ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT-ESIA (DRAFT REPORT)

OF THE

ENERGIZING EDUCATION PROGRAMME PHASE II

AT

ADEYEMI FEDERAL UNIVERSITY OF EDUCATION, ONDO TOWN, ONDO STATE

BY

RURAL ELECTRIFICATION AGENCY (REA)

AUGUST, 2026

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ACRONYMS

AC	Alternative Current
AfDB	African Development Bank
AFUED	Adeyemi Federal University of Education
AIDS	Acquired Immuno-Deficiency Virus
AQ	Air Quality
BOS	Balance of System
CBOs	Community Based Organizations
CDA	Community Development Organization
CEDAW	Convention on the Elimination of All Forms of Discrimination Against Women
CH_4	Methane
CoO	Certificate of Occupancy
COx	Oxides of Carbon
COPE	Care of the People
CSP	Concentrated Solar Power
dB	Decibel
DC	Direct Current
DISCOs	Power Distribution Companie
DRG	Debt Relief Gains
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EoL	End-of-Life
ESMF	Environmental and Social Management Framework
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
EPC	Engineering Procurement Construction
E&S	Environmental and Social
ESO	Environmental Safeguard Officer
FEC	Federal Executive Council
FEPA	Federal Environmental Protection Agency
FGD	Focus Group Discussion
FGN	Federal Government of Nigeria
FPIC	Free, Prior and Informed Consent
FMEnv	Federal Ministry of Environment
GBV	Gender Based Violence
GCFR	Grand Commander of Federal Republic
GHG	Green House Gas
GO	Gender Officer

GRC	Grievance Redress Committee
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
GW	Ground Water
HIV	Human Immuno-Deficiency Virus
H_2S	Hydrogen Sulphide
HSE	Health, Safety and Environment
IFC	International Finance Corporation
IGR	Internally Generated Revenue
IMM	Impact Mitigation Monitoring
ICREEE	Inter-Ministerial Committee on Renewable Energy and Energy Efficiency
ISO	International Standard Organization
ISS	Integrated Safeguards System
IUCN	International Union for Conservation of Nature
kWac	Kilowatts Alternating Current
Km	Kilometre
LFN	Law of Federation of Nigeria
LGA	Local Government Area
L&FS	Life and Fire Safety
MDAs	Ministry, Departments and Agencies
M & E	Monitoring and Evaluation
MPTT	Maximum Power Point Tracking
MW	Mega Watts
NCCP	National Climate Change Policy for Nigeria
NACOP	National Council on Power
NEEAP	National Energy Efficiency Action Plans
NEPP	National Electric Power Policy
NEP	National Energy Policy
NESREA	National Environmental Standards and Regulations Enforcement Agency
Ni-Cd	Nickle Cadmium (
NiMET	Nigeria Meteorological Agency
NOx	Oxides of Nitrogen
NSITF	National Social Insurance Trust Fund
OHS	Occupational, Health and Safety
OHSP	Occupational Health and Safety Plan
ODMOE	Ondo State Ministry of Environment
OSWMA	Ondo State Waste Management Authority
O & M	Operations & Maintenance
PMU	Project Management Unit
PSRP	Power Sector Recovery Programme
PV	Photo Voltaic

QA	Quality Assurance
QC	Quality Control
RAM	Risk Assessment Matrix
REA	Rural Electrification Agency
SEA	Sexual Exploitation and Abuse
SEP	Stakeholders' Engagement Plan
SE4Al	Sustainable Energy for All
SOx	Oxides of Sulphur
SPM	Suspended Particulate Matter
SSO	Social Safeguard Officer
SPC	Solar Photo Voltaic
STEM	Science, Technology, Engineering, and Mathematics
SW	Surface Water
TES	Thermal Energy Storage
TMP	Traffic Management Plan
VAC	Violence Against Children
WMP	Waste 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.

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 is 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).

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 proposed project location is at the Adeyemi Federal University of Education, Ondo Town in the Ondo West LGA of Ondo State. With a spatial coverage of 10.78 acres of land, the proposed project location is a fallow land with vast vegetation located on the west flank (along the Laje-Ondo Road) of the prestigious institution. Located in Ondo town in the southwestern part of Nigeria, the town (Ondo) is the second largest town in Ondo state and it is known as the commercial hub under the amiable leadership of the Osemawe.

As an institutional land, the proposed project site is located within an area designated (on the masterplan) for power and ancillary services and thus, the landuse is majorly fallow secondary vegetation.

ES 1.3 Legal and Administrative Framework

In order to establish the proposed EEP in Adeyemi Federal University of Education, Ondo Town, Ondo 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 (2023)
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)
ix. Employee Compensation Act (2010)
x. Land Use Act (1978) and Urban and Regional Planning Act
xi. Climate Change Act (2021);
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 of the Project and 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 Proposed 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 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 Proposed 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 Rationale 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 3.2: Project Components and Activities

The EEP Phase, Nigeria Electrification Project Phase II (Desert-to-Power) project in the Adeyemi Federal University of Education, Ondo Town, Ondo 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 acres 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 4.1 Stakeholders' Engagement

Stakeholder engagement was conducted between 24th to 267th of April, 2026 as part of the ESIA for the proposed project. This included consultation with the strata of stakeholders

University's management, staff and students' associations. 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 Proposed 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.

However, the potential adverse impacts of the proposed project activities are categorized based on the severity while the adequate mitigation measures have also been provided in the Table ES1: below.

Table ES1: Potential Associated Impacts and Mitigation Measures

High Impact		Mitigation Measures
1.	Distortion of the natural ecosystem as a result of site clearing.	i. Site clearing activities shall be limited to the required for the project. ii. Restrict the extent of vegetation to be cleared to the demarcated area. iii. A comprehensive Environmental and Social Management Plan (ESMP) shall be developed and implemented throughout the project lifespan
2.	Displacement of biodiversity on the site	i. The undeveloped areas around the project shall be revegetated with native plants. ii. Site clearing shall be carried out with machinery that has optimal fuel-efficiency and less emissions. iii. Site clearing shall be limited to project area. iv. Trees impacted by site clearing shall be replanted in a ratio of 1:10.
3.	Increased noise from vehicular movements and workers on the project	i. Develop a Traffic Management Plan (TMP) for the project and be operated by the EPC Contractor.
4.	Increased dust from construction activities	i. The site shall be secured with perimeter fencing and security men. ii. Use sprinklers to mitigate the emission of SPM. iii. Excavation works shall only be carried out during fair weather conditions. iv. Excavated soil shall be stockpiled on a dedicated spot in the project location for future use.
5.	Conflict arising from labour and GBV-related issues	i. A grievance redress mechanism (GRM) procedure for receiving and addressing the concerns of employees shall be established for the project. ii. The GBV Action Plan for EEP shall be sustained throughout the Project lifespan. iii. 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). iv. There shall be a GBV sensitive channel for addressing GRM on the project. v. The O & M Contractor shall be required to employ at least a Gender/GBV Officer. vi. The O & M Contractor shall collaborate with relevant government institutions

			and/or GBV service providers to address any GBV case on the project.
		vii.	The O & M Contractor shall provide separate and sufficient conveniences for men and women use on the facility with appropriate caution signs.
Moderate Impact		**Mitigation Measures**	
1.	Contamination of the proximate surface water	i.	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.
2.	Indiscriminate dumping of waste generated on the project	i. ii.	Develop a Waste Management Plan to be implemented by the EPC Contractor; 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.
3.	Slips, falls, Injuries, accidents on the site	i. ii. iii. iv. v.	Assess Drivers on competency level and trained appropriately for the project activities. Prevent spills/contamination Develop Spill Containment Plan (SCP) Place caution signs strategically across the project site and put in place safety measures to prevent incidences/accidents. The work area for the project shall be clearly demarcated and cordon off to prevent encroachment into the site.
4.	Used oil or other hazardous spills	i. ii.	Ensure that disused oil/other hazardous liquids are containerized, labelled and stored in a special location. Liaise with statutorily approved companies/institutions for disposal
5.	Low-quality equipment/installations and poor workmanship	i. ii. iii.	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. The components of the project shall be subjected to testing by experienced personnel in the EPC Contractor. 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.

		iv.	Any labourer/daily worker employed on the project shall be properly screened before commencing work.
6.	Poorly maintained equipment	i.	Ensure regular maintenance of equipment
7.	Irregular working hours	i.	Restrict site clearing activities to during daytime (weekdays from 8:00am to 5:00pm but weekends from 9:00am to 1:00pm)
8.	Fire risk	i. ii. iii.	Ensure training of personnel on safe handling of equipment, chemicals and materials. Provide appropriate fire extinguishers Conduct fire/safety drills for personnel as parts of the recruitment training
9.	Worker's safety	i. ii. iii. iv. v. vi.	Restrict undue movements Build capacity of personnel on safety Provision and enforcement of adequate PPE like gloves, safety boots, and hard hats for the project workers. At least a safety Officer shall be engaged to monitor the compliance of workers to safety rules. Proper safety and caution signs shall be placed at strategically across the site. There shall be routine safety training specific to each job type for all workers on the site.

ES 6.0: Environmental and Social Management Plan (ESMP)

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.

The summary of the indicative budget to effectively implement the ESMP for the mitigation of all the potential and associated impacts of the proposed project is presented below.

Table ES2: Indicative Budget for ESMP Implementation

S/n	Fundamental ESMP Activities	Cost Estimates (US $)
1.	Pre-construction phase E&S management activities	4,700
2.	Construction phase E&S management activities	13,500
3.	Commissioning phase E&S management activities	700
4.	Operational phase E&S management activities	11,000
5.	Preparation of additional management plans	15,500
6.	Institutional Capacity Strengthening Plan	3,000
7.	Monitoring and Evaluation Programme	19,000
8.	GRM Implementation	6,550
Total		**73,950**

ES 7.0 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.

8.0 Conclusion

The proposed Energizing Education Programme (EEP), Nigeria Electrification Project Phase II (Desert-to-Power) project to be established in the Adeyemi Federal University of Education, Ondo Town 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 Sub-Project

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 Study

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.

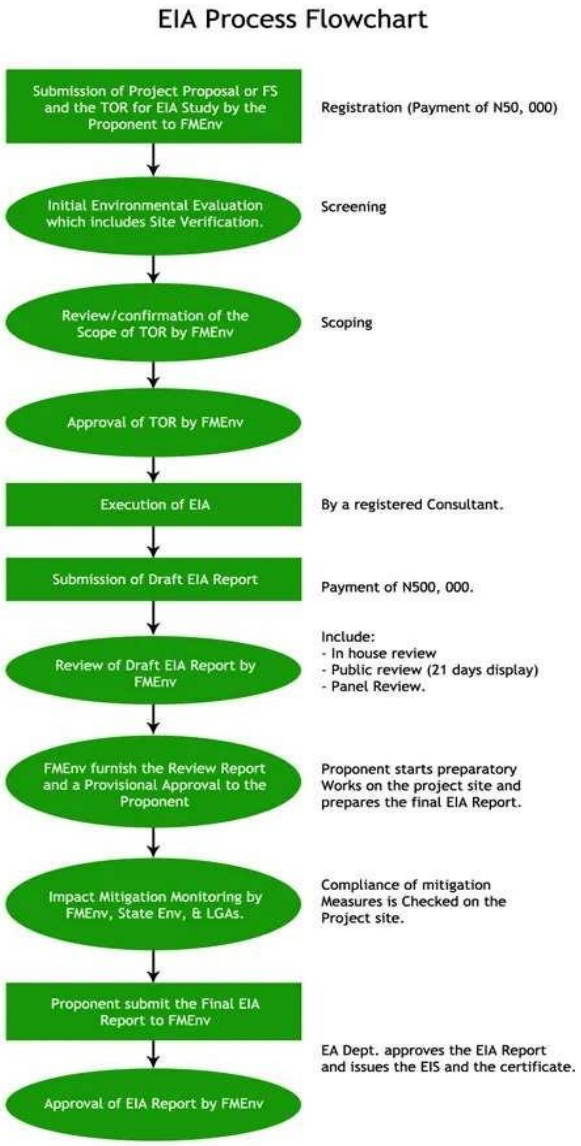


Figure 1. 1: Federal Ministry of Environment Environmental Impact Assessment Process
(Source: Environmental assessment department, Federal Ministry of Environment)

1.4 Limitation of the ESIA 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 (FGDs), 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 of the Ondo State Special Agro-Processing Zone Project (2021) 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 (Adeyemi Federal University, Ondo) ambient environment.

