6 CONSULTING FIRM QUALIFICATION / COMPETENCY AND EXPERTISE REQUIREMENT

The Consulting firm must have a minimum of 10 years of post-incorporation experience in the environmental and social sector. The firm must be duly registered with the Federal Ministry of Environment and have a valid certification for operating in Nigeria.

The firm must have:

- Demonstrated in-depth understanding of Nigeria's regulatory framework for environmental projects and experience working with relevant regulatory bodies involved in the review and approval of environmental projects.
- Experience with African Development Bank's Integrated Safeguards System (AfDB-ISS) or other MDAs Safeguard Systems, including compliance with environmental and social assessment requirements
- Proven experience in conducting environmental and social assessments, producing comprehensive reports that align with regulatory requirements and stakeholder needs.
- Capability to produce clear, detailed, and actionable reports that meet the expectations of both regulatory bodies and review processes.
- Deep understanding of resettlement and livelihood restoration issues in the Nigerian context.
- A track record of successfully engaging stakeholders, including affected communities, regulators, and other key groups through consultation processes.
- A proven record of successfully completing several environmental and social projects in Nigeria.

- Demonstrated ability to manage and execute projects in Nigeria, with experience working with industry, state, and federal government MDAs and relevant stakeholders.
- Experience in surveying projects, particularly in land surveys in Nigeria.
- Proven experience in collaborating with relevant regulatory bodies and government agencies in the context of surveying projects.
- Excellent written and verbal communication skills, with the ability to produce high-quality, clear documentation.
- Effective in presenting complex issues in an accessible manner to a variety of stakeholders.
- Demonstrated efficient and effective time management skills, ensuring timely delivery of project milestones and documentation.
- Evidence of completing similar assignments for the African Development Bank (AfDB) or other international donors will be considered an added advantage.

The Consulting Firm shall provide experienced personnel to carry out the assignment with the following minimum qualifications:

SN	Personnel – ESIA	Minimum Qualifications	Experience in years
1	Team Leader / Lead Environmental Specialist	M.Sc. in Environmental Sciences, Natural Sciences or Similar Discipline	• Minimum 10 years post-graduation experience. • At least 8 years specific experience leading Environmental and Social Impact Assessments (ESIAs). • Proven record of serving as Team Leader on at least two (2) AfDB or other multilateral development bank (MDB)-funded ESIA projects within the last 5 years. • Demonstrated leadership, coordination, and stakeholder engagement skills.
2	Social Development / Safeguards Specialist	M.Sc. in Sociology, Social Sciences, Environmental or Development Studies	• Minimum 7 years post-qualification experience. • At least 5 years specific experience in social assessment, stakeholder engagement, resettlement planning, and livelihood restoration. • Participation in at least one (1) MDB-funded ESIA or Resettlement Action Plan (RAP) projects within the last 5 years.
3	Air quality and Noise specialist	M.Sc. in Environmental Sciences,	• Minimum 7 years' post-graduation experience.

		Environmental Engineering, or a related discipline	• At least 5 years specific experience in air quality monitoring, emissions modelling, and noise assessment. • Participation in at least one (1) MDB-funded ESIA assignments (including AfDB) within the last 5 years.
4	Ecologist / Biodiversity Specialist	M.Sc. in Ecology, Botany, Zoology, or Natural Resource Management	• Minimum 7 years post-graduation experience. • At least 5 years specific experience in biodiversity assessments, habitat mapping, and ecological baseline studies. • Experience in at least one (1) AfDB or equivalent MDB-funded ESIA projects in the last 5 years.
5	GIS and Mapping Specialist	M.Sc. in GIS, Remote Sensing, Geography, or Geospatial Science	• Minimum 7 years post-graduation experience. • At least 5 years hands-on experience in spatial data analysis, cartography, and environmental mapping. • Proficiency in ArcGIS, QGIS, AutoCAD, and other geospatial software. • Experience on at least one (1) MDB-funded ESIA in the last 5 years.
6	Soil and Land Resource Specialist	B.Sc. in Soil Science, Environmental Chemistry, Agronomy, or related discipline	• Minimum 5 years post-graduation experience. • At least 3 years' experience in soil quality analysis and contamination studies. • Participation in at least one (1) MDB-funded ESIA project in the last 5 years.
7	Electrical / Renewable Energy Engineer	M.Sc. in Electrical, Renewable Energy, or Power Systems Engineering	• Minimum 7 years post-graduation experience. • At least 5 years relevant experience in assessing electrical infrastructure and renewable energy systems under ESIAs. • Participation in at least one (1) MDB-funded ESIA within the last 5 years.
8	Senior Land Surveyor	M.Sc. or B.Sc. in Land Surveying or Geomatics, Licensed Surveyor	• Minimum 7 years post-graduation experience. • At least 5 years cognate experience in surveying and land demarcation in Nigeria.

			• Familiarity with land administration and regulatory frameworks. • Must be a qualified (licenced) Land Surveyor. Should also have a professional certification.
9	Climate Change and Sustainability Specialist	M.Sc. in Climate Change, Environmental Management, or Sustainable Development	• Minimum 7 years post-graduation experience. • At least 5 years' experience in climate risk assessment, carbon footprint analysis, and adaptation planning. • Prior experience integrating climate considerations in ESIAs.
10	Socio-Economic Field Enumerators (4 positions): 2 each to support the social survey and land survey	B.Sc. in Social Sciences, Geography, Statistics, or related discipline	• Minimum 3 years post-graduation experience. • Two (2) years specific experience in land Survey for survey assistants. • Two (2) years specific experience in social surveys for social assistants.

Towards, developing the land surveys required, the Senior Land Surveyor (K-8) who shall be a qualified surveyor, shall:

- Conduct site verification visits to determine current use to which the site/ land is being put to
- Conduct investigation by way of searching legal records, survey records, and land titles in order to obtain information about property boundaries and ownership in areas to be surveyed;
- Conduct investigation as to the current use of land and assets by communities, even if without a formal title;
- Conduct investigation as to how the project may affect access to assets, even though without a formal title;
- Commence surveys of the proposed DtP Project sites;
- Verify the accuracy of survey data, including measurements and calculations conducted at survey sites;
- Prepare and maintain sketches, maps, reports, and legal descriptions of surveys in order to describe, certify, and assume liability for work performed. Such maps, reports etc. should include but not be limited to information on the following:
  - Ownership/ title to land
  - How land is being currently used by communities, even though without a formal title
  - Information on the shape, contour, location, elevation, and dimensions of land or land features; heights, depths, relative positions, flooding history, property lines, and other characteristics of terrain; and
  - *Baselines, elevations, and other geodetic measurements, longitudes and latitudes of important*

features and boundaries in survey areas using theodolites, transits, levels, and satellite-based global positioning systems (GPS).

- *Apply to the National Institute of Surveyors (NIS) for a beacon or special number for the survey documentation.*
  - *Satisfy requirements of the NIS*
  - *Submit survey documentation to the Surveyor-General's office through the NIS.*

7 ONBOARDING OF CONSULTANT

In addition to the project supervisory and other responsibilities contained in this assignment, the client shall provide the Consultant with the following project documents:

- Relevant project documents, maps, route surveys.
- Support in interacting with relevant stakeholders

8 DURATION OF THE ASSIGNMENT

The Consultant shall prepare time schedules to be submitted to the E&S unit of the PMU in accordance to this ToR. The time frame for the entire consultancy services is within four (4) months of contract signing.

9 REPORTING AND TRANSFER OF KNOWLEDGE

The Consultant shall report to the Head, Project Management Unit (HPMU) through the E&S Team of the REA PMU. The Consultant shall closely work with E&S unit of the PMU and other members of the REA PMU to transfer all relevant knowledge required.

10 SELECTION METHOD

Consultant will be selected in accordance with the Least Cost Selection (LCS) set out in the AFDB procurement framework for group funded operations, October 2015. www.afdb.org

11 COPYRIGHT AND OWNERSHIP

All materials, finished and unfinished, including the ESIA and certified Land Surveys, will be owned by the Rural Electrification Agency. The Consultant shall maintain confidentiality of all information received from the Rural Electrification Agency concerning all data and insights obtained during the course of the project.

Appendix 2A

Socio-Economic Questionnaire for the Proposed Solar Hybrid Mini Grid at the Federal University of Agriculture & Technology, Okeho, Oyo State

Name of Community: ________________________________LGA: _______________________

Name of Interviewer: __________________________________Date of Interview: ___/____/___

Please tick ( ) the most suitable answer to the question.

Section A: Socio-demographic information

1. Sex of Respondent: Male: ____; Female: _____; Others:______
2. Age of Respondent: < 20 ___; 21-30____; 31-40 ___; 41-50 ___; 51 + Above ____
3. Marital Status: Single: ____; Married: ____; Divorced: ____; Widow: ___; Widower: ___; Others (specify): _________
4. Literacy Status; Literate _______; Illiterate_________
5. Educational Qualification: FSLC____;WASC:___; NCE/OND:____;HND/B.Sc.:____;PG:___; Others (specify):________
6. What is your status in this household? Household Head (HH)___; Spouse of HH ___; Son of HH ___; Daughter of HH ___; Brother of HH____; Others (specify)_______
7. Population of household: < 5____; 6-10 _____; 11-15 _____; 16-20 _____, 20 +______
8. *What is your status in this hostel? Hostel exco (HEx)___; Friend of Hostel Exco (FHEx)___; Classmate of Hostel Ex (CHEx)___; Roommate of Hostel Exco (RHEx)___; Sibling of Hostel Exco (SHEx)____; Others (specify)__________*
9. *Population of Roommates in the hostel: < 5____; 6-10 _____; 11-15 _____; 16-20 _____, 20 +______*
10. Indicate your primary occupation

S/N	Occupation	Response
1.	Trading	
2.	Fishing	
3.	Farming	
4.	Full housewife	
5.	Civil/public service	
6.	Teaching/Lecturing	
7.	Technical services & Artisan (hairdressing, mechanics, carpentry etc)	
8.	Professional (Doctors etc)	
9.	Unemployed	
10.	Retiree	
11	Others (specify)	

Section B: Welfare Indicators

11. Indicate the main source(s) of drinking water

S/N	Source(s) of water in the neighborhood	Response
1.	Public pipe borne water	
2.	Private borehole	
3.	Well (without pump)	
4.	Well (with bump)	
5.	Surface water (e.g. stream, river, lagoon etc)	
6.	Water sachet (pure water)	
7.	Bottled water	
8.	Others (specify)	

10. Source of electric power supply

S/N	Source(s) of Electric Power Supply	Response
1.	Electric distribution company (PHCN)	
2.	Fossil fuel-powered generating set(s)	
3.	LNG powered generating set(s)	
4.	Home/office solar-powered light	
5.	Lantern	
6.	Others (specify)	

11. How do you dispose solid waste?

S/N	Disposal Methods	Response
1.	Dumping at unapproved sites (backyard, road side and drainage)	
2.	Dumping at water bodies	
3.	Burning	
4.	Compost	
5.	Approved waste collection points and waste collectors (PSP)	
6.	Burying	
7.	Others (specify)	

12. What kind of toilet facility(ies) do you use?

S/N	Disposal Methods	Response
1.	Pit latrine	
2.	Dung hills	
3.	Near-by bush	
4.	Inside water body/drainage	
5.	In the near-by dumpsite	
6.	Flush toilet	
7.	Others (specify)	

13. Is there any public health facility in your community? Yes_____; No_________
14. How far is the health facility to your house? <200m___; 200-500m____;500- <1km____, 1km + above____
15. If no, where do you receive medical treatment?