1.5 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.

1.5.1 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.

1.5.2 Policy, Legal and Administrative 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.

1.5.3 Policy Framework

1.5.3.1 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.

1.5.3.2 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.

1.5.3.3 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.

1.5.3.3 The National Electric Power Policy (NEPP), 2021

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.

1.5.3.4 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.

1.5.3.4 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.

1.5.3.5 National Legal Framework

1.5.3.6 The Environmental Impact Assessment (EIA) Act No. 86 (1992)/EIA 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. Thus, this ESIA for the proposed project is implemented furtherance to the provision of the EIA Act no. 86 of 1992.

1.5.3.7 Electric Power Sector Reform Act 2005

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

1.5.3.6 Nigeria Labour Act 2024

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. Following the provisions The REA shall ensure that EPC contractor(s) adhere to the Nigeria Labour Laws.

1.5.3.7 Land Use Act of 976 and Resettlement Procedures

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

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

The Act categorized the land in a State to urban and non-urban or local areas. The administration of the urban land is vested in the Governor, while the latter is vested in the Local Government Councils. At any rate, all land irrespective of the category belongs to the State while individuals only enjoy a right of occupancy as contained in the Certificate of Occupancy, or where the grants are "deemed".

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

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

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

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

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

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

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

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

Payment of such compensation to the holder and the occupier as suggested by the Act may appear confusing as it raises the following question: Does it refer to holder in physical

occupation of the land or two different parties entitled to compensation perhaps in equal shares? The correct view appears to follow from the general tenor of the Act.

First, the presumption is more likely to be the owner of such unexhausted improvements. Secondly, the provision of section 6 (5) of the Act, which makes compensation payable to the holder and the occupier according to their respective interests, gives a pre-emptory directive as to who shall be entitled to what. Again, the Act provides in section 30 that where there arises any dispute as to the amount of compensation calculated in accordance with the provisions of section 29, such disputes shall be referred to the appropriate Land Use and Allocation Committee. It is clear from section 47 (2) of the Act that no further appeal will lie from the decision of such a committee. If this is so, then the provision is not only retrospective but also conflicts with the fundamental principle of natural justice, which requires that a person shall not be a judge in his own cause.

The Act must, in making this provision, have proceeded on the basis that the committee is a distinct body quite different from the Governor or the Local Government. It is submitted, however, that it will be difficult to persuade the public that this is so since the members of the committee are all appointees of the Governor.

Where a right of occupancy is revoked for public purposes within the state of the Federation; or on the ground of requirement of the land for the extraction of building materials, the quantum of compensation shall be as follows:

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

Where the right of occupancy revoked is in respect of a part of a larger portion of land, compensation shall be computed in respect of the whole land for an amount equal in rent, if any, paid by the occupier during the year in which the right of occupancy was revoked less a proportionate amount calculated in relation to the area not affected by the revocation; and any interest payable shall be assessed and computed in the like manner.

Where there is any building installation or improvement or crops on the portion revoked, the quantum of compensation shall follow that outlined in paragraph (ii) above and any interest payable shall be computed in like manner.

Since the proposed project will be sited on a fallow land within the University, therefore there is no need for new acquisition and compensation taking into cognizance the provision of the Landuse Act.

1.5.3.7 The Nigerian Urban and Regional Planning Act CAP N38, 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 (fifty thousand naira).
- ✓ **Section 72** provides for the preservation and planting of trees for environmental conservation.

The proposed sub-project shall take into consideration the provisions of the urban planning laws including the preservation of trees and general environmental conservation.

1.5.3.8 Harmful Waste (Special Criminal Provisions) Act CAP H, 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.

Recognizing the effect of unwholesome waste management on the environment, the REA shall ensure proper waste management by the EPC including the implementation of the Waste Management Plan (WMP) for the project.

1.5.3.8 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 which serve as habitats to both flora and fauna that may be impacted by the proposed assignment. Hence, the proposed project

activities shall be carried out with strict compliance to the relevant provisions. Suffice it to mention that there are no endangered species within the project site.

1.5.3.9 Inland Fisheries Act, CAP110, LFN 2004

This Act focuses 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. Base on the observation during the fieldwork, there are no water bodies in the proposed project site. However, adequate housekeeping shall be carried out to prevent potential leakages from batteries or any project-induced sources of pollution.

1.5.3.10National Commission for Museums and Monuments Act 2004

The Act provides for the dissolution of both the Antiquities Commission and the Federal Department of Antiquities and to create a National Commission for Museums and Monuments, with the responsibilities to establish and administer national museums, antiquities and monuments, including, antiquities, science and technology, warfare, African, Black and other antiquities, arts and crafts, architecture, natural history and educational services.

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.

There is no known site (for monument, burial or religious) in the proposed project site. However, the provision of Sections 20 shall be followed in the case of accidental discovery(ies).

1.5.3.11 The Factories Act (Factory Act CAP FL, LFN 2004)

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.

The project shall ensure that all Occupational, Health and Safety (OHS) issues are taken into consideration in all the phases of the proposed project.

1.5.3.11 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. REA shall ensure that the remuneration of personnel including causal staff commensurate with the national minimum wage (currently ₦70,000.00 per month) while also ensuring that all individuals contracted/employed in relation to the proposed project shall not earn less than the minimum wage.

1.5.3.12Employee Compensation Act 2010

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 workplaces. 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 project will employ both skilled and non-skilled labour and shall be subject to this law as applicable.

1.5.3.13 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.
  The proposed project shall ensure strict adherence to environmental protection of all the three (3) receiving media (soil, water and air) across all the phases of the project.

1.5.3.14 NESREA National Environmental (Battery Control Regulations) 2024

The National Environmental (Battery Control) Regulations 2024 is a legal framework launched by Nigeria's Federal Ministry of Environment and enforced by the National Environmental Standards and Regulations Enforcement Agency (NESREA). Section 34 of the Act, 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, S.I. No.79, 2022.
- National Environmental (Wetlands, River Banks and Lake Shores) Regulations, 2009. S.I. No. 26.
- National Environmental (Sanitation and Wastes Control) Regulations, 2009. S. I. No. 28.
- National Environmental (Watershed, Mountainous, Hilly and Catchments Areas) Regulations,2009. S. I. No. 27.
- National Environmental (Sanitation and Wastes Control) Regulations, 2009. S. I. No. 28.
- National Environmental (Noise Standards and Control) Regulations, 2009. S. I. No. 35.
- National Environmental (Air Quality Control) Regulations, 2013, S. I. No. 64,
- National Environmental (Soil Erosion and Flood Control) Regulations, 2010. S. I. No. 12.
- National Environmental (Surface and Groundwater Quality Control) Regulations, 2010. S. I. No. 22.
- National Environmental (Control of Vehicular Emissions from Petrol and Diesel Engines) Regulations, 2010. S. I. No. 20.
- The National Environmental (Battery Control) Regulations, 2024
  Rural Electrification Agency (REA) shall ensure conformity with the provisions of the Act.

1.5.3.15 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.

1.5.3.16 EIA Sectoral Guidelines (Infrastructures)

This provides general guidelines for EIA of projects in infrastructure sectors of Nigeria, with specific details for sub-sectors. Thus, this ESIA study shall comply with the Sectoral guidelines for infrastructural development especially those that relates to solar mini grid implementation.

1.5.3.17 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 ESIA study shall conform with all the guidelines for solar mini-grid projects in Nigeria.

1.5.6 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 (1968)
- Convention on Biological Diversity (1992)
- Endangered Species (Control of International Trade and Traffic) 1975
- 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) 1979
- Human and Peoples' Rights on the Rights of Women in Africa (2005)
- Civil and Political Rights Covenant (1966)
- Economic, Social and Cultural Rights Covenant (1967)
- Convention on the Rights of the Child (1989).

Considering the national and international dimensions to environment and sustainable development, the ESIA study therefore shall ensure compliance to all related international Conventions, Guidelines and Protocols.

1.5.7 International 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.

1.5.8 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. The proposed sub-project will be implemented in consonance with the national policy on environment.

1.5.8.1 Federal Ministry of Environment (FMEnv.)

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. Thus, the ESIA together with other safeguards instruments attest to the commitment of REA to ensuring a clean and safe environment.

1.5.8.2 The National Environmental Standards and Regulations Enforcement Agency (NESREA)

Ensures the embodiment of laws and regulations focused on the protection and sustainable development of the environment and its natural resources are monitored and complied with. NESREA ensures that the operational phase of the solar power mini- grid project complies with national environmental standards and regulations. As required by law, the proposed project shall collaborate with the NESREA to ensure full compliance with all national environmental standards and regulations.

1.5.8.3 The National Universities Commission (NUC)

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. The REA shall continue to collaborate with the NUC in ensuring the delivery of the dividends of good governance across the beneficiary Universities.

1.5.8.4 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.

The proposed project shall ensure full compliance with the Electricity Act.

1.5.8.4 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 former President-Chief Olusegun Obasanjo's administration (1999 -2007. 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. The proposed project will conform with the NERC policy on mini-grid.

1.5.8.5 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.

1.5.8.6 Rural Electrification Agency (REA)

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.

No doubt, this Desert to Power Project of the REA attest to the commitment and fulfillment of the institutional mandate of the Agency (REA).

1.5.8.7 Federal Ministry o 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.

As an equal-opportunity employer, REA shall ensure that EPC contractors comply with the national and international standards by ensuring equality in employment opportunities and also prevent any form of Gender-Based Violence (GBV) in all phases of the proposed project.

1.5.8.8 State Institutions

Ondo State Ministry of Environment

The Ministry of Environment is responsible for the protection of the environment and its 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 Ondo State Environmental Law 2021. This ESIA study attests to the compliance of the proposed project to the requirements of the State's ministry of environment while there will be continuous monitoring activities in collaboration with the personnel of the Ministry.

Ondo 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. The Rural Electrification Agency (REA) shall ensure full that all barriers to gender inequalities are eliminated on this proposed project while also ensuring that EPC contractors sign and implement the Contractor's Code of Conduct.

Ondo 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. The proposed project site (within the University) has been surveyed and will ensure full compliance with the State's rules of the State's Ministry of Lands and Survey.

1.6 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. The REA will ensure that the proposed project comply with all the requirements of the AfDB.

1.6.1 The African Development Bank's (AfDB) Integrated Safeguard Systems (ISS)

The programme has been assigned a category II (projects with moderate risks) 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 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 is triggered since construction will involve use of fuels and possibly some hazardous materials. Also, the E&S OS 6 (OS6): Habitat and Biodiversity Conservation and Sustainable Management of Living Natural Resources is-trigged due to the activities of the EEP Phase III. OS10: Stakeholder engagement and information disclosure ensure that stakeholder engagement must continue throughout the project life cycle. The Borrower is expected to maintain communication with stakeholders during preparation, implementation, and operation, and to seek feedback not only on project design but also on environmental and social performance, including the implementation of environmental and social management measures. This is particularly relevant for the DtP Project, where site specific risks, contractor performance issues, community concerns, and implementation challenges may emerge at different stages and across different subprojects. 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). This ESIA aims to address all the triggered ISS by the project and an affirmation of the commitment of REA to addressing project's induced environmental and social impacts.

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

2..1 Introduction

This chapter highlights the project location, the rationale for the proposed 1MW solar-hybrid power plant and associated infrastructure at the Adeyemi Federal University of Education of Technology (AFUED), Ondo town, Ondo West LGA, Ondo 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.

2.2 Project Site and Locations

The Adeyemi Federal University of Education is a federal government higher education institution located in Ondo City, Ondo State, Nigeria Formerly Adeyemi College of Education named after Canon M. C. Adeyemi (one of the earliest educationists in Yorubaland in recognition of his immense contribution to educational development in the then Ondo Province.

The institution was established in 1963 to produce qualified teachers to teach in secondary schools and teachers' training colleges and to conduct research and experiments on methods of teaching at all levels of education in Nigeria. It formally commenced operations on 22 May 1964 with 93 students, 24 women and 69 men, and has metamorphosed into a first-class College of Education in Nigeria and in the West Africa sub-region.