S/N	Place of Treatment	Response
1.	Church	
2.	Traditional medical practitioner	
3.	Near-by pharmacy shop	
4.	Self-medication	
5.	Others (specify)	

16. Has there ever been any case of disease outbreak in the community? Yes_____; No______
17. Specify the major ailments in the community?

S/N	Diseases	Response
1.	Malaria	
2.	Typhoid	
3.	Tuberculosis	
4.	HIV/AIDS	
5.	Others (specify)	

18.
19.
20.
21.
22.
23.
24. What type(s) of energy do you use for cooking? (a). Fuel wood __; (b). Coal__; Kerosene__; (d). Gas____; Others (specify)___
25. Means of transportation? (a). Road_; (b) Water__ (c). Motor bike (okada)___; (d). Others (specify)____
26. What is your estimated monthly income?

S/N	Estimated Income	Response
1.	<₦50,000.00	
2.	₦51,000.00 – ₦100,000.00	
3.	₦101,000.00 - ₦150,000.00	
4.	Above ₦ 151,000.00	
5.	Can't Say	

27.
28.
29.
30.
31.
32.
33. Is there any educational facility in your community? Yes_____; No_______
34. How far is the educational facility to your house? <200m___; 200-500m____;500- <1km____, 1km + above____
35. What are the most common crime(s) in this community?

S/N	Crime	Response
1.	Petty stealing	
2.	Robbery	
3.	Rape	
4.	Others (specify)	

36.

37.
38.
39.
40.

36. Is there are police station in this community? Yes______; No______
37. How far is the police station to your house? <200m___; 200-500m____;500- <1km____, 1km + above____

Section C: Anticipated impact of the proposed project

38. In what way do you think the proposed solar mini grid project will affect your daily activities? (a). Positively_; (b); Negatively _____
39. What are the likely impacts of the solar mini grid project on your academic activities/livelihood?

S/N	Likely Impact	Response
1.	Improved efficiency including research and academic activities	
2.	Increase employment	
3.	Contribute to unemployment	
4.	Affect the amount of land for use within the University	
5.	Contribute to environmental pollution	
6.	Others (specify)	

Appendix 2B

Focus Group Discussion (FGD) Guide

1. What is name of community?
2. Tribe?
3. Local Government Area (LGA)
4. Brief history of the community
5. Focus group/stakeholder
6. What is the average population size of the community?
7. Community administrative structure and available traditional institutions/groups
8. Available traditional activities, the season and the dos and don'ts
9. What are the sources of drinking water for the community?
10. Is the community connected to the national grid?
11. Available roads to/in the community and status of the road(s)
12. What are the major occupational activities?
13. What are the major agricultural goods of the people in the community?
14. What is/are the name(s) of major market(s) and the days?
15. Names of the available health facility (ies)?
16. The distance of the health facility to the community
17. Name of educational institutions
18. Distances of the educational institutions
19. In what way(s) do you think the proposed project will affect your livelihood (positively and Negatively)?
20. What are the expectations of the community from the project?

Appendix 3: Attendance Sheet for FGD

Attendance Sheet for Focus Group Discussion (FGD) for the ESIA Study of the Proposed Solar Hybrid Mini Grid at the Federal University of Agriculture & Technology, Okeho, Oyo State

Name of Community: Okeho LGA: Kajola LGA

Name of Focus Group: Fed. University, Okeho Mgt Date: 26/04/26

S/N	Name	Position	Phone No.	Signature
01	Prof O.J. Babayemi	VC	08023430684	
02	M.O. Amuni	Registrar	08038004518	
03	OGUNSAWE, David	ESIA Consultant	08028588819	
04	Fokrin Olusola	CSO	08055352625	
05	Aina Oladipupo	ESIA Consultant	08035394078	
06	Ajayi Ayodeji . B.	FMARV ABUJA	08060802263	

Attendance Sheet for Focus Group Discussion (FGD) for the ESIA Study of the Proposed Solar Hybrid Mini Grid at the Federal University of Medical Sciences, Ila Orangun, Osun State

Name of Community: Okelio LGA: Kajola

Name of Focus Group: Okelio Market Women Date: 27/4/2026

S/N	Name	Position	Phone No.	Signature
1	Alawaye Opeyemi	Trader	08169973983	
2	Dauda Kehinde	K.D	08033455241	
3	Azeez Tawakalitu W	Trader	08108156821	
4	Salami Nafisat	—	07037874761	
5	Akintunde Elizabeth	—	08183392995	E
6	Mary Okanlawon	—	08080327405	
7	Hamzat Fadhilah	—	07060654745	F
8	Ismail Adijat	—	09037990297	F
9	Ismail Muibat	—	08147956206	
10	Ajefenwa Monsurat	—	07054668603	AB
11	Alayande Awawu	—	08143277535	
12	Hakmot Rafiu	—	07073428449	
13	Afolabi Monsurat	—	07017732048	
14	Oyedemi Nafisat	—	07019633192	
15	Aziez Salamot	—	07047464977	
16	Mashood Sikuru	—	09068595804	
17	Salami Zaynab	—	08164166405	
18	Azeez Adiyat	—	07018525730	
19	Hamzat Bashirat	—	08060366673	
20	Azeez Rofiat	—	08061282367	
21	Adebayo Bashirat	—	09023472481	
22	Adebayo Rhodiat	—	08137249013	

Attendance Sheet for Focus Group Discussion (FGD) for the ESIA Study of the Proposed Solar Hybrid Mini Grid at the Federal University of Agriculture & Technology, Okeho, Oyo State

Name of Community: Meseole Okeho LGA:

Name of Focus Group: Meseole Men Date: 26/04/26

S/N	Name	Position	Phone No.	Signature
(1)	Mr Salami Isiaka	Community Leader	08027747982	[signature]
(2)	Chief Shittu Basiru	Community Chief	08066633939	[signature]
(3)	Oyemiran Olayemi	Community Rep	08166225157	[signature]
(4)	Akintunde Surajudeen	Member	08035283551	[signature]
5	Ibrahim Ismaeel	"	08034759234	[signature]
(6)	Dauda Kafimda	"	08033455249	[signature]
(7)	Amuda Taiye	"	08055759043	
8	Raheem Olatedo	"	07078378854	[signature]
9	Azeez Akeem	"	07022254775	[signature]
(10)	Olaiya Azimiyu	"	07084413133	[signature]
11	Ajandiran Rasheed	"	08056138458	[signature]
12	Oyedemi Taiwo	"	08022875064	[signature]
13	Nasiru Sikiru	"	08035283543	[signature]
14	Oyeniran Sola	"	08025764731	[signature]

Annex 3: Waste Management Plan

1.0 BACKGROUND

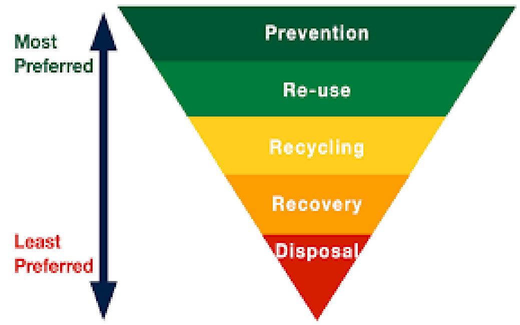
This waste management plan has been developed as part of the ESIA for the proposed Energizing Education Program III in Federal University of Agriculture and Technology, Okeho, Oyo State. A Waste Management Plan (WMP) plays a key role in achieving sustainable waste management. The purpose of this plan is to ensure that effective procedures are implemented for the generation, handling, storage, transportation and disposal of waste that is generated from the activities on site. The plan prescribes measures for the collection, temporary storage and safe management/ disposal of the waste streams associated with the project and includes provisions for the recovery, re-use and recycling of waste.

This WMP has been compiled as part of the project Environmental and Social Management Plan (ESMP) and includes potential waste stream information based of previous experiences in similar projects. Construction practices and operations must be measured and analysed in order to determine the efficacy of the plan and whether further revision of the plan is required. This plan should be further updated should further detail regarding waste quantities and categorisation become available, during the construction and/or operational stages.

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 World Bank 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



An integrated approach to waste management is needed on this sub-project. Waste management is premised on certain principles, which include avoidance or prevention, minimization or reduction reuse, recycle, recover and proper disposal. For the current project, waste generation shall be limited to the lowest possible.