The college was a combination of the various institutions that sprang up in the sixties to cater to the development of Manpower in secondary schools and teacher training colleges in the Western region. However, the federal government of Nigeria under the Goodluck Jonathan presidency upgraded the College to a full-fledged university of education in May 2015.However, the administration of former President Mohammed Buhari decided to put the new status on hold till the National Assembly finally passed the Adeyemi Federal University Establishment bill in December 2018 and the bill was assented by the former President of the Federal Republic of Nigeria Mohammed Buhari in December 2021.

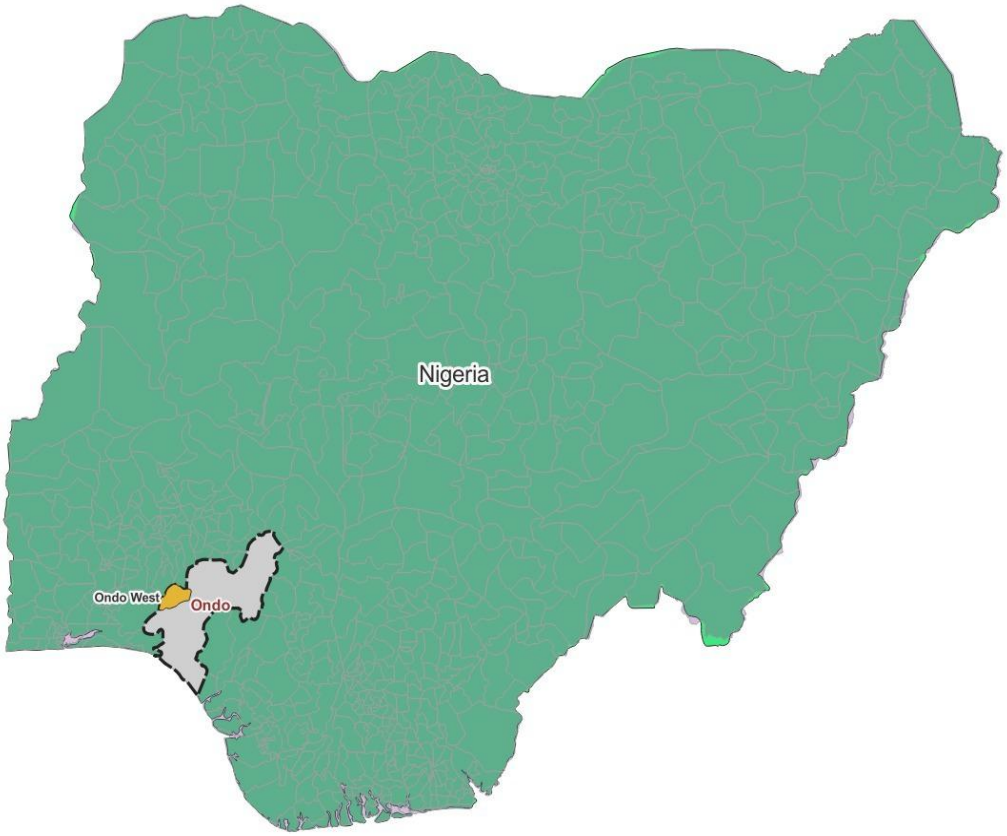


Figure 2. 1: Map location of EEP project site in AFUED, Ondo

2.2.1 The Adeyemi federal University of Education (AFUED), Ondo

The Adeyemi Federal University of Education, Ondo Town (AFUED) is a newly established federal university located in Ondo town, Ondo West Local Government Area, Ondo 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

AFUED 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 Educational and Vocational disciplines. The approved academic units include:

- Faculty of Education

- Faculty of Sciences
- Faculty of Art and Social Sciences
- Faculty of Languages
- Faculty of Vocational and Technical Education.

The institution offers over 49 undergraduate programmes spanning Educational Foundations and Counselling, Educational Management, Adult Education and Lifelong Learning, Educational Technology and Library Studies, and Early Childhood and Primary Education, STEMs to practical skills and technical expertise.

Leadership and Governance

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

Infrastructure and Campus Development

The Adeyemi Federal University of Education is a federal government higher education institution located in Ondo City, Ondo State, Nigeria Formerly Adeyemi College of Education named after Canon M. C. Adeyemi (one of the earliest educationists in Yorubaland in recognition of his immense contribution to educational development in the then Ondo Province. The institution was established in 1963 to produce qualified teachers to teach in secondary schools and teachers' training colleges and to conduct research and experiments on methods of teaching at all levels of education in Nigeria. It formally commenced operations on 22 May 1964 with 93 students, 24 women and 69 men, and has metamorphosed into a first class College of Education in Nigeria and in the West Africa sub-region. The college was a combination of the various institutions that sprang up in the sixties to cater to the development of Manpower in secondary schools and teacher training colleges in the Western region.

2.3 Description of Proposed Project Site

The Proposed project site is located at Adeyemi Federal University of Education. The summary description of the project site, is given in the Table 2.1. Out of the total land size of the university, only 10.58 acres have been earmarked for the proposed project area for the EEP and allocated and a “No Trespassing” sign board can be sighted on the parcel of land to warn trespassers. However, the spatial characteristics of the proposed project area of coverage is presented in Table 2.1 below.

Table 2.1: Quadrants for the Proposed Solar Hybrid Power Project Site

S/n	Easting	Northings
1.	4.8132486	7.0764779
2.	4.8149871	7.076352
3.	4.8162491	7.0765023
4.	4.8161875	7.0758822
5.	4.8147494	7.0757054
6.	4.8131719	7.0760191
7.	4.8128575	7.075206
8.	4.8138519	7.0754205
9.	4.8152819	7.075037
10.	4.8162356	7.075596
11.	4.8160728	7.0748575
12.	4.8161738	7.0745598
13.	4.8152777	7.0746884
14.	4.8146983	7.0761705
15.	4.8152212	7.0754412
16.	4.8135645	7.0746105

Also, the land use plan of the entire University (Adeyemi Federal University, Ondo) is presented below.

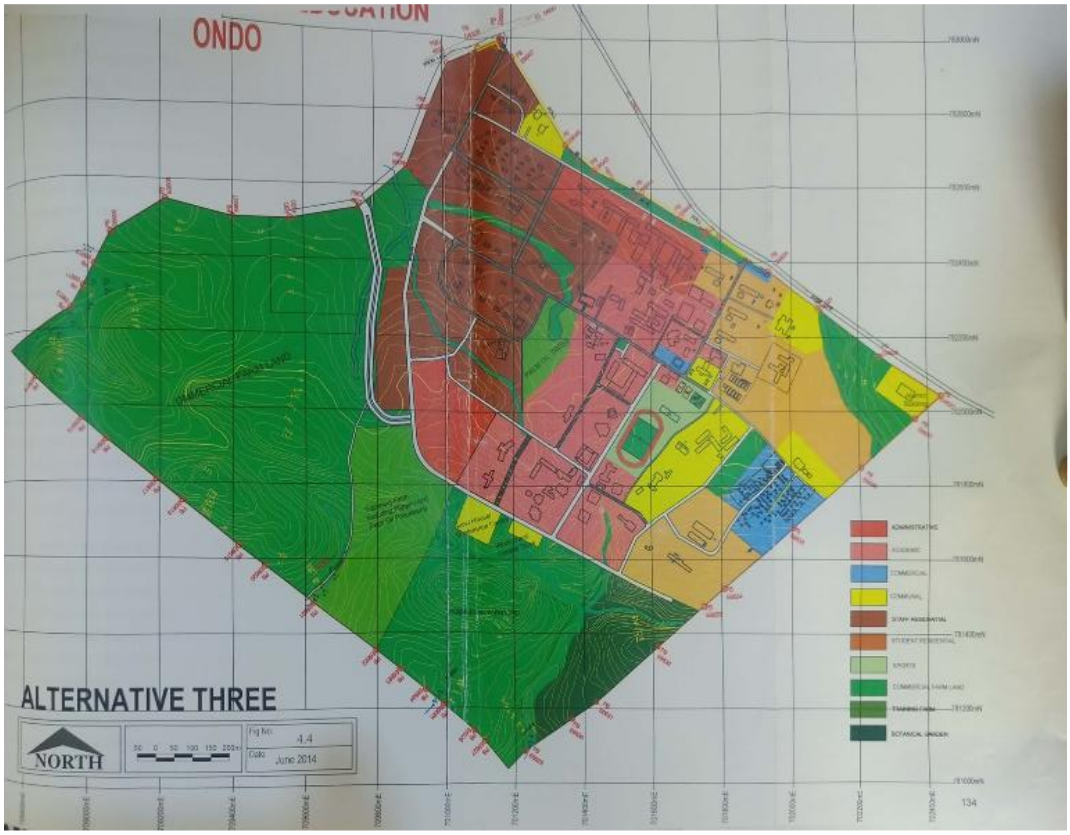


Figure 2.2: Land use Map of Adeyemi Federal University of Education Ondo Town

2.4 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 almost 1984.882meter away 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 10.58 acres.

The layout showing the electrical architecture of the institution is shown in Figure 2.3 below.

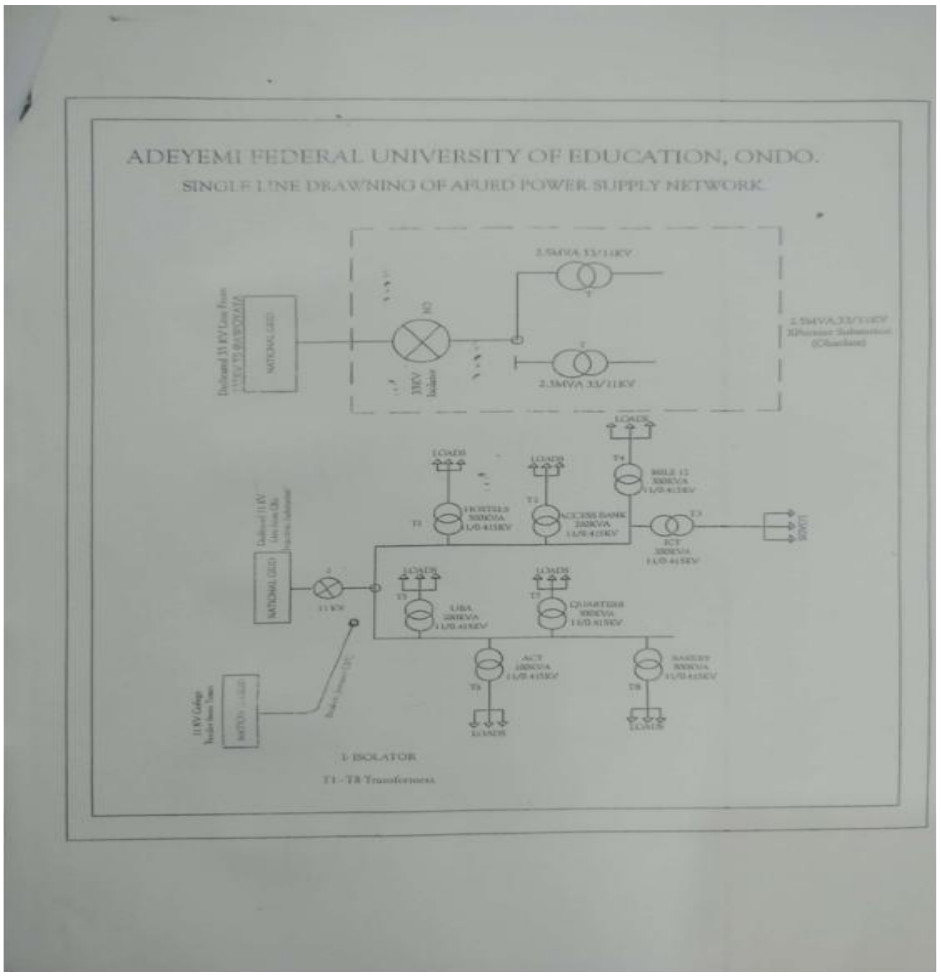


Figure 2.3 Draft Layout HT and Lt Lines, Transformers and Generator

2.5 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 Adeyemi Federal University of Education, Ondo Town, 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.

2.6 Value of the Proposed 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.

2.6.1 Project's 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.

2.7 Envisaged Sustainability

2.7.1 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 Adeyemi Federal University of Education of Technology, Ondo town.

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 Adeyemi Federal University of Education 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.

2.7.2 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.

2.7.3 Economic Sustainability

The proposed project is part of the FGN's EEP initiative, a component of NEP. NEP therefore 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.

2.7.4 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).