Reducing volumes of waste is a priority; if reduction is

not feasible, the maximum amount of waste is to be recycled; and wastes that cannot be recycled is to be disposed of in the most environmentally responsible manner as possible. The Waste Management Hierarchy, from most desirable to least desirable, is presented below:

- **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 minimize and appropriately manage the waste generated on site, the following good management practices will be used:

i. Reduction of waste generation (through management practices, avoiding or decreasing materials use, etc.) is the primary goal of this plan.
ii. Non-hazardous wastes will be segregated from hazardous wastes.
iii. Wastes to be sent to licensed recycling/dumpsites will be segregated by type.
iv. Effort will be made to minimize the quantity of hazardous materials used.

v. Personnel that handle hazardous materials and wastes, will be trained for proper handling and management.
vi. Spills of hazardous materials will be prevented through careful and sensible management of the materials.

vii. Regular inspections of storage areas will be conducted. If damaged or leaking containers are detected, they will be replaced.
viii. Preventive maintenance will be performed on equipment to avoid potential spills.
ix. Waste storage areas will have secondary containment or spill trays.
x. 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.

2.2 Potential Sources of Waste

Avoiding the generation of waste remains of highest importance to (project) when considering waste minimization and management measures. Waste management and reuse strategies will be considered and implemented where practical and cost-effective as outlined in Table 1. On-site reuse opportunities will be maximized, with efforts made to implement reuse and off-site recycling initiatives.

Table 1 lists the waste generating aspects and identifies the range of solid, hazardous wastes that are likely to be generated by construction. It also outlines the proposed reuse, recycling or disposal method.

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	Reuse onsite where possible or Off-site

		(non-putrescible)	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

Activity / Waste Aspect	Types	Classification	Proposed Reuse / Recycling / Disposal Method
	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

	Domestic waste generated by workers including food packs, cans, bottles	General solid (putrescibles)	Off-site disposal at an approved facility
	Sanitary Waste/Sewage	General solid (putrescibles)	Off-site disposal at an approved facility
	Waste water / recycled water / stormwater	Liquid	Off-site disposal at an approved facility, or use of onsite sewer system
Office Waste	Paper, cardboard and plastic	General Solid (non-putrescible)	Off-site recycling
	Glass bottles and aluminium cans	General Solid (non-putrescible)	Off-site recycling
	Ink cartridges	General Solid (non-putrescible)	Off-site recycling
	Domestic waste including food waste generated by workers	General Solid (putrescible)	Off-site disposal at an approved facility

3.0 PROJECT PHASE - WASTE MANAGEMENT PLAN

3.1 Preconstruction and Construction Phase

A plan for the management of waste during preconstruction and construction is detailed below. As previously stated, preconstruction and construction practices must be measured and analyzed in order to determine the efficacy of the plan and whether further revision of the plan is required. A method statement detailing specific waste management practices during site clearing activities and construction shall be prepared by the Contractor prior to the commencement of works.

3.1.1. Waste Assessment / Inventory

- The Environmental Officer must develop, implement and maintain a waste inventory reflecting all waste generated during construction for both general and hazardous waste streams.
- Construction method and materials should be carefully considered in view of waste reduction, re-use, and recycling opportunities.
- Once a waste inventory has been established, targets for recovery of waste (minimisation, re-use, recycling) should be set.

3.1.2. Waste collection, handling and storage

- Each contractor/ subcontractor must implement their own waste recycling system, i.e. separate bins for food waste, plastics, paper, wood, glass cardboard, metals, etc.
- Portable toilets must be monitored and maintained daily.
- Below ground storage of septic tanks, if installed, must withstand the external forces of the surrounding environment. The area above the tank must be demarcated to prevent any vehicles or heavy machinery from driving around the area.
- Waste collection bins and hazardous waste containers must be provided by the principal contractor and placed at various areas around site for the storage of organic, recyclable and hazardous waste.
- A dedicated waste area must be established on site for the storage of all waste streams, before removal from site.
- Signage/ colour coding must be used to differentiate disposal bins for the various waste streams (i.e. paper, cardboard, metals, food waste, glass etc.).
- Hazardous waste must be stored within a bonded area constructed according to FMEnv requirements. The volume of waste stored in the bunds must not exceed 110% of the bund capacity.
- The location of all temporary waste storage areas must aim to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage, and vermin control.
- Waste storage shall be in accordance with all Regulations and best-practice guidelines and under no circumstances may waste be burnt on site.
- Vegetation removed from the site must be chipped, removed from the site and disposed of at an appropriate waste disposal facility or used as mulch on site.
- The Environmental Officer shall be responsible for ensuring the continuous sorting of waste and maintenance of the area. He/ She shall train other team members on waste handling and management.

- All waste removed from site must be done so by a registered/ licensed subcontractor, whom must supply information regarding how waste recycling/ disposal will be achieved. The registered subcontractor must provide waste manifests for all removals at least once a month.

3.1.3. Management of waste storage areas

- The position of all waste storage areas must be located away from water courses and ensure minimal degradation to the environment.
- Waste storage areas must be under roof or the waste storage bins/ containers must be covered with tarpaulins (or similar material) to prevent the ingress of water.
- Collection bins placed around site must be maintained and emptied on a regular basis.
- Waste must be stored in designated containers and not on the ground.
- Inspections and maintenance of bunds must be undertaken daily. Bunds must be inspected for leaks or cracks in the foundation and walls.
- It is assumed that any rainwater collected inside the bund is contaminated and must be removed and stored as hazardous waste, and not released into the environment. If any leaks occur in the bund, these must be removed immediately.

3.1.4. Disposal

- Waste generated on site must be removed on a regular basis, as determined by the Environmental Officer. This frequency may change during construction depending on waste volumes generated at different stages of the construction process.
- Waste must be removed by a suitably qualified contractor and disposed at an appropriately licensed landfill/ dumpsite site. Proof of appropriate disposal must be provided by the contractor.

3.1.5. Record keeping

The success of the waste management plan is determined by measuring criteria such as waste volumes, cost recovery from recycling, cost of disposal. Recorded data can indicate the effect of training and education, or the need for education. It will provide trends and benchmarks for setting goals and standards. It will provide clear evidence of the success or otherwise of the plan. Records will include:

- Documentation (waste manifest, certificate of issue or safe disposal) must be kept detailing the quantity, nature, and fate of any regulated waste for audit purposes.

- Waste management must form part of the monthly reporting requirements in terms of volumes generated, types, storage and final disposal.

3.1.6. Training

Training and awareness regarding waste management shall be provided to all employees and contractors as part of on-site awareness sessions.

3.2 Operational and Maintenance Phase

It is expected that the operational and maintenance phases will result in the production of limited general waste consisting mostly of cardboard, paper, plastic, tins, metals and vegetation materials especially from the training centres. Limited hazardous wastes (end-of-life EEE) may also be generated during maintenance activities. All waste generated will be required to be temporarily stored at the facility in appropriate containers prior to disposal at a permitted landfill site.

The following waste management principles apply during the operational phase:

- The O&M contractor and Site Manager must develop, implement and maintain a waste inventory reflecting all waste generated during operation for both general and hazardous waste streams.
- Adequate waste collection bins at site must be supplied. Separate bins should be provided for general and hazardous waste.
- Recyclable waste must be removed from the waste stream and stored separately.
- All waste must be stored in appropriate temporary storage containers (separated between different operational wastes, and contaminated or wet waste) at each operational area prior to being taken to the waste storage area for final sorting (if required). Waste storage shall be in accordance with all best-practice guidelines and under no circumstances may waste be burnt on site.
- Vegetation removed from the site must be chipped, removed from the site and disposed of at an appropriate waste disposal facility or used as mulch on site.
- Waste generated on site must be removed on a regular basis throughout the operational phase.
- Waste must be removed by a suitably qualified contractor and disposed at an appropriately licensed landfill site. Proof of appropriate disposal must be provided by the contractor.
- Waste EEE especially from damaged panels or end-of-life batteries shall be managed in line with the EPR plans set during purchase of all e-equipment associated with the project, and also in line with the FMEnv/NESREA regulations on e-wastes.

3.3 Decommissioning Phase

The project is expected to last for a minimum of 25 years, where with proper maintenance and management, it could last for up to 40years. Waste management principles applicable during this waste will include:

- Informing the appropriate ministries including FMEnv and NESREA about the decommissioning;
- Ensuring best practices in demolition and decommissioning to prevent pollution or contamination associated with improper waste handling.
- Use of the EPR as a standard for managing all associated e-wastes.
- Disposal of all other waste types using certified waste managers and at appropriate licensed landfills.

4.0 MONITORING OF WASTE MANAGEMENT ACTIVITIES

Records must be kept of the volumes/ mass of the different waste streams that are collected from the site throughout the life of the project. The appointed waste contractor is to provide monthly reports to the operator containing the following information:

- Monthly volumes/ mass of the different waste streams collected;
- Monthly volumes/ mass of the waste that is disposed of at a landfill site;
- Monthly volumes/ mass of the waste that is recycled; and
- Data illustrating progress compared to previous months.

This report will aid in monitoring the progress and relevance of the waste management procedures that are in place.

5.0 WASTE MANAGEMENT MITIGATION AND MONITORING COST

Finances must be allocated for proper waste management. The cost of mitigation and monitoring for waste management from pre-construction to operations and maintenance phase has been factored into each phase in the ESMP. This will cover trainings, PPE, receptables, containment areas and disposals. The cost for decommissioning will be however be required to be developed at the decommissioning phase with the realities at that period.

6.0 CONCLUSION

The waste management plan iterated above has been prepared with a view to ensuring that all wastes generated from the proposed project are effectively disposed. The effectiveness of the plan is premised on a number of factors, including, prompt and timely carting away of the wastes and using the right materials and equipment. To this end, waste disposal will be carried out only by contractors certified/approved by the Oyo State Environmental and Protection Agency. In addition, adequate supervision shall be provided by the REA-PMU and the respective MDAs.

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

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 roducing nutrient rich patches from sheep waste under shaded panels. Nutrient enrichment may favour exotic animals over natives.
Shading by solar pane	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.
Noise	Regular	Low	Construction	• Construction machinery and

2. BIODIVERSITY MITIGATION AND MANAGEMENT MEASURES

A range of mitigation requirements and control measures are identified in the EIA, and ESMP. Specific measures and requirements to address impacts to biodiversity are outlined in Table 2.1. The measures have been listed to cover broad activities and as such there may be some repetition of mitigation measures.