2.8 Project Alternatives

2.8.1 Analysis of Project Alternatives

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 Adeyemi Federal University of Education of Technology, Ondo town 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.

2.8.2 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) ii) security;

iii) iii) absence of any physical structure on the site that could be affected by the proposed Project;

iv) iv) absence of any rocky outcrops on the site that could pose constraints to the solar panels to be installed;

v) 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.

2.8.1.1 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 Panel

2.8.1.2 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-hour 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.

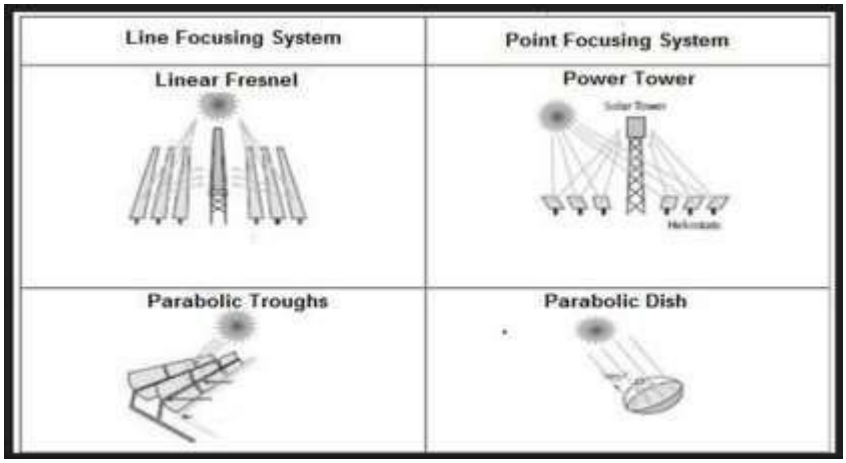


Figure 2.4: Four Different Types of Solar Collector Designs

(Source: The End of CSP As We Know It? | Energiek (wordpress.com)

2.8.1.3 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 W_p	300 W_p	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%

2.8.3 Solar Batteries Alternatives

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

Lead-Added 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.

2.8.4 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"Options

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

The plan for Federal University in Ondo town is a solar hybrid plant of 1,000KW. 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

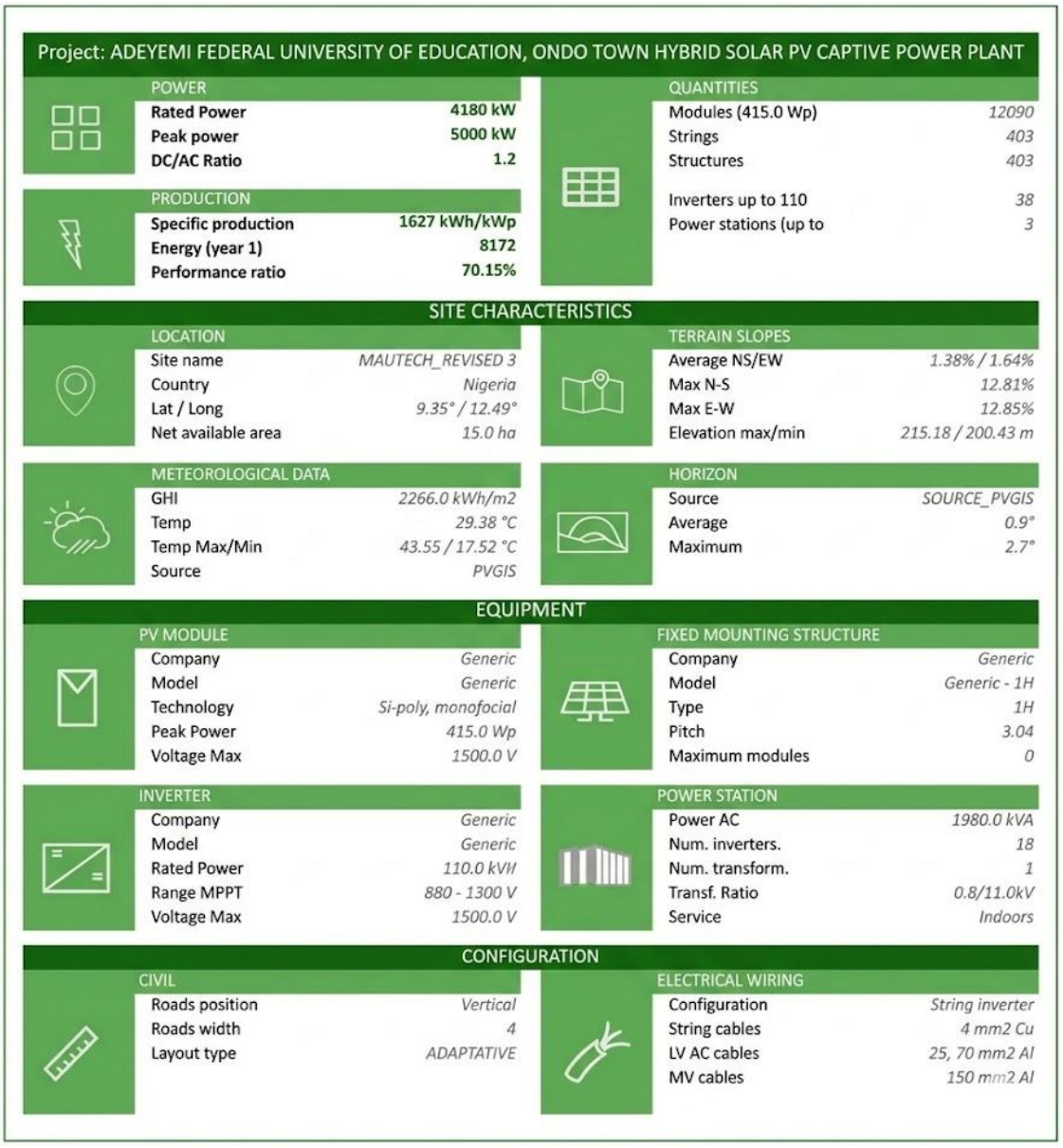


Figure 3. 1: Overview of Site Characteristics, Equipment and General Configuration
(Source: REA EEP 3 Front End and Engineering Design)

3.1 Project Requirements

Land: The area where the PV plant is to be built consists of 1 available area, with a total surface area of 10.576 acres. A total of 1 restricted area is not suitable for the installation of PV modules. The final available area covers a surface of 10.576 acres. The size of each area and the total suitable area for installation purposes is shown in Table 3.1.

Table 3. 1: Area coverage

Area Name Size	**Total**
Available areas	10.576 acres
Restricted areas	0 acre
Substation area	0 acres
Total available area	**10.576 acres**

(Source: REA NEP 3 FEED)

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).

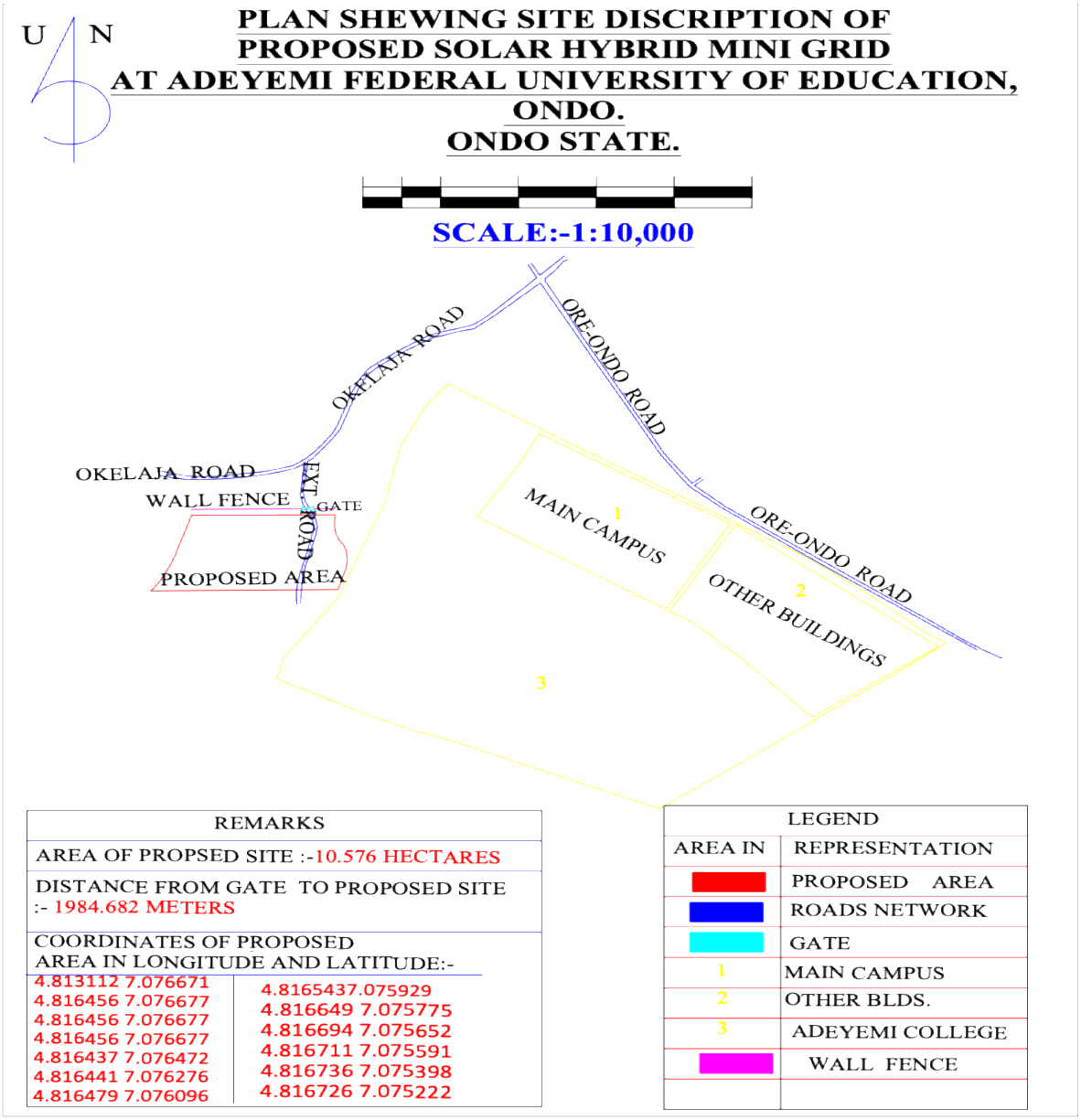


Figure 3. 2: Proposed PV Project at Adeyemi Federal University of Education, Ondo

Water Use and Supply: **Climate Conditions and Water Resource Management**

Climatic Characteristics of Ondo town Community

The proposed Project is located in Ondo town Community, Ondo West Local Government Area of Ondo 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.

Ondo town 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 Ondo town 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 as presented below;

- Each PV panel requires approximately 5 litres of water per cleaning cycle.
- Cleaning will occur every month (i.e 12 times in a year) intermittently and will not represent continuous or large-scale abstraction.

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

Table 3.2: 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	12 (i.e. panels will be cleaned once per month)
Total annual water requirement		330,000L

However, the estimated 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 run-off collection pond.
3. Supplementary groundwater abstraction if required during prolonged dry periods.

Also, the groundwater recharge within the project area is primarily driven by direct precipitation. Thus, 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, run-off 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 Ondo town Community, Ondo West 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.

Table 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

There are many organizations that develop the standards and codes for PV systems. ASTM mainly known as the American Society of Testing and Materials has developed more than 12,000 international standards to improve the quality of the product and enhance safety. The PV standard developed by ASTM technical committee is E44.09 Photovoltaic electric power

conversion. The International Code Council (ICC) is involved mainly with the development of a single set of comprehensive international model construction codes engrossed in building safety and fire prevention. The International Electro-Technical Commission (IEC) has published Technical Specifications IEC 62257, a set of standards covering technical and organizational aspects of mini-grids (design, installation, maintenance, contracting) and a checklist of good practices

The EEP 3 program and system designer have taken cognizance of the national and international standards into consideration for the design and execution of this project.

3.2 Components of the Proposed Project

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).

Table 3. 4: Features of the Fixed Mounting Structure

S/No	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)

Table 3.5 gives a summary of the project's characteristics and figure 3.3 shows the electrical configuration of the PV plant.