Table 2.1: Biodiversity management and mitigation measures

Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
Prior to the commencement of construction, the contractor must prepare A Biodiversity Management Plan for the development in consultation with DPP, and to the satisfaction of the PMU. This BMP: a. include a description of the measures that would be implemented for: • minimising the amount of native vegetation clearing within the approved development footprint; • minimising the loss of key fauna habitat; • managing potential indirect impacts on threatened and migratory species, including: — flora species and — fauna species; • rehabilitating and revegetating temporary disturbance areas; • protecting native vegetation and key fauna habitat outside the approved disturbance areas; • maximising the salvage of vegetative and soil resources within the approved disturbance area for • beneficial reuse in the enhancement or the rehabilitation of the site; and controlling weeds and feral pests;	• This BMP EIA • Coarse wood debris (CWD) reuse protocol • Pest and Weed Control Protocol • Ground Disturbance Protocol	Pre-construction	Site HSE Manager	• This BMP EIA

Protecting and promoting the growth of native plant species (including Plant Community Types) and controlling the growth of exotic ground cover; b. include a seasonally-based program to monitor and report on the effectiveness of these measures against the detailed performance and completion criteria; and	• Inspection and monitoring forms. • Grassland Monitoring program			

Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
c. include details of who would be responsible for monitoring, reviewing and implementing the plan, and timeframes for completion of actions.				
Prior to construction, surveys must be conducted for Andropogon gayanus (Gamba grass), Hyparrhenia rufa (Jaragua grass), Imperata cylindrica (Spear grass), Pennisetum polystachion, Cynodon dactylon, Dactyloctenium aegyptiacum, Gardenia ternifolia, Protea elliotti, Acacia ataxacantha ,Bombax costatum (Red silk cotton) , various Ficus species (Figs), the palm Raphia sudanica ,Borassus aethiopum (African fan palm) , Anchomanes welwitschii (Isu-Baka).Aspilia africana (Yunyun), Tridax procumbens, and Chromolaena odorata (Siam weed).to determine presence or absence on the site. If a species credit is required for any of these species, then this must be incorporated into the final credit profile and offset strategy before construction commences.	EIA	Pre-construction	N/A	--------- EIA
Protection of native vegetation and fauna habitat to be retained				
Where trees are to be retained, an adequate VEZ will be provided around each tree for the duration of construction.	• Exclusion materials (temporary fencing/tape) • Vegetation Clearing Procedure	• Pre-construction • Construction	Site HSE Manager	EIA
Stockpiling and storage of materials and machinery will be avoided within the dripline (extent of foliage cover) of any native tree.	• This BMP • Mapped VEZs	Construction	• Site HSE Manager • Lead Civil Superintendent	EIA

Any fallen timber, dead wood and bush rock (if present) encountered on site will be left in situ or relocated to a suitable place nearby. Rocks will be removed with suitable machinery so as not to damage the underlying rock or result in excessive soil disturbance.	• Vegetation Clearing Procedure • Vegetation Clearing Protocol • Mapped VEZs	Construction	• All plant operators • Site HSE Manager	EIA
Native vegetation areas to be retained will be delineated and construction activities will be excluded from these areas. Clearing and construction contractors will be given inductions that make clear the importance of these areas and component species.	• Mapped VEZs • Induction/training materials	• Pre-construction • Construction	Site HSE Manager	EIA

Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
No plantings will occur within VEZs.	• This BMP • Mapped VEZs	• Construction • Operation	• Site HSE Manager • Lead Field Technician	DPP Consultation
Native grassland will be managed through mowing and/or grazing on the following recommendations: • November – December graze sheep/mow. Primarily this will reduce the level of dry matter from annual growing species for summer fire hazard. The annuals will tend to have a greater palatability/digestibility than the natives at this stage and be preferentially grazed. • Remove sheep/mow mid-August. This will allow annual grass seed heads to emerge evenly. • Mow to 5-10 cm mid-September/October when annual grasses flowering. This will prevent seed set of exotic annual species enhancing native abundance as well as reducing combustible load. • Destock/low stocking rate over summer. Enhance seed set of perennial native species. • Only mow/graze during dry season if grassland growth will result in average dry matter exceeding 5000 kg/ha DM.	• This BMP • Biomass assessment (each October) • Lease agreement with livestock owner(s) where applicable • Grassland monitoring results (after first year)	Operation	Site HSE Manager	Grassland Monitoring Program
Awareness training during site inductions regarding enforcing site speed limits.	• Toolbox talks • Induction materials	Pre-construction Construction	Site HSE Manager	EIA
Plain wire is to be used on internal fencing where practicable and where it meets safety and security requirements of the solar farm.	• Infrastructure design plans • This BMP	Pre-construction	• Project Manager	EIA

			• Lead Civil Superintendent	
Vegetation clearing protocols				
A Vegetation Clearing Procedure will be developed as required to: • Include best practice methods for the removal of woody vegetation and non-woody vegetation. • Trees will be removed in such a way as not to cause damage to surrounding vegetation. The root system areas will be rehabilitated by filling these areas with spoil from	• Vegetation Clearing Procedure • *National Environmental (Control of Bush/ Forest fire and Open Burning) Regulations, S.1. No 15, 2011.* • National Environmental (Protection of Endangered	Pre-construction	Project Manager	• Agency submissions • DPP consultation

Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
close by road construction. This spoil will have similar soil and grass composition and only come from within • the solar farm to promote germination of similar grass species. • A suitably qualified ecologist/expert to ensure that this process promotes the rehabilitation of these areas. • Require that where work cannot avoid encroaching into the Tree Protection Zone, it does not impinge on the structural root zones (SRZ) of trees to be retained. • All trees to be removed should be disposed of in accordance with the CDW procedure or WMP. • Vegetation clearing protocol includes staged habitat removal, and a requirement for an ecologist to be present during the felling of all hollow-bearing trees to ensure that potential impacts on fauna are minimized.	Species in International Trade) Regulations, S. I. No. 16, 2011 • National Environmental (Control of Alien and Invasive Species) Regulations, S. I. No 32, 2013. • National Environmental (Soil Erosion and Flood Control) Regulations, S. I. No. 12, 2011.			
A pre-clearing process will be implemented before clearing begins. Pre-clearing surveys will be carried out by an ecologist and will include general fauna surveys, general tree hollow inspections and waterway inspections. Habitat trees will be clearly marked with flagging tape.	• Qualified Ecologist • Marking tape/spray • Vegetation clearing procedure	• Pre-construction • Construction	Site HSE Manager	Agency submissions
Prior to the commencement of work, a physical boundary of the approved clearing limit is to be clearly delineated and implemented. The delineation of such a boundary may include the use of temporary fencing, flagging tape, parawebbing or similar.	• Mapped VEZs • Temporary fencing, flagging tape	• Pre-construction • Construction	Site HSE Manager	• DPP consultation

Trees with hollows should not be removed between 1 September and 1 January, in order to mitigate direct impacts to threatened fauna during the breeding season. Clearing of Hollow Bearing Trees will be avoided where possible.	Vegetation clearing protocol	• Pre-construction • Construction	• Project Manager • Site HSE Manager	Agency submissions
Clearing and construction contractors would be given inductions that make clear the importance of the VEZs and their component species.	• Mapped VEZs • Training materials	• Pre-construction • Construction	Site HSE Manager	EIA
The vegetation clearing protocol (section 5.2.1) will be followed for all vegetation clearing.	Vegetation clearing procedure	Construction	Site HSE Manager	Agency submissions

Measure / Requirement	Resources needed	When to implement	Responsibility	Reference
An Unexpected threatened species finds procedure (section 5.3) will be followed where any unexpected fauna is encountered	• Qualified ecologist • This BMP	• Pre-construction • Construction	Site HSE Manager	EIA
Minimise construction impact extent				
Construction activities and storage of materials for boundary fencing should be wholly contained within the proposal area. Disturbance to road reserves other than access points identified in the EIA must not occur.	• This BMP • Mapped project footprint and approved infrastructure locations • Ground disturbance permit procedure	• Pre-construction • Construction	• Site HSE Manager • Lead Civil Superintendent	EIA
Minimise clearing and avoid unnecessary disturbance associated with the construction and operation of the project.	• This BMP • Mapped project footprint and approved infrastructure locations • Ground disturbance permit procedure	Construction	• Site HSE Manager • Lead Civil Superintendent	DPP consultation

3. SPECIFIC WORKS AND KEY ACTIONS REQUIRED

3.1 CONSTRUCTION ACTIVITIES

This construction methodology is indicative of the staging that will be implemented at the project site. Some activities may occur in parallel, particularly given the size of the project site. The following methodology is indicative of construction sequencing and vehicle movements.

There are a lot of vehicle movements involved in the construction of the solar farm. Most of these movements terminate at the site entrance/laydown area.

The majority of vehicular traffic onsite is by light vehicle and restricted to internal access tracks only. The notable exceptions are during piling, tracker install, trenching and panel installation. Tracked piling rigs and wheeled forklifts will traverse the grasslands along and across each row. However, this is limited to only a handful of movements (pile delivery, piling, tracker install and panel fitting). Repetitive vehicle movements will be avoided to reduce soil impacts and time wastage. Tracked mini-piling machines will be used.

The schedule of work in Table 3.1 guides the key actions required for management of biodiversity for the project.

Table 3.1: Schedule of construction works

Project Phase	Potential Disturbance	Key actions and Mitigation	Performance Target
Construction site set up, construction of access.	• Disturbance to native groundcover from vehicle movements. • Disturbance and removal of fauna habitat including woody debris. • Spread of weeds, particularly high threat exotic plants.	• Clearly delineate the approved clearing and disturbance footprint using temporary fencing, flagging tape, Para webbing or similar. • Machinery, trucks and equipment will be restricted to designated parking areas. Disturbance to road reserves other than access points identified in the EIA must not occur. • Wash and inspect plant and vehicles as per Traffic Management Procedure. • Implement ground disturbance permit procedure prior to any clearing activity. • Pre-clearing surveys will be carried out by an ecologist and will include general fauna surveys, general tree hollow inspections and waterway inspections. Habitat trees will be clearly marked with flagging tape. • Trees with hollows will not be removed between 1 September and 1 January, in order to mitigate direct impacts to threatened fauna during the breeding season. • Implement Vegetation Clearing Protocol for vegetation removal. • Place CWD in remaining vegetated areas where practicable.	• No native vegetation other than the approved will be disturbed. • Direct impacts to native grassland must not exceed the identified in the EIA. • No mortality of native fauna during vegetation removal. • No pollution or siltation of aquatic ecosystems, wetlands, endangered ecological communities or threatened species habitat. • 5% low threat exotic plant cover. Remainder of the development site not to exceed 5% high threat exotic plant cover or 50% low threat exotic plant cover.

		• Record clearing and ground disturbance via spatial mapping. • Install and maintain erosion and sediment (ERSED) controls.	
Internal road construction	• Erosion and sedimentation of drainage channels from levelling and bridge construction. • Disturbance to native fauna from lights and noise. • Disturbance of groundcover from stockpiles.	• Provide awareness training during site inductions and toolbox talks-emphasise the importance of native groundcover. • Machinery, trucks and equipment will be restricted to designated parking areas. No parking on roadside vegetation will occur. • Plant and vehicles will be washed and inspected as per Traffic Management Procedure.	• No native vegetation other than the approved will be disturbed. • Direct impacts to native grassland must not exceed identified in the EIA. • No dirty water leaves the site • Dirt tracking is minimised on sealed public roads.5% low threat exotic plant cover.

	• Spread of weeds, particularly high threat exotic plants.	• Stockpiling and storage of materials and machinery will occur only on designated direct disturbance areas. • Stockpiling and storage of materials will avoid the dripline (extent of foliage cover) of any native tree. • Direct any lighting away from woodland vegetation. • Install and maintain ERSED controls.	• Remainder of the development site not to exceed 5% high threat exotic plant cover or 50% low threat exotic plant cover.
Construction of solar farm infrastructure	• Erosion and sedimentation of drainage channels from levelling and bridge construction. • Disturbance to existing native fauna from lights and noise. • Disturbance of groundcover from stockpiles. • Spread of weeds, particularly high threat exotic plants.	• Provide awareness training during site inductions and toolbox talks- emphasise the importance of native groundcover. • Machinery, trucks and equipment will be restricted to designated parking areas. No parking on roadside vegetation will occur. • Stockpiles and storage of materials and machinery will avoid the dripline (extent of foliage cover) of any native tree. • Stockpiling and storage of materials will occur only on designated direct disturbance areas. • Direct any lighting away from woodland vegetation. • Plant and vehicles will be washed and inspected as per Traffic Management Procedure. • Topsoil will be stockpiled and replaced over direct disturbance areas as soon as practicable as per Rehabilitation and • Revegetation Protocol. • Install and maintain ERSED controls.	• No native vegetation other than the approved will be disturbed. • Direct impacts to native grassland must not exceed identified in the EIA. • 5% low threat exotic plant cover • Remainder of the development site not to exceed 5% high threat exotic plant cover or 50% low threat exotic plant cover.

Removal of temporary construction equipment	• Disturbance to existing native fauna from lights and noise. • Disturbance of groundcover from stockpiles. • Spread of weeds, particularly high threat exotic plants.	• Provide awareness training during site inductions and toolbox talks- emphasize the importance of native groundcover. • Machinery, trucks and equipment will be restricted to designated parking areas. No parking on roadside vegetation will occur. • Stockpiles and storage will be occurring only on designated direct disturbance areas. • Direct any lighting away from woodland vegetation.	• No native vegetation other than the approved will be disturbed. • Direct impacts to native grassland must not exceed identified in the EIA. • Moderate condition of Plant Community Type grassland not to exceed 2% high threat exotic plant cover, or 5% low threat exotic plant cover.

		• Plant and vehicles will be inspected and washed as per • Traffic Management Procedure. • Install and maintain ERSED controls.	• Remainder of the development site not to exceed 5% high threat exotic plant cover or 50% low threat exotic plant cover.

3.2 OPERATIONAL ACTIVITIES

3.2.1 Security and maintenance

Operational traffic within the panel area will be minimal with approximately 3-5 vehicles based permanently at the site. Periodical infrastructure upgrades may be required and will generate additional traffic movements for short periods. DPP will be contacted prior to any major upgrades or maintenance works and in the event of any incident affecting biodiversity.

Table 3.2: Schedule of operation works

Project Phase	Expected Disturbance	Key actions and Mitigation	Performance Target
Operation	• Minor ground disturbance from panel maintenance. • Disruption to the movement of native fauna. • Fauna mortalities due to contact with project infrastructure such as fences and panels. • Spread of high threat exotic plants.	• Awareness training for operational staff. • Record incidents of fauna mortalities and report threatened species encounters to DPP. • Wash and inspect vehicles as per the Traffic Management Procedure. • Implement Weed Management Procedure. • Implement Animal Pest Management Procedure as required.	• Moderate condition Plant Community Type grassland not to exceed 2% high threat exotic plant cover, or 5% low threat exotic plant cover. • Remainder of the development site not to exceed 5% high threat exotic cover or 50% low threat exotic plant cover. • No native fauna mortalities.

Grassland management	Impacts on native grassland condition from managing fuel load.	• Manage native grassland as per the Native Grassland Management Procedure. • Wash and inspect vehicles as per the Traffic Management Procedure.	• Moderate condition Plant Community Type grassland not to exceed 2% high threat exotic plant cover, or 5% low threat exotic plant cover. • Remainder of the development site not to exceed 5% high threat exotic plant cover or 50% low threat exotic plant cover.

4. COMPLIANCE MANAGEMENT

4.1 ROLES AND RESPONSIBILITIES

The Project Team's overall roles and responsibilities are outlined hereunder. Key responsibilities relating to managing biodiversity during construction are:

- The EEE III Project Contractor is responsible for the development and maintenance of all management plans including the overarching environmental management strategy as listed in the EIA
- The EEE III Project Contractor /Project Manager is responsible for ensuring groundworks occur onsite in accordance with the BMP. This includes but is not limited to disturbance in designated areas only, traffic management restricting movements off internal access tracks, topsoil storage and reuse, rehabilitation of disturbed works are carried out as soon as practicable.
- The Site HSE Manager who manages the ground disturbance permit process and records a running total of vegetation clearing within the development site. The Site HSE Manager also manages the contracts with ecologists for environmental monitoring.
- The Lead Civil Superintendent is responsible for supervising construction workers and will ensure they are sufficiently trained in the protection of biodiversity and minimising disturbance detailed below. The Lead Civil Superintendent in conjunction with the Site HSE Manager will oversee weed control and rehabilitation of the site.
- The Onsite Logistics Manager is responsible for implementing the Traffic Management Plan, which includes controlling and recording heavy vehicle movements onsite. Workers involved in installing solar infrastructure will be trained and directed to limit vehicle movements between the rows of panels.

Key responsibilities relating to managing biodiversity during operation are:

- The Operator is responsible for the development and maintenance of all management plans including the overarching environmental management strategy as indicated in the EIA
- The Operations and Maintenance (O&M) Manager is responsible for ensuring groundworks occur onsite in accordance with the BMP. This includes but is not limited to disturbance in designated areas only, traffic management restricting movements off internal access tracks, topsoil storage and reuse, rehabilitation of disturbed works are carried out as soon as practicable. The O&A Manager also manages the contracts with ecologists for environmental monitoring as necessary.

- The Lead Field Technician now manages the ground disturbance permit process. The Lead Field Technician will oversee bushfire management, weed control and rehabilitation of the site to achieve biodiversity outcomes.
- The Engineering Supervisor is responsible for supervising maintenance works and will ensure workers are sufficiently trained regarding protection of biodiversity and minimizing disturbance.

4.2 TRAINING

All employees, contractors and staff working on site will undergo induction training covering all procedures and protocols included within this BMP. Site induction provides an introduction to the ground disturbance permit and vegetation clearing processes, traffic movement restrictions and hygiene, threatened fauna identification and handling and locations of environmentally sensitive areas. Further details regarding staff induction and training are outlined in the EIA.

Staff and contractors will attend pre-commencement meetings at the beginning of each shift, which will include the details of any urgent biodiversity matters such as any breeched of protocols or procedures. Longer toolbox meetings will occur weekly where staff and contractors will be made aware of any less urgent biodiversity matters and reinforce training on implementing protocols and procedures.

4.3 INSPECTIONS AND MONITORING

Inspections of sensitive areas and activities with the potential to impact biodiversity will occur monthly for the duration of construction and annually for the operation of the project. General biodiversity monitoring will include a quantitative and ongoing assessment of grassland and woodland condition. Monitoring and evaluation of success will include a reflection on the seasonal conditions for the previous period. Monitoring during construction will be monthly inspections of high disturbance areas, groundcover, protected woodland areas and boundary fence lines. These monthly inspections will include:

- Details of Course Woody Debris (CWD) placement, recorded as it occurs.
- A review of any fauna killed or injured. Threatened fauna mortalities will be reported to DPP and the deaths of any birds resulting from contact with fences or solar panel will be recorded.
- Fauna relocations relating to vegetation clearing will be recorded.
- Areas of high and low threat exotic plants will be recorded and controlled on a seasonal basis Biodiversity monitoring during operation will include:

- A quantitative assessment of groundcover will occur 6 months after construction. If groundcover is less than 70% cover during this time, corrective actions will be required. This will include consideration of soil conditions such as compaction, frequency of traffic movements, low seedbank storage, lack of soil moisture and nutrient imbalance. If soil chemistry the growth limiting factor, soil testing will be used to determine any need for amelioration.
- Feral animal and weed control surveys will occur on a seasonal basis.