Table 3. 5: Key Project Characteristics

Main Characteristics	
Location	Ondo 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	10.58 Acres
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)

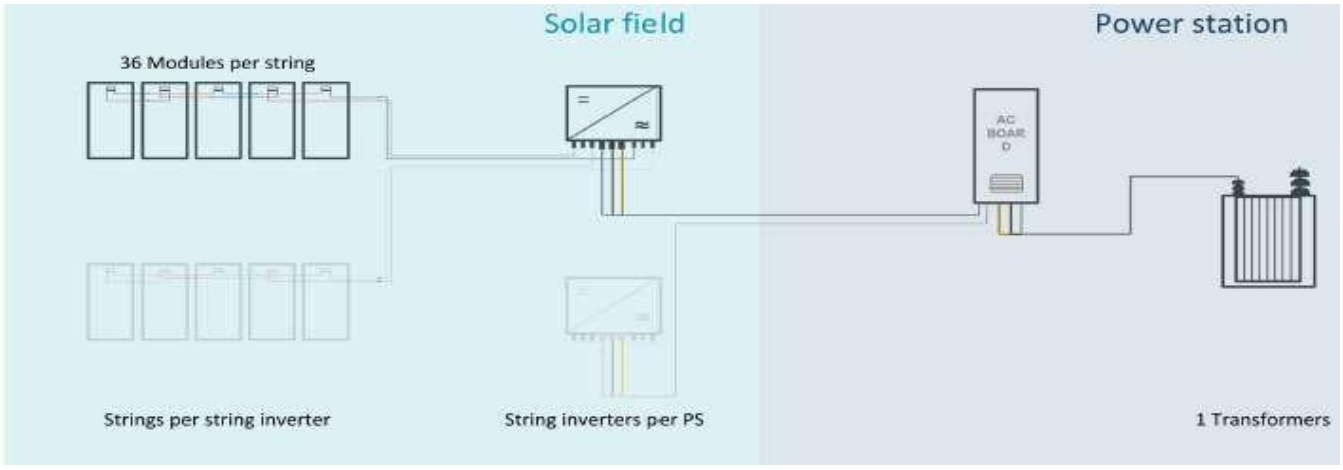


Figure 3. 3: Simplified Electrical Configuration Diagram
(Source: REA EEP 3 Front End and Engineering Design)

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 3.6, an example picture of a Monofacial Si-poly module is shown in figure 3.4.

Table 3. 6: Photovoltaic Module Characteristics

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. 7: Inverter Characteristics

Inverter Characteristics	
Main Characteristics	
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)

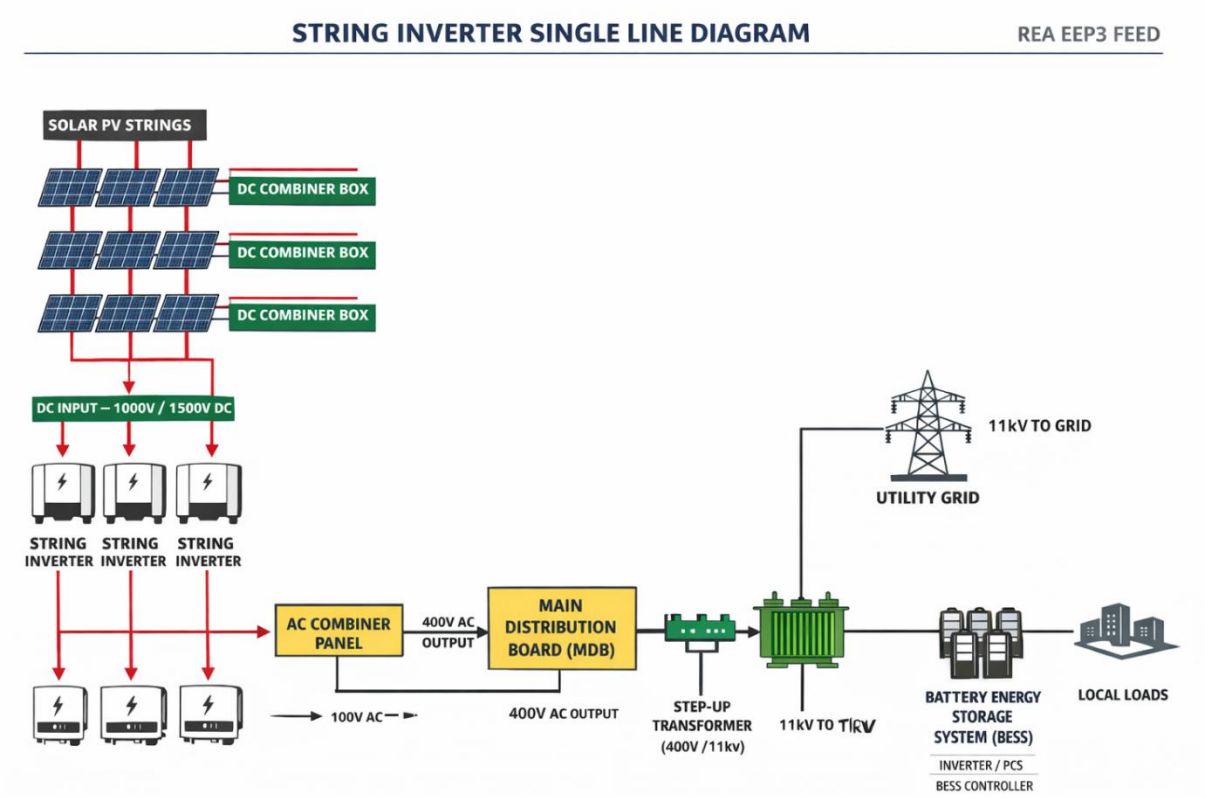


Figure 3.6: Single Line Diagram for Inverter

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.

However, a typical power transformer is shown in Figure 3.7 below.

Figure 3. 7: Example of Transformer
(Source: REA EEP 3 FEED)

Also, the main features of the power transformer are shown in Table 3.8.

Table 3. 8: Transformer Characteristics

Transformer Characteristics	
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.

(Source: REA EEP 3 FEED)

Figure 3. 8: Example of a Power Station

The power station shall be supplied with medium voltage switchgears that include one transformer protection unit, one direct incoming feeder unit, one direct outcoming feeder unit and electrical boards. Particularly, for the first power station of each MV line, a direct incoming unit will not be installed.

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

Table 3. 9: Power station characteristics

Power Station Characteristics	
Number of transformers	1
Voltage ratio	0.8/20.0kV
Service Indoors	Indoors

(Source: REA EEP 3 FEED)

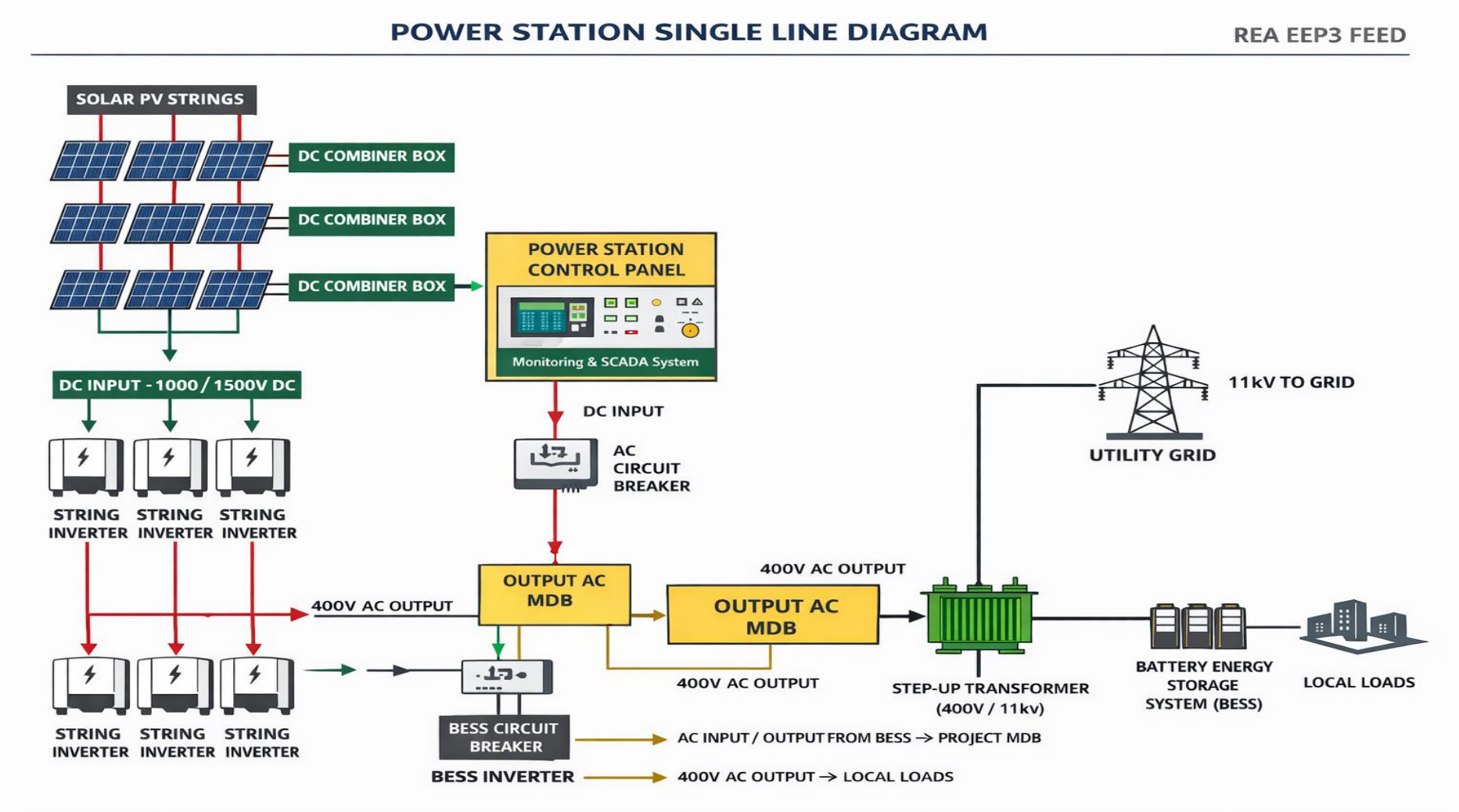
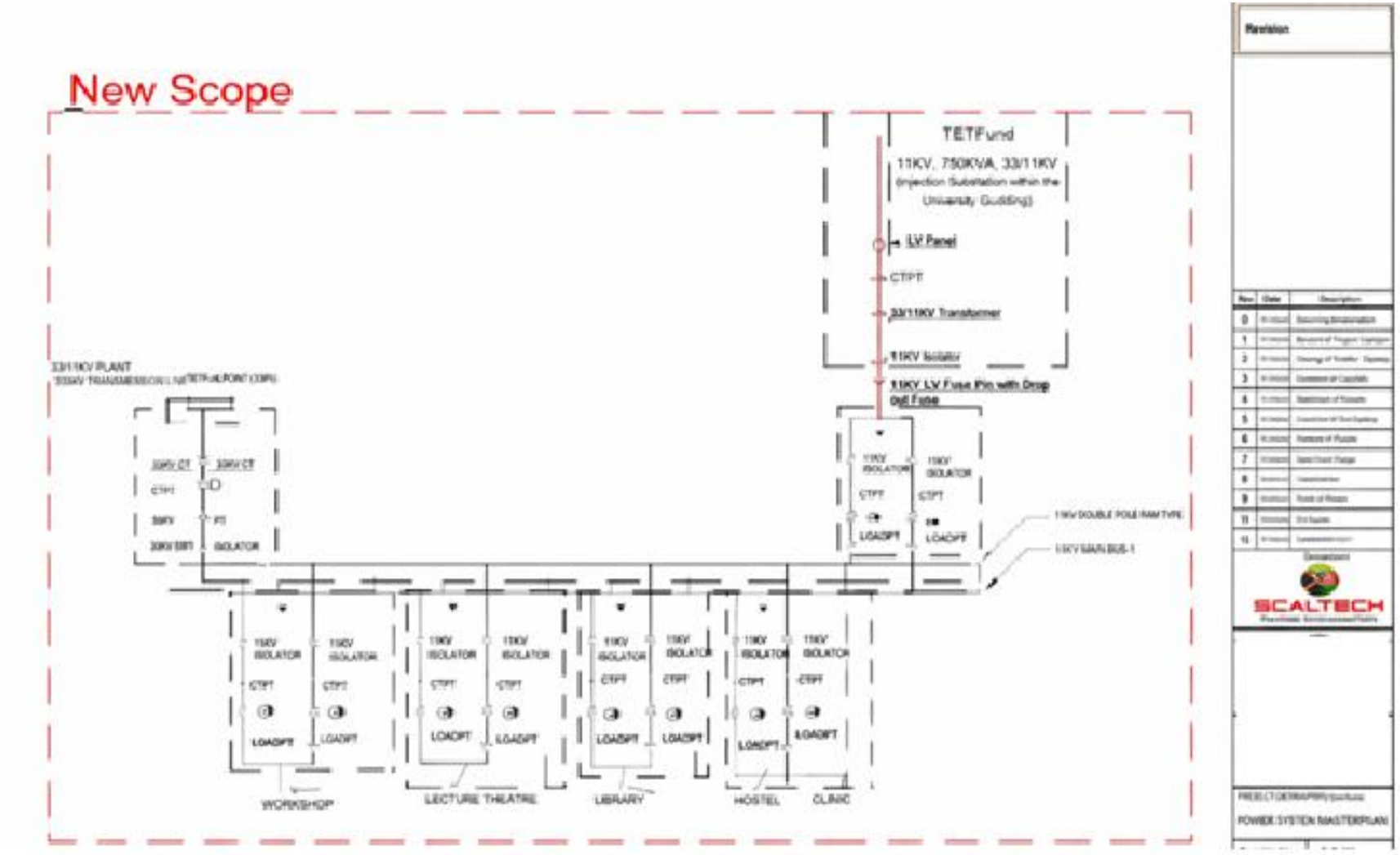


Figure 3. 9: Power Station Single Line Diagram
(Source: EEP3 FEED)



*F*igure 3. 10: Proposed Adeyemi Federal University of Education, Ondo Town 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.