Trigger points for corrective action include:

- Damaged exclusion fencing or signage.
- CWD stacked, not distributed.
- Any storage or infrastructure located underneath driplines of trees.
- Presence of injured or deceased fauna.
- Scours greater than 50 mm deep and 100 m long.
- Bare ground within native grassland patches greater than 20 m^2.
- High threat exotic plant covers greater that 2% of moderate condition plant community type
- Low threat exotic plant covers greater than 5% of moderate condition plant community type.
- High threat exotic plant covers greater than 5% for the remainder of the development site.
- Low threat exotic plant covers greater than 50% for the remainder of the development site.
- Groundcover achieves seed set across less than 70% of area.
- Observed feral animals or observations from neighbours. A monitoring program summary is provided in Table 4.1

Table 4.1: Monitoring program summary – minimum requirements

BMP Section	Monitoring Plan	Timing / Frequency	Responsibility	Decision trigger / adaptive response	Reporting
Pre-construction					
Section 5.2.1	Inspection of VEZ marking and fencing (no-go zones) including individual trees.	At commencement of Project.	Site HSE Manager and suitably qualified ecologist.	If fencing is damaged it is rectified.	On-site reporting.
Section 5.2.2	Survey before removal of tree vegetation. Hollows to be rechecked prior to clearing.	Before Clearing Commences on-site.	Suitably qualified ecologist.	Implement fauna handling procedure if native fauna is found roosting in hollows.	Ecologist Report.
Section 5.2.1	Visual inspection vegetation of clearance activities.	Weekly.	Site HSE Manager	Clearing not aligned to survey, clearing to cease immediately.	On-site reporting.
Section 10.1	Issue ground disturbance permit.	Weekly during construction.	Site HSE Manager.	Work will cease if no aligned to Ground Disturbance Permit.	On-site reporting.
During construction					
Section 5.2.1	Visual inspection of vegetation clearance activities.	Regularly at least weekly.	Sit HSE Manager.	• If lack of exclusion fencing leads to damage to retained vegetation, stop work and report incident. Reinstate exclusion fencing as required. • Incident to be detailed at staff and contractor pre-commencement meetings at the beginning of each shift	• Site HSE Manager to inform DPE of non-compliance within 7 days. • Site HSE Manager to inform DPP immediately of incidents causing harm to threatened species, or ecological communities.
Section 5.4	Maintain a log of salvaged animals and actions taken to relocate them.	As required	Site HSE Manager.	If threatened species are identified, triggers then review and report.	Ecologist Report.
5.4k	Inspections for fauna where footings have been left overnight.	Daily as required.	Site HSE Manager.	No work to proceed until fauna removed from footings.	On-site reporting.

	Inspection of rehabilitation works during construction.	Monthly.	Site HSE Manager.	N/A	On-site reporting.

BMP Section	Monitoring Plan	Timing / Frequency	Responsibility	Decision trigger / adaptive response	Reporting
5.4	Inspection to detect high and low threat exotic plant cover throughout development site.	Quarterly.	• HSE Manager and • Ecologist.	• High threat exotic plant cover of 2% and low threat exotic plant cover of 5% for moderate condition Plant community type. • High threat exotic plant cover of 5% and low threat exotic plant cover of 50% for the remainder of the development site.	• Site HSE Manager • Annual report to DPP.
	Inspection of high threat exotic plant cover control sites.	Monthly.	• HSE Manager and • Ecologist.	Following corrective action.	• Site HSE Manager • Annual report to DPP.
Post-construction					
	Maintain a log of mowing activities to be included with quarterly reporting on grassland management.	Quarterly.	Operations Manager.	Biomass equal to or exceeding 5000 kg/ha dry matter.	• Site HSE Manager • Annual report to DPP.
	Inspection of revegetated areas after all sowing is complete.	6 Monthly.	Operations Manager	Failed patches >5m² Seed set across less than 80% of the area.	• Site HSE Manager • Annual report to DPP.
Operation					
	Inspection of high and low threat exotic plant cover control sites	Quarterly	Operations Manager	• High threat exotic plant cover of 2% and low threat exotic plant cover of 5% for moderate condition PLANT COMMUNITY TYPE • High threat exotic plant cover of 5% and low threat exotic plant	• Lead Field Technician • Annual report to DPP.

				cover of 50% for the remainder of the development site.	
	• Grassland monitoring program: • Re-sampling / Framework for Biodiversity Assessment in PLANT COMMUNITY TYPE • Sampling of at least thirty permanent 1 x 10 m plots for plant	• Six-monthly, and autumn spring. • Three years, starting autumn or spring construction	Expert ecologis t	Increase in exotic species richness and cover	• Y, .

4.3.1 AUDITING

The Site HSE Manager will maintain a compliance register for the Project to ensure audits and reporting requirements are met within scope and within set timeframes. The compliance register will include a list of biodiversity commitments identified in the EIA, and this BMP. Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this BMP and compliance with other relevant approvals, licenses and guidelines including: Independent Environmental Audit within six months from the commencement of construction. This will be prepared in accordance with the relevant Independent Audit Post Approval Requirements. A copy of the report will be submitted to DPP and REA PMU.

Corrective measures or actions to improve the environmental performance of the Project recommended by auditors will be reviewed by the senior management team and incorporated into strategies, plans or programs required under by the Development Consent. The recommendations of the Independent Environmental Audit must be implemented to the satisfaction of the Secretary. Additional audit requirements are detailed in the ESMP

4.4 REPORTING

Reporting requirements and responsibilities are documented in detailed in the ESMP. EEP II Project Contractor will document the outcomes of pre-construction surveys required. The Proponent will progressively monitor the clearing of native vegetation and provide a Compliance Report and mapping to ensure compliance. The Site HSE Manager will inform DPP of any non- compliance incident within 7 days of occurrence. Any additional mitigation or management measures relevant to biodiversity have been incorporated into this BMP. Any independent environmental audit, and the Proponent's response to the recommendations in any audit will be made publicly available on the internet. Any other biodiversity matter will also be made publicly available as required by DPP.

4.6 REVIEW AND IMPROVEMENT

This BMP will be reviewed every three years. Continuous improvement of this BMP will be achieved by the ongoing evaluation of performance against the BMP environmental policies, objectives and targets to identify opportunities for improvement. The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance.
- Determine the cause or causes of non-conformances and deficiencies.

- Develop and implement a plan of corrective and preventative action to address non-conformances and deficiencies.
- Verify the effectiveness of the corrective and preventative actions.
- Document any changes in procedures resulting from process improvement

4.7 PROTOCOLS AND PROCEDURES

4.7.1 GROUND DISTURBANCE PERMIT PROCESS

The ground disturbance permit process is integral to communicate the distinction between vegetation projection areas and the ground disturbance footprints which contractors will be working within. This process is also vital to enable the Contractor to track and control vegetation clearing on a daily, weekly and monthly basis. The ground disturbance permit process is managed by the Site HSE Manager and is summarised below;

- Contractors are informed within their contract and site induction that all ground disturbing activities require them to obtain a ground disturbance permit prior to undertaking the work.
- The ground disturbance permit form is available in hard copy at the site office or through University Director of physical planning and must be submitted to the Site HSE Manager via email at least 48 hours before the work is undertaken.
- The Site HSE Manager will compare the proposed ground disturbance area to the project footprint detailed in the current approved development design.
- The Site HSE Manager will visit the site if required and mark out vegetation projection areas and 10 m buffer zones if applicable.
- The Site HSE Manager will either issue the permit unamended or contact the contractor for further clarification.
- Once the permit has been issued, the contractor may undertake ground works as per their contract.
- Once the work has been completed (date specified in the permit), the Site HSE Manager will inspect the site, request any additional clean up or remediation activities and sign-off that the conditions of the permit have been met.
- The Site HSE Manager will then record the disturbed area as part of a running total disturbed area for the project.

An example of the ground disturbance permit form is provided in Figure 5.1 below.

Project: EEE III Solar Farm	**Project No:**
Requested By:	
Habitat Clearing Start Date:	**Expected Completion Date:**

HABITAT CLEARING LOCATIONS – ATTACH DRAWINGS / SKETCHES IF NECESSARY

Location	Comments

This section to be completed by Ecologist and Site HSE Manager for clearing of trees, logs, rocky features, and other habitat features, with reference to constraints mapping.

Has the limit of clearing been clearly delineated?	☐ ☐ **Yes No**
All trees / vegetation / habitat to be retained identified and No-Go Areas fenced off?	☐ ☐ **Yes No**

State how identified:	☐ ☐ **Yes No**
Have habitat trees been identified and appropriately marked?	☐ ☐ **Yes No**
State how identified:	☐ ☐ **Yes No**
Are specific targeted surveys required?	☐ ☐ **Yes No**
State how survey was completed, including results:	☐ ☐ **Yes No**

Is there a risk of weed infestation or spread?	☐ ☐ **Yes No**
Are any animals present? (If Yes, relocation required)	☐ ☐ **Yes No**
Are any active nests/burrows present? (If Yes, relocation required)	☐ ☐ **Yes No**
If soil disturbance is to occur, has an ERSED Plan been created and have these controls been installed?	☐ ☐ **Yes No**
Have relevant workers been given toolbox talks on limit of clearing, fauna handling procedures and any other SHE Controls?	☐ ☐ **Yes No**
Can habitat features be re-used for habitat enhancement?	☐ ☐ **Yes No**
Can the habitat feature be re-used immediately?	☐ ☐ **Yes No**
If not re-used immediately, where will it be stockpiled?	
Comments:	

APPROVALS

Inspection completed by Ecologist: **Date:**

Ecologist Signature Required

Approval by Site HSE Manager: **Date:**

Site HSE manager Signature Required

SIGN-OFF (ONCE WORKS COMPLETED)

Have the conditions of the permit been met?

Site HSE Manager Signature Required

Figure 5.1: Sample ground disturbance p

Date:

4.7.2 VEGETATION CLEARING PROTOCOL

When undertaking vegetation clearing, the following process shown in Figure 5.2 must be followed to minimise the area of disturbance and the amount of vegetation to be cleared.

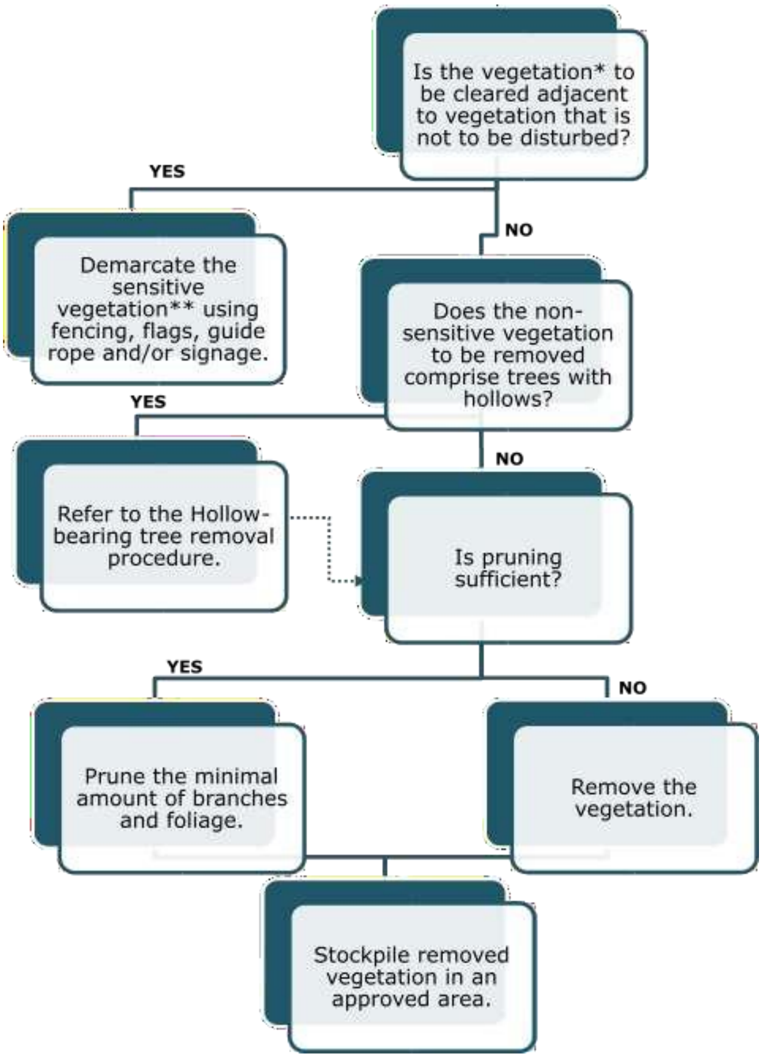


Figure 5.2: Vegetation clearance procedure

4.7.2.1 Vegetation Exclusion Zones

Sensitive vegetation will be protected by exclusion fencing and signage (e.g., Figure 5.3 and Figure 5.4). A 10 m VEZ will be established inside perimeter fencing. A 20 m VEZ will be established around internal woodland vegetation to ensure that sensitive vegetation is not impacted accidentally. The only exception to internal 20m zones is in the approved areas highlighted in Appendix C where it will remain a 10m Exclusion

Zone. In these areas the project contractor will ensure an ecologist inspects these areas to ensure there will be no impact to protected vegetation root systems. This inspection will be documented and kept on record. Exclusion fencing will define vegetation to be retained and beyond that a VEZ will be established to mitigate impacts from construction activities.

Figure 5.3: Example of exclusion zone signage.

Figure 5.4: Example of exclusion zone fencing.

4.7.2.2 Lopping, pruning and trimming procedure

Heavy machinery should not be used for pruning or trimming. Appropriate tools to use are loppers, chain saws and vehicle mounted saws. In the first instance, hollow bearing limbs should be retained. If this is not possible the hollow bearing limb should be inspected by the Project Ecologist / suitably qualified expert and placed in adjacent un- disturbed vegetation to provide fauna habitat. Tree limbs are to be removed using the three-cut method as shown below in Figure 5.4.

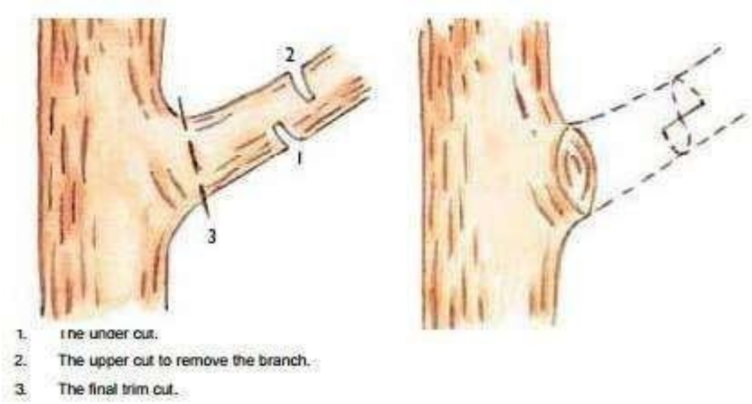


Figure 5.5: Tree cutting method

4.7.2.3 Hollow-bearing tree removal procedure

Hollow-bearing trees are important habitat feature for a variety of native animals such as possums, gliders, birds and bats. Before clearing any hollow-bearing trees, it is important to consider if animals are present. The following procedure (Figure 5.6) is a guide to give animals an opportunity to escape a hollow-bearing tree prior to it being removed.

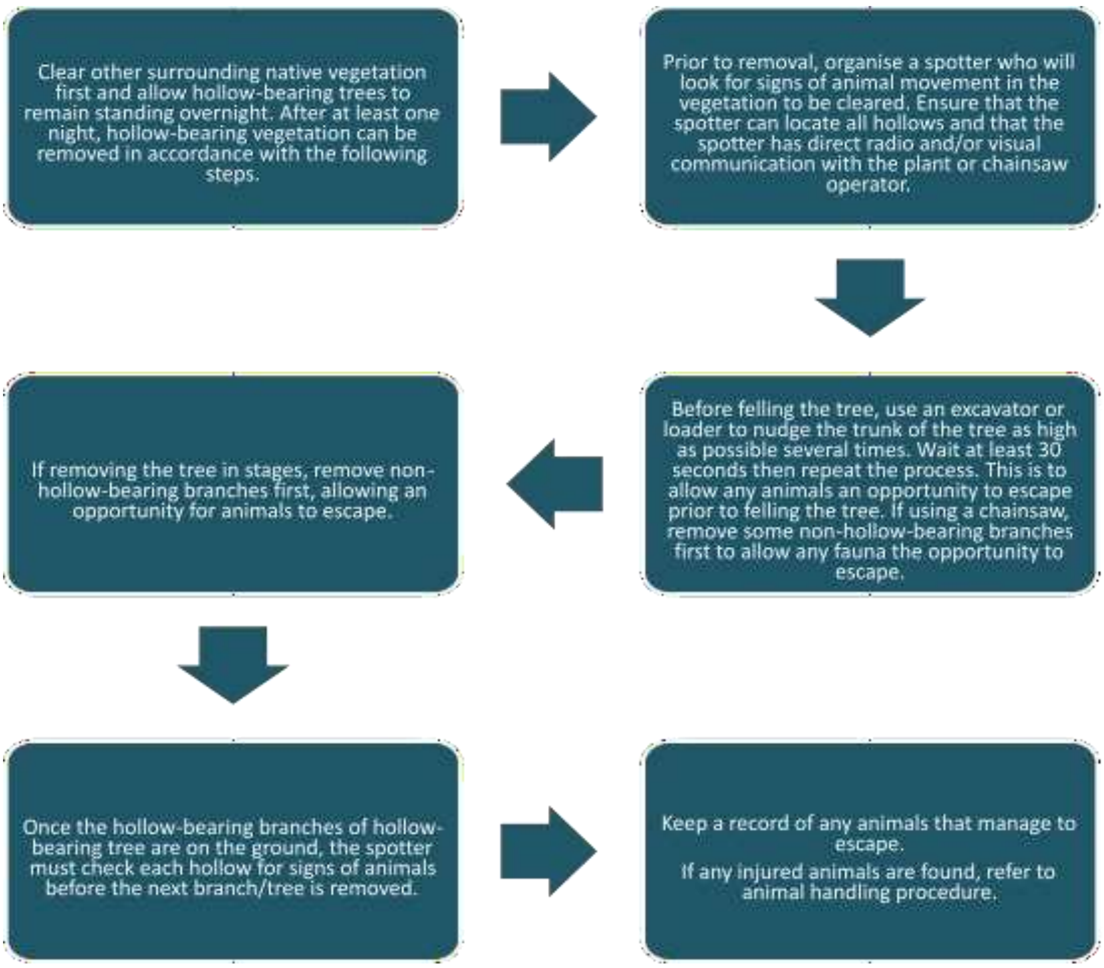


Figure 5.6: Hollow baring tree removal procedure

4.7.2.4 Removal of trees outside the approved clearing limits

The approved clearing limit is the line between the vegetation to be removed and the vegetation to be retained. It will be shown on all design plans as required. This is to be avoided where at all possible. Where additional impacts to trees are proposed, the following process should be followed:

- The Supervisor should notify the Site HSE Manager of the location and need for the tree impact via the ground disturbance permit process.
- The Site HSE Manager/Lead Field Technician should assess that the tree (or other vegetation type) is not heritage listed, a habitat tree, nominated for retention or protected under relevant legislation and is legally able to be removed and/or trimmed. Alternatives to removing the tree should also be investigated at this stage.
- The Site HSE Manager/Lead Field Technician should notify consult a heritage specialist if heritage significance is suspected, which may require a site visit.
- The Supervisor should await written confirmation from the Site HSE Manager prior to re- commencing works around the tree(s).

4.7.2.5 Re-use of coarse woody debris

Felled timber greater than 600 mm (primarily tree trunks) will generally be removed from site. Felled timber greater than 200 mm and less than 600 mm will be used as CWD for habitat enhancement and to maximize the salvage of resources within the disturbance area for beneficial reuse. CWD can be used to enhance habitat values in existing vegetation and rehabilitated areas including derived native grassland (either in offset areas or areas adjoining impacted areas). CWD can provide:

- Habitat for micro invertebrates.
- Habitat for macroinvertebrates.
- Habitat for vertebrates using fallen timber for shelter, e.g. skinks, geckoes, dunnarts.
- Habitat for vertebrates using fallen timber for foraging, e.g. tree creepers, robins.
- A source of nutrients for native vegetation.
- Increased habitat complexity.

CWD will be placed within protected woodland areas as discrete logs rather than in piles to reduce fire risk and potential for use as shelter by feral animals such as rabbits. CWD will be placed at discrete intervals at densities to ensure that the CWD Benchmark for the receiving PCT is not exceeded. The density of CWD must take into account existing fallen timber. Removal, transportation, and placement of CWD will be carried out in a manner that minimizes disturbance to native vegetation, including the canopy, trees, shrubs, standing dead timber, fallen timber, and groundcover, as well as topsoil. CWD between 10 and 200 mm in diameter will be chipped and used for disturbed area rehabilitation.