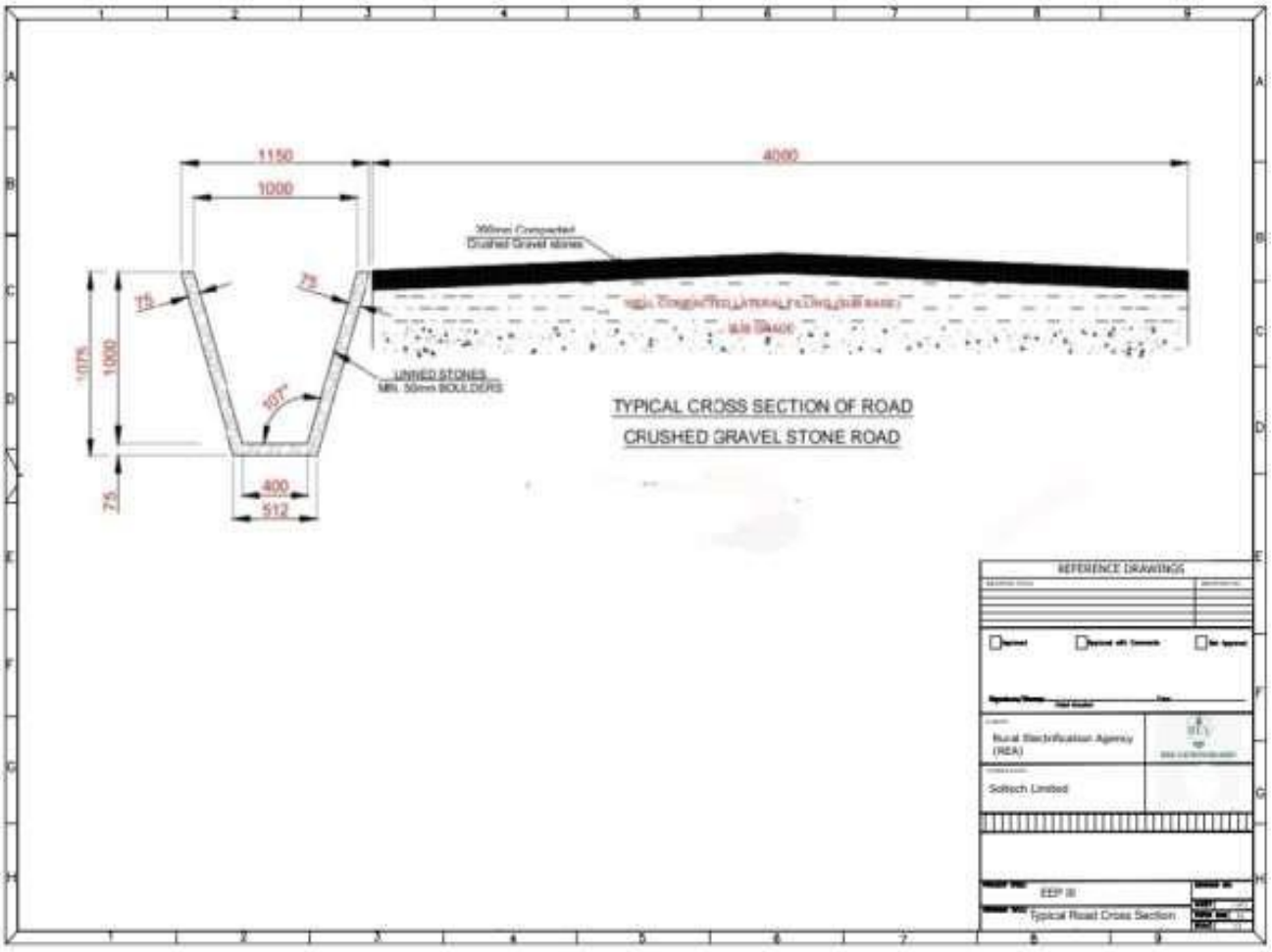


Figure 3. 11: Typical Road Cross Section
(Source: REA NEP 3 FEED)

Component 4: Buildings

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)

Component 5: Transmission Line

The power generated from the proposed solar power plant would be evacuated through an 11-kV transmission line to the university load center through underground cable. The path for the underground cable will be beside the existing road. The length of distribution network for AFUED Ondo town is 3km. Figure 3.13 is the Distribution Network Layout for AFUED, while Figure 3.14 is the harmonization of AFUED's Existing/Proposed Distribution Network in a Single Line Diagram.

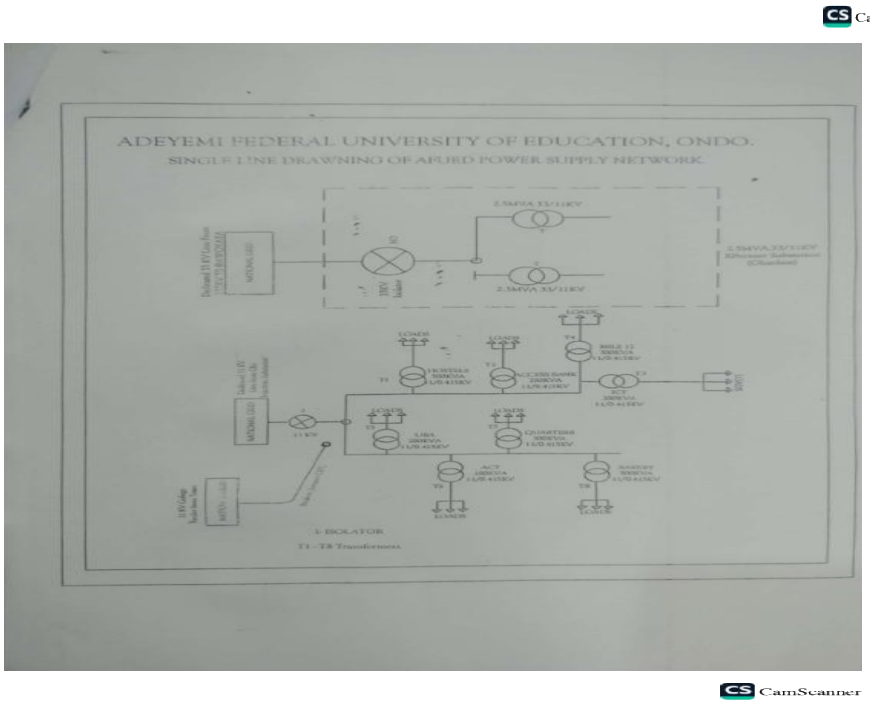


Figure 3. 13: Adeyemi Federal University of Education Ondo Town 11kv Distribution Network Layout

3.3 Operation and Maintenance (O & M)

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 Pre-Construction

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 and connect the panels;
- Erect weather station;
- Commission the panels/transmission lines; and
- Carry out land reinstatement, remove temporary compounds and clear the site.

Construction activities will usually be restricted to day time i.e, between 8am to 5pm; 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 Commissiong 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. 10: 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 armored 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, as well 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 components of the Project	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.

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

Table 3. 11: Personnel Requirements

Personnel Requirement	Estimated Number
PRE-CONSTRUCTION STAGE	
Manual Workers	10
Skilled Labor/ Professionals/ Managers	5
Security	3
Total	18
CONSTRUCTION STAGE	
Manual Workers	20
Skilled Labor/ Professionals/ Managers	10
Security	4
Total	34
OPERATIONS STAGE	
Cleaners	10
Security	4
Heavy maintenance	10
Light electrical maintenance	5
Infrastructure maintenance	5
Parts and Inventory management	4
Total	38
DECOMMISSION STAGE	
Manual Workers	30
Skilled Labor/ Professionals/ Managers	15
Security	5
Total	50

(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. 12: Solar PV Project Interfaces

S/n	Element	Organisation	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	• Mounting or Tracking system supplier • Civil contractor • Module supplier • Electrical contractor	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)

3.6 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. However, figure 3.16 shows a typical EPC construction phase and the handover protocol.

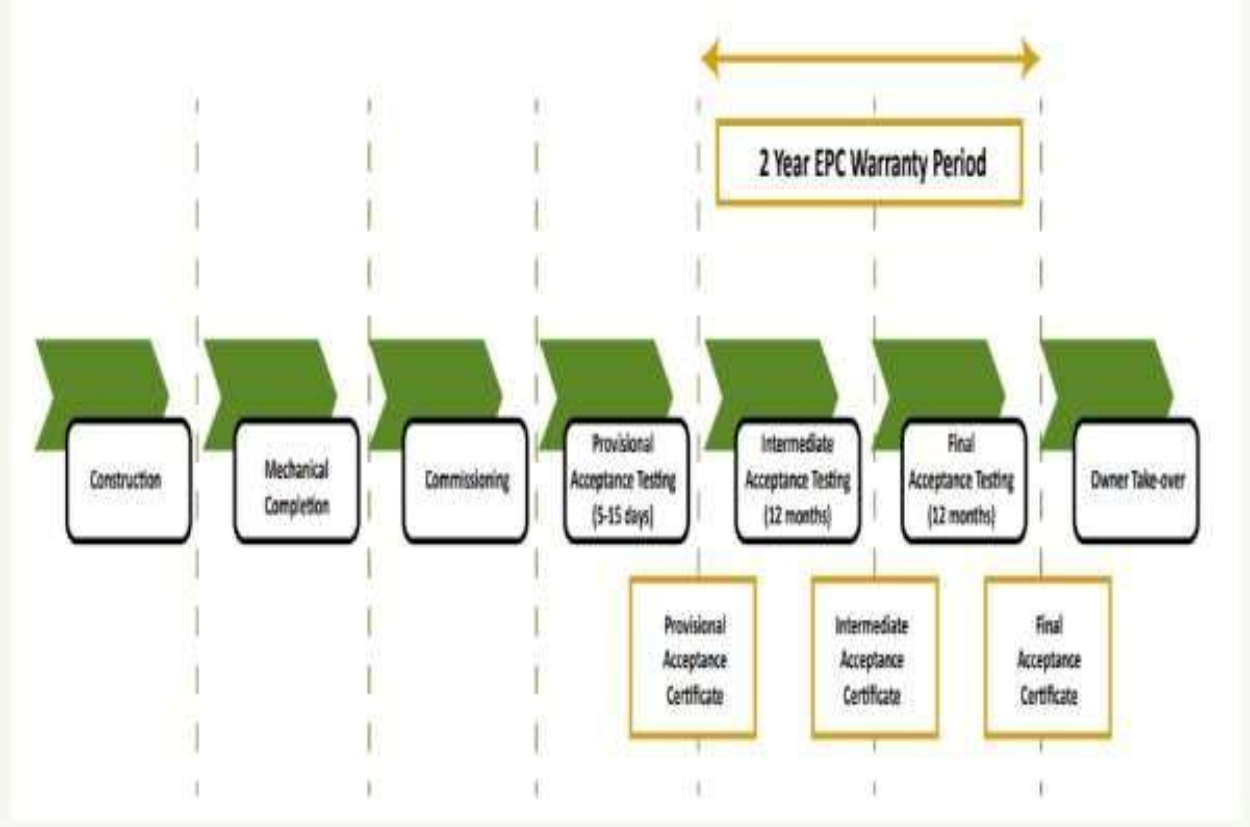


Figure 3. 16: Typical EPC Construction Phase and Handover Protocol

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

CHAPTER FOUR

Description of The Environment

The chapter presents the extensive description of the existing environmental and social baseline conditions of the proposed project environment. The understanding of the current condition of the ambient environment provides the right platform for the assessment of the future environmental and social footprints of the proposed beyond 1MW solar mini power project on the ambient environment. In order words, the assessment of the current environmental condition will provide the frame of reference for the determination of the future impact of the proposed project activities on the environment.