4.1.1 UNPLANNED THREATENED SPECIES FINDS PROCEDURE

This procedure depicted in Figure 5.7 is derived from information provided by the WWF and Federal Ministry of Environment **wildlife rescue** centres. Any nests found in habitat features to be removed should be inspected by the Ecologist to determine whether fauna is using the nest, and whether relocation of the fauna and the nest to an adjacent area is viable. As a general principle, any native animals found with the construction area should be avoided. Fauna should only be handled by a qualified ecologist or wildlife carer with relevant skills and experience (e.g. snake handling), and only when absolutely necessary.

Any onsite protected fauna found within a habitat feature to be removed should be captured and relocated according to the following steps. Any onsite protected fauna injured during a construction activity should be captured and a registered wildlife handler or veterinarian contacted.

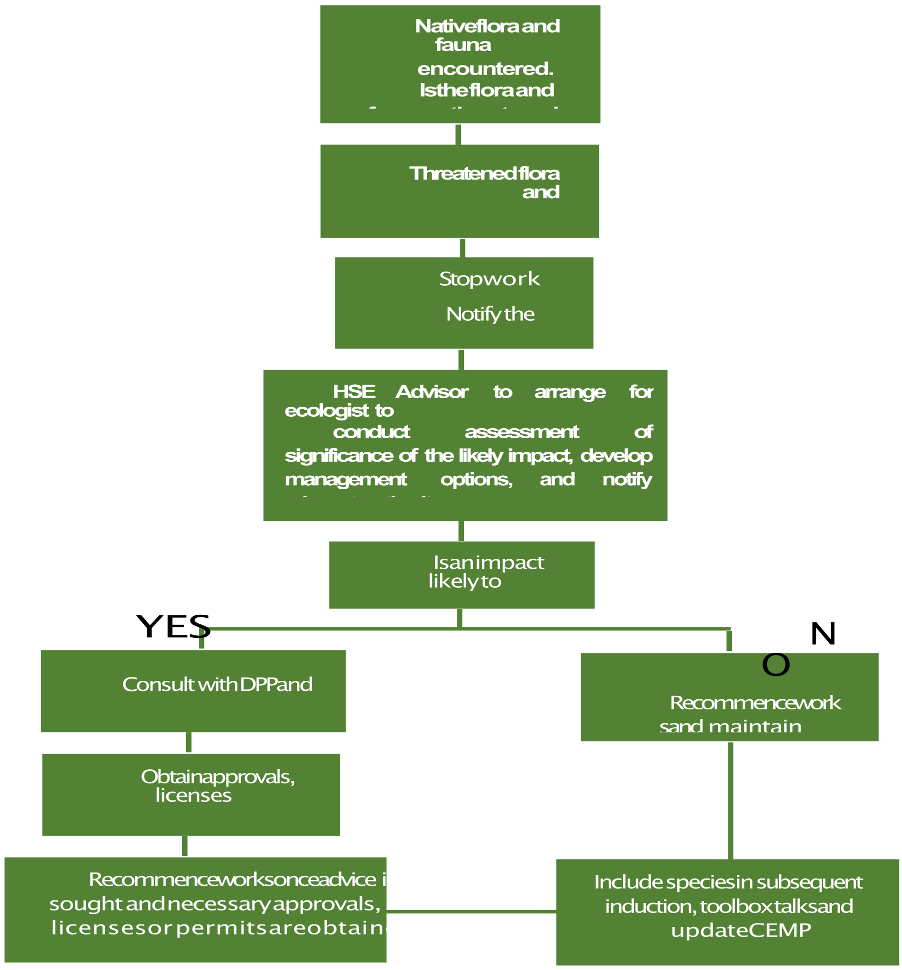


Figure 5.7: Threatened fauna encounter procedure

Step 1

Remove any threat to the animal that could cause or exacerbate an injury.

Step 2

Use appropriate equipment to capture the animal. This may include:

- Frogs: disposable gloves, disinfectant on hands and equipment between animals, disposable plastic bags (one per animal, one use only).

- Mammals: gloves, cloth bags/cotton pillow slips, up-to-date Bat Lyssavirus vaccinations.

Step 3

Contain the animal to minimise stress. Gently place the animal in a holding box specifically designed for holding animals. Cotton pillowslips may be used to cover mammals, or mammals may be placed inside them. Boxes should be placed in a quiet, safe, dark location (not in a vehicle unless temperature is constantly monitored). Do not give the animal food or water.

Step 4

Call the respective ecologist contact person or DPP, who will provide advice on what to do until a trained WILDLIFE rescuer can come to take the animal away.

Step 5

Release fauna into similar habitats, as near as possible to their capture location. Diurnal (day-active) fauna should be released during the day of capture. Nocturnal (night-active) fauna should be released at or after dusk. Arboreal fauna should be slowly released from their bag onto the trunk of a tree, with bats and gliders placed on a tree with rough or peeling bark and hollows.

Step 6

Details of fauna captured and relocated should be recorded in the following register. Any injury or death of a threatened species should be reported to the Site HSE Manager.

Table 5.1: Threatened species register

Date	Species	Location and time captured	Location and time released	Behaviour and condition on release	Details of any injuries/ death	Contact details of vet/wildlife handler if transferred to their care

4.1.1 NATIVE GRASSLAND MANAGEMENT PROCEDURE

Native grassland will be managed through mowing and/or grazing following specific recommendations of grassland. The objective for the grassland management regime is to effectively balance biodiversity outcomes and reduce the risk of fire, exacerbated by high fuel loads. Early in the construction phase, grassland will be mowed to 100 – 200 m to facilitate the installation of panel infrastructure. Following this initial mowing, the grassland will then be managed throughout the remainder of the construction phase and then during operations for the life of the project.

4.1.2 PEST AND WEED MANAGEMENT PROTOCOL

The Project Manager or Site HSE Manager will initiate collaboration with adjoining landholders to control animal pests and exotic plant species that may traverse property boundaries. These initial communications will inform collaborative past and weed management measures into and during operation.

4.1.2.1 Animal Pest Management Procedure

Due to perimeter fencing limiting entry to the project site by large mammal pests such as feral cats, and rabbits, it is anticipated that most pest control activities will be limited to the control of small mammals such as rodents and invertebrates. Larger pest animals may however be present at the site early in during the construction phase and may enter the site periodically through the main access way.

Feral cats/ pest control

Reducing the impact of the feral cats relies on a mixture of control techniques comprising poison baiting, shooting, trapping, fencing and guard animals. All these techniques have a short-term effect on local numbers. No single control method will be successful on its own and when feral cats are removed from an area, reinvasion or immigration from existing untreated areas generally occurs within 2 to 6 weeks.

Rabbit pest control

The rabbit is a declared noxious animal. Landholders are obliged to control rabbit populations on their land. The aim of control is to reduce the impact of rabbits on farm enterprises and the natural environment. The success of rabbit control should be determined more by how many rabbits remain than by how many rabbits have been removed. Rabbits have the ability to rapidly re-invade and recolonize areas following control, so control programs should involve as large a number of properties as possible. Set clear, attainable objectives for control work, taking account of available financial and physical resources.

Two broad rabbit control strategies are applied to rural lands: the combination of poisons and harbor destruction in three Stages of rabbit control:

- Stage 1- Initial reduction.
- Stage 2- Follow up control.
- Stage 3- Advanced control.

Control methods include:

- Monitoring of population density prior to deciding a control method.

- Poisons.
- Harbour destruction.
- Fumigation.
- Shooting.
- Trapping.

Pesticide application record

Pesticide application will only be administered by authorized personnel with Respective environmental accreditation –in accordance with SafeWork requirements. Pesticides will only be applied in accordance label instructions for that product. A Pesticide Application Record will be completed and public notifications made in accordance with relevant legislation, where pesticides are to be used in areas that could be accessed by members of the public. Only pesticides registered for use near water may be used near any waterways.

4.1.2.2 Weed Management Procedure

During construction, the project has the potential to spread weeds through the movements of heavy machinery and light vehicles. Weeds will be controlled through:

- An adaptive management approach whereby management actions will be adjusted to optimise the grassland growth addressing on-site observations as per the Native Grassland Management Procedure in section 5.4.
- For more intensive infestations of weeds, the use of selective herbicides may be warranted to prevent seed set and promote weed control. The advice of an ecologist and agronomist will be sort to advise on the control of weed infestations.
- Any supplementary feeding of livestock will use treated or processed feed to remove viable seeds and prevent weeds being introduced to the site.

A detailed weed management procedure is provided below.

Invasive weeds

The BMP lists the implementation of weed control measures to ensure invasive weed problems are not exacerbated. Once weeds are identified within the construction area, they should be marked up on relevant drawings.

Weed inspection

The Site HSE Manager/Lead Field Technician will inspect the project area for weeds as required:

- Prior to clearing and grubbing.
- When a potential weed infestation has been identified.
- Prior to rainy season till around August to identify high and low threat exotic plants before they go to flower and seed.

Exotic plant cover will be mapped with GPS following inspections including noting the specie(s) degree of infestation and capturing an image for monitoring purposes.

Weed treatment

A general guide to weed control and management is presented above. More detailed information, including herbicide types and application rates, can be sought from the project Ecologist.

Herbicide application record

Herbicide application will only be administered by authorized personnel with environment accreditation in accordance with SafeWork requirements. Herbicides will only be applied in accordance label instructions for that product. A Herbicide Application Record will be completed and public notifications made in accordance with relevant legislation, where herbicides are to be used in areas that could be accessed by members of the public. Only herbicides registered for use near water may be used near any waterways.

Follow-up inspection

The Site HSE Manager/Lead Field Technician will ensure that a follow-up inspection is undertaken of identified exotic plant cover to ensure treatment was successful. Where high threat exotic plants cannot be effectively destroyed prior to topsoil stripping, weed contaminated topsoil will be isolated and disposed of at an approved offsite licensed facility as directed by the Site HSE Manager/Lead Field Technician.

Ongoing management & monitoring

Monitoring of exotic plant cover will occur as part of the routine monthly inspections to determine effectiveness of management controls. The presence of any exotic plant cover and the necessary management actions will be noted on the Environmental Inspection Checklist (refer to EMS).