Thus, in line with global best practice and furtherance to the fulfilment of the AfDB ISS including the provisions of the FMEnv, the Environmental and Social Impact Assessment (ESIA) study was implemented for the proposed beyond 1MW hybrid solar project activities to be located within the 10.58 acres of land within its Campus (along the popular Ondo-Laje Road) of the prestigious University-Adeyemi Federal University of Education, Ondo in the Ondo West Local Government Area of Ondo State, Nigeria. The ESIA study encompasses the assessment of the baseline environmental and social parameters which such as; climate and meteorology, air quality and noise, geology/geotechnical, soil, biodiversity (flora and fauna), land use of the project environment, groundwater (hydrobiology), socio-economic and health impact, that could be affected by the proposed project activities and phases (pre-construction, construction, operation and decommissioning).

4.1 Methodology of the 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 (24th to 25th of April, 2026) while the wet season field result conducted in June 2021 for the Special Agro-Industrial Processing Zone-SAPZ in Ondo 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.

Suffice it to mention that there is a high correlation between various environmental parameters such as air quality, noise, meteorological as well as concentrations of pollutants in soil and water samples.

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.

4.1.1 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.

4.2 Project Location

Recognizing its status as a federal government higher education institution furtherance to its upgrade by the federal government during the administration of former President Goodluck Jonathan to a full-fledged university of education in May 2015. This feat no doubt remains a significant step in the transformation of the erstwhile Adeyemi College of Education named after Canon M. C. Adeyemi (one of the earliest educationists in Yorubaland in recognition of his immense contribution to educational development in the then Ondo Province.

Since its establishment in 1963, the institution has over the time produced qualified teachers for secondary schools and has metamorphosed into a first-class College of Education in Nigeria and in the West Africa sub-region.

The proposed project site is located at the West-End (along Laje-Ondo Road) of the Adeyemi Federal University of Education, Ondo in the Ondo West Local Government Area (LGA) of Ondo State. The proposed site (with a spatial coverage of 10.58 acres) is an uncultivated vast land with varying flora species. The site however falls within the space earmarked for future power plants by the University (see Appendix 6 for the satellite image of the proposed project location).

Suffice it to mention that the proposed project will significantly improve teaching and learning, research and more importantly huge positive impact on environmental sustainability, reduced noise and emission including reduction in the operational costs of power supply in the University as well as improved security and livelihood amongst strata of stakeholders within the beneficiary University.

The pictures of the proposed project environment and its adjacent locations are shown below.

Plate 4.1: The Proposed Project Site at the Adeyemi Federal University of Education, Ondo

Located in Ondo town in the southwestern part of Nigeria, the town (Ondo) is the second largest town in Ondo state and it is known as the commercial hub under the amiable leadership of the Osemawe. However, since the project area (Adeyemi Federal University of Education is located within the Ondo metropolis which shares similar environmental and social characteristics with the entire State, therefore the description of the project environment would be generalized in line with the feature of Ondo State.

4.2.1 Climate and Meteorology

The field data was obtained through the usage of weather Tracker Kestrel 4500 model for the following components: Temperature, Relative Humidity, Pressure, Wind direction and Speed. Also, secondary data was obtained from Nigerian Meteorological Agency (NiMET), Akure Airport for the meteorological data of the Ondo town.

The proposed project site is within the premises of Adeyemi Federal University of Education, Ondo Town. It is 10.58 acres fallow land with vast vegetation and abandoned land within the institution. However, meteorological data such as temperature, Relative Humidity *R.H), wind speed and direction etc were taken at selected locations within and around while the Control

Sample (Ctrl) was also collected by the main gate of Mother and Child Hospital (Laje-Ondo Road) with a distance of above 2.5km (see appendix 4 for air quality and meteorological map).

4.2.2 Terrestrial Vegetation

Vegetation distribution and land use observations were made and geo-referenced at intervals. Species composition, density and habitat conditions were studied in detail using the Quadrat and Belt Transect Methods. Sampling was carried out along transects at each site. All plants within each quadrat were systematically evaluated identified to species level and the number of individuals of each species enumerated. Specimens of plant species that could not be readily identified on the field were collected and pressed in a plant press and taken for proper identification. The lengths of the transects varied depending on the real extent of the vegetation being studied.

The number of strata in the vegetation was noted and the dominant species recorded. The height of the plants was measured with measuring tape and Haga altimeter. Where counting of individuals was not possible in situations where there are creeping plants, cover was measured according to Greig-smith (1983).

Land-use investigation was carried out along four cardinal points with the tracks serving as the baseline. The major crop species, farming system, habitat and non-farming activities along each of the cardinal points were documented. Plants that were of economic importance were identified and counted.

4.2.3 Water Quality Assessment

Three (3) ground water samples consisting of a hand dug well (GW1) (at the University's Cassava processing centre and a borehole (BH1) within the staff quarters (Rotimi Close) as well as another hand dug well (opposite Mother & Child Hospital-Laje Road) Control sample (GW_2Ctrl). The in-situ parameters of the water samples were determined using HORIBA Water Quality Checker. These parameters are water temperature, pH, Electrical Conductivity (EC), turbidity, Dissolved Oxygen (DO), salinity and Total Dissolved Solid (TDS). The geographical co-ordinates and the physico-chemical parameters of the groundwater samples (BH_1, GW_1 and GW_2Ctrl) are as shown in Table 4.1. The temperature observed for the ground water sources were 29.0^{o}C and 29.5^{o}C and 27.7 ^{0}C for the water samples BH_1, GW_1 and GW_2Ctrl respectively while the pH levels were 6.31 (BH_1) and 6.60 (GW_1) and 6.48 GW_2 (Ctrl), this shows that the groundwater at were mildly acidic.

The Electrical Conductivity (EC) levels of the samples were 78.0µS/cm (BH_1), 60.0µS/cm for BH_2 and 74.5µS/cm (GW_2Ctrl). These levels were all below the 1000 µS/cm recommended threshold for portable water by the Standard Organization of Nigeria (SON).
Generally, the levels observed are indication that the groundwater sources contain low levels of dissolved ions. This is also indicated by the Total Dissolved Solid (TDS) while the Total Suspended Solids (TSS), Turbidity and Total Hydrocarbon Content (THC) were all below the (<0.01) across the monitored Stations. Also, chloride and hardness concentrations at mean levels of 81.0mg/L, 28.0mg/L and 47.0mg/L respectively in the Stations. However, the observed concentrations for TDS and hardness are lower than the recommended thresholds (150mg/L) for portable water by SON as shown in Table 4.1.

Ammonium and Nitrite were below <0.01mg/L across the ground water samples. However, the concentrations of Calcium and Magnesium hardness was equally reflective of the trend observed in the Total Hardness with (Stations BH1, GW1 and GW2 with total hardness concentration range of 7.00mg/L, 24.00mg/L and 9.3mg/L respectively. The measured concentrations of Ammonia were below <0.01 across the monitored ground water samples while the acidity ranged from 4.0mg/L (BH_1), 28.0mg/L (GW_1) and 5.2mg/L (GW_2) respectively. The concentrations of anionic nutrients in the water samples also show the concentration of Sulphates were 0.40 L^{-1}, 0.016mgL^{-1} and mgL-1 at Stations BH_1, GW_1 and GW_2Ctrl while Nitrate was below the detectable limit in all the samples.

Also, the measured concentrations of Fe, Cu, Pb, Cd, and Cr were all below detection limit (BDL) of <0.001 mg/L across the monitored stations.

Table 4.1: Results of Physico-Chemical Parameters of the Water Samples

Parameters	BH_1	Well$_1$ (GW_1)	Well (GW_2Ctrl)	**NESREA Limit**
Appearance	Colourless and Clear	Colourless and Clear	Colourless and Clear	-
Temperature (^{0}C)	29.0	29.5	27.7	Ambient
Conductivity (µS/cm)	78.0	60.0	74.5	1000
TDS	39.8	32.6	36.2	-
Turbidity (NTU)	<0.1	<0.1	<0.1	-
TSS (mg/L)	<0.1	<0.1	<0.1	-
THC mg/L	<0.1	<0.1	<0.1	-
pH	6.31	6.60	6.48	7.0 - 8.5
COD (mg/L)	8.32	8.15	8.22	-
DO (mg/L)	6.10	6.40	5.98	-
BOD_5 (mg/L)	0.40	0.50	0.47	-
Salinity as Cl (mg/L)	7.69	6.75	6.43	-
Oil and Grease(mg/L)	<0.01	<0.01	<0.01	-
Nitrate (mg/L)	0.025	0.016	0.029	45
Sulphate (mg/L)	0.40	0.01	0.51	-
CO_3^2 (mg/L)	<0.05	<0.05	<0.05	-
Total Hardness (mg/L)	7.00	24.00	9.3	100
Ammonia (mg/L)	<0.01	<0.01	<0.01	-
Nitrite (mg/L)	<0.01	<0.01	<0.01	0.5
Acidity (mg/L)	4.0	28.00	5.2	-
Alkalinity (mg/L)	11.00	BDL	13.2	-
Potassium	0.11	0.063	0.09	-
Magnesium	0.152	0.098	0.141	30
Manganese	0.076	0.054	0.086	-
Sodium	0.298	0.315	0.272	-
Nitrogen	<0.01	<0.01	<0.01	-
Coliform Count (mpn/100ml)	15	18	15	10
THB (cfu/ml X 10^4)	3.00	3.50	3.00	0
THF (cfu/ml X 10^3)	1.50	1.00	1.3	0
HUB (cfu/ml X 10^3)	Nil	Nil	Nil	0

HUF (cfu/ml X 102)	0.50	Nil	Nil	0
Iron	BDL	BDL	BDL	0.1
Copper	BDL	BDL	BDL	0.05
Lead	BDL	BDL	BDL	-
Cadmium	BDL	BDL	BDL	-
Zinc	BDL	BDL	BDL	5.0
Chromium	BDL	BDL	BDL	0
Manganese	BDL	BDL	BDL	0.05
Location of Sampled Station	Rotimi Close, Residential Quarters	Gari Processing Factory	Opposite Mother & Child Hospital Gate, Laje-Ondo Road	
Northings Eastings	N7.07924 E4.8192908	N7.076274 E4.816668	N7.073812, N4.815485	

(Source: ESIA Field Survey, 2026)

4.3 Biological Environment

4.3.1 Survey of Wildlife

Data were collected from existing tracks and footpaths in each sample area which were geo-referenced with a hand-held Global Positioning System (GPS). Direct and indirect methods were used to ascertain the presence of animal species in the area.

Direct Observation: - Actual sighting of the animal species involving: spot identification, behavioral features and indices of various species were done during the survey. **Indirect Observation**: - This involved sighting of signs (e.g. footprints, spoors and calls) left by an animal and information received from the farmers and local hunters living within the sampled area. Other Indirect signs used to estimate animal abundance include: faecal pellets and dung piles. Each time an animal or group of animals is encountered, the following information were recorded according to Gaston *et al*. (2000):

- Species type
- Number of animals counted
- Mode of detection (whether sight, vocalization or sound produced by an animal moving through the vegetation)
- Time sighted
- Observer's location
- Animal - Observer distance
- Animal activity when first detected

Information gathered from indirect observations which involved sighting of signs such as footprints and spoors, faecal pellets and dung piles left by an animal was also used in the determination of the faunistic composition. This was also augmented by information on the wildlife received from the farmers and local hunters living within the sampled area were also

used in the determination of the faunistic composition of the project area. Other indirect observations used to estimate animal abundance include: faecal pellets and dung piles.

4.3.2 Quality Assurance (AQ) and Quality Control (QC)

Measures in Field Survey

Quality Assurance/ Quality Control (QA/QC) procedures covered all aspects of the study, including sample collection, handling, laboratory analyses, data coding and manipulation, statistical analyses, presentation and communication of results. The methods of analyses used in this study were those specified in Federal Ministry of Environment Guidelines and other internationally accepted analytical procedures, in order to ensure the reliability and integrity of the data obtained.

Sample Collection and Handling

Sample collection and handling procedures to maintain the integrity of samples and enhance the quality of the results, were in accordance with Federal Ministry of Environment. Following procurement, all samples were immediately labelled indelibly, giving details of sampling point, location of sampling, date and time of sampling, name of personnel sampling, etc. To reduce sampling error, measurements were replicated and a number of spatially distributed samples were composited before sub sampling for analysis. The sample collection and handling procedures are summarized as follow:

- Standard field procedures and methods approved FMEnv were adopted.
- All sampling equipment was maintained in excellent condition, calibrated against international standards and adequate steps were taken to ensure that they function normally.
- Only new and thoroughly washed, rinsed and sterilized sampling containers were used.
- For heavy metal determination, sampling bottles were used and were rinsed with a solution of one-part nitric acid to four parts water, followed by copious amounts of distilled water. Water samples for BOD5 determination were collected in black oxygen bottles and kept away from light source.
- All parameters without holding time were measured *in situ* on the field.
- Samples for other parameters were preserved as soon as they were collected. Dissolved oxygen samples were fixed with Winkler's Reagents; while heavy metal samples were acidified to a pH of about 2 with concentrated H_2SO_4 respectively.
- All samples were adequately labelled to preserve their identity. Label included sample reference code number, source, sampling date, etc.
- All samples were safely packed and transported to the laboratory base

Sample contamination and deterioration were avoided by pre-sterilising sampling tools and containers, pre-treating and preserving samples in transit in ice-cooled chest (<4^{o}C) to the laboratory and storing samples at that temperature in refrigerators pending subsequent analysis especially for attributes having short-holding time such as total hydrocarbon, heavy metals and microbiology.

4.3.3 Sample Preservation

Sample contamination and deterioration were avoided by pre-sterilizing sampling tools and containers, pre-treating and preserving samples in transit in ice-cooled chests to the laboratory and stored at that temperature in refrigerators pending subsequent analysis. All parameters with short holding time such as pH and temperature were measured *in situ* on the field, while samples for delayed analyses were preserved by refrigeration (for general water chemistry), pH adjustment or chemical pre-treatment (for heavy metals, Total Hydrocarbon, Dissolved oxygen). Dissolved oxygen samples were acidified to a pH 2 with concentrated H_2SO_4 and NHO_3 respectively and samples for microbiology were stored immediately in ice-cooled chest (at 4^0C) in transit to the laboratory base where they were stored in refrigerators.

4.4 Description of Bio-Physical Environment of the Project Area

4.4.1 Climate and Meteorology

The following sub-sections draw, where relevant, on data for Ondo 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 the region within the tropics, the temperature in the study area is generally high with mean monthly minimum and maximum ranges of 22^0C and 34^0C, respectively and an annual mean of 32^0C. Usually, the highest maximum 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.

However, the sampling of the air quality, noise and meteorology parameters were taken at twenty (20) pre-established locations consisting of 19 experimental and one (1) control point. The sampling locations (AQ_1 to AQ_{19}) were determined based on the sensitivities and were grided using geo-spatial technology (Global Positioning System-GPS) within the proposed project site while station (AQ20ctrl) was by the main gate of the "Mother & Child Hospital), along the popular Ondo-Aje Road (a distance of about 2.5 kilometeres).

4.4.1.1 Climate and Meteorology

The mean monthly relative humidity of the project area occurs with the highest values in July (92%) and August (92%) and lowest values recorded in December (76%), January (68%) and March (78%). 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 Ondo town between 2015 and 2024 is presented below.

Table 4.2: Average Weather Trends for Ondo (2015 – 2024)

S/No.	Month	Average Temp (^{0}C)	Rainfall (mm)	Cloud Cover (Oktas)	Pressure (mbar)	R/H (%)	Wind Speed (m/s)	Wind Direction
1.	January	29.5	19	5	1009	77	2.9	NE
2.	February	30.1	49	6	1008	81	3.4	SW
3.	March	30.1	85	6	1008	84	3.8	SW
4.	April	29.6	137	6	1008	85	3.8	SW
5.	May	29.3	245	6	1009	85	3.6	SW
6.	June	28.2	374	7	1011	87	4.2	SW
7.	July	27.3	237	7	1012	87	4.8	SW
8.	August	27.7	98	7	1012	88	4.8	SW
9.	September	27.2	188	7	1011	89	4.3	SW
10.	October	28.5	165	6	1010	87	3.5	SW
11.	November	29.5	64	6	1009	83	2.8	SW
12.	December	29.6	21	5	1009	78	2.5	NE

Source: NIMET, Akure, Ondo

Also, the measured Relative Humidity (R.H%) across the monitored stations AQ_1 to $AQ_{20(}$ctrl (control) is presented in figure 4.1 below.

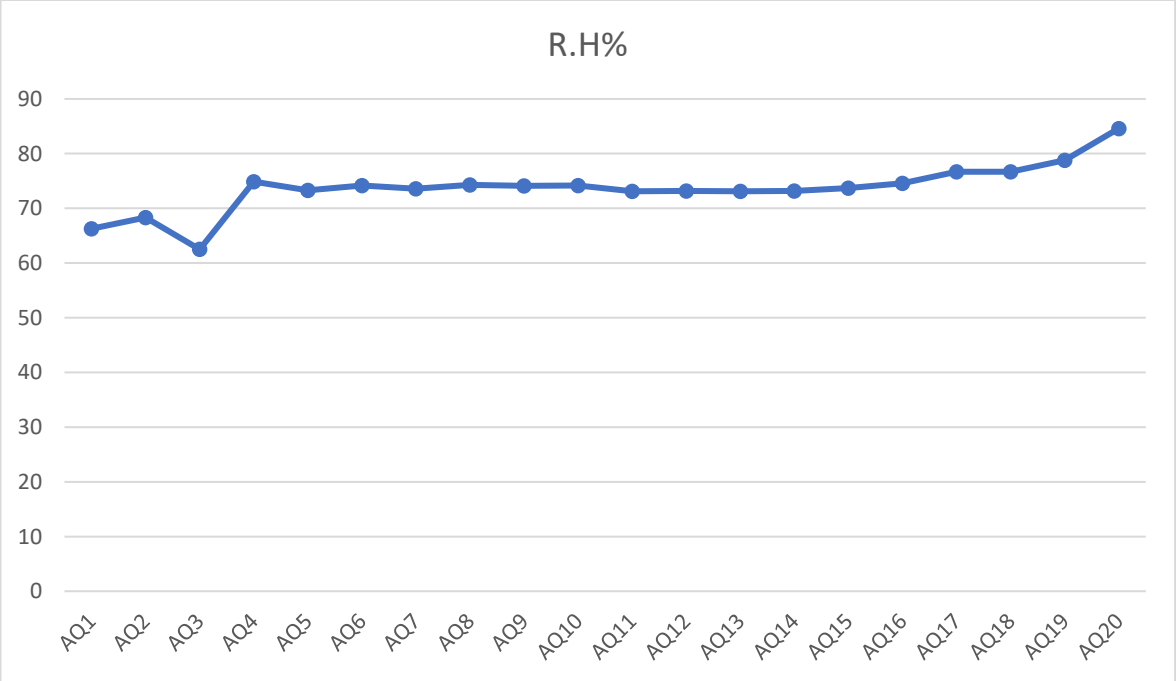


Figure 4.1: Measured Relative Humidity

4.4.1.2 Rainfall

Ondo town has a mean cumulative annual rainfall of 1,320. The wet season lasts about seven (7) to eight (8) months, while the dry season lasts between three (3) to four (4) months. A typical wet day has at least 0.04 inches of liquid or liquid-equivalent precipitation. In Ondo town, the chance of a wet day over the course of July is very rapidly decreasing, starting the month at 75% and ending it at 67%. For reference, the year's highest daily chance of a wet day is 83% on September 11, and its lowest chance is 3% on December 31.

4.4.1.3 Wind speed and Direction

The Study area has a calm weather with wind speed ranging between 0.7 m/s to 6.2 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 (Figure 4.5). 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 while the measured mean wind speed varied from 0.5 to 2.5 m/s.

4.4.1.4 Sunshine

Data obtained from NIMET for Ondo town shows that the mean monthly sunshine period is between 4.8 hours to 7.6 hours per day (Figure 4.6). 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.

4.4.1.5 Cloud Cover

Cloud cover in the Ondo Town area is generally low throughout the year and has very little variation. The mean monthly range is between 6.1 Oktas and 6.9 Oktas, indicating an overcast sky with some blue sky. The minimum cover occurs in December, and the maximum in July.

4.4.1.6 Validity

The mean monthly visibility of the proposed project area ranges from 1.9–12.3 km. While the minimum is in September, the maximum is in January.

However, the measured temperature across the Stations AQ_1 to AQ_{20}ctrl (Control) ranged from 28.30^{0}C ($AQ_{20\ ctrl}$) to 33.3^{0}C 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 Ondo State and south-west Nigeria.

The measured meteorological data during the field work is presented below in Table 4.3.

Table 4.3: Measured Meteorological Variables for the Proposed Solar Mini-Grid Project at Adeyemi Federal University of Education, Ondo

Station Code	Location	Coordinate of Station	Ambient Temp (^{0}C)	R.H (%)	Wind Velocity (m/s)	Wind Direction	EMF (Hz)
AQ_1	Bayo Akinnola Road	E4.818553 N7.076505	32.4	66.3	1.1	SE	0.38
AQ_2	Garri Processing Plant	E4.818549 N7.076289	32.1	68.3	1.3	SW	0.35
AQ_3	Proposed Project Location	E4.816049 N7.076108	30.8	62.5	2.0	SW	0.37
AQ_4	Proposed Project Location	E4.815575 N7.076142	30.9	74.9	1.2	SE	0.36
AQ_5	Proposed Project Location	E4.819290 N7.075705	33.3	73.3	1.4	SW	0.40
AQ_6	Proposed Project Location	E4.815567 N7.076142	33.2	74.2	2.1	SE	0.39
AQ_7	Near Borehole Rotimi Close (Residential Quarters)	E4.819290 N7.07924	31.3	73.6	1.3	SE	0.38
AQ_8	Proposed Project Location	4.816049 N7.076108	30.6	74.3	1.6	SW	0.38
AQ_9	Proposed Project Location	E4.8160452 N7.076101	31.1	74.1	2.1	SW	0.32
AQ_{10}	Proposed Project Location	E4.816049 N7.076112	31.4	74.2	2.3	SW	0.38
AQ_{11}	Proposed Project Location	E4.818540 N7.076261	31.1	73.1	1.8	SE	0.37
AQ_{12}	Proposed Project Location	E4.815545 N7.076142	31.2	73.3	1.6	SE	0.39
AQ_{13}	Proposed Project Location	E4.815581N 7.076141	31.1	73.1	1.5	SE	0.40
AQ_{14}	Proposed Project Location	E4.815564 N7.076140	30.4	73.2	2.2	SE	0.38
AQ_{15}	Proposed Project Location	E4.819291 N7.075702	31.1	73.7	2.0	SW	0.43
AQ_{16}	Proposed Project Location	E4.819275 N7.075791	30.2	74.1	2.1	SW	0.38
AQ_{17}	Proposed Project Location	E4.819278 N7.075702	29.9	74.6	1.7	SE	0.37
AQ_{18}	Proposed Project Location	E4.819294 N7.075702	29.6	76.7	1.9	SE	0.38
AQ_{19}	Opposite Mother and Child Hospital)	E4.815933 N7.076763	31.1	78.8	1.4	SE	0.37
$AQ_{20\ Ctrl}$	Mother & Child Hospital (Laje-Ondo Road) Gate	E4.815485 N7.073812	28.3	84.6	1.8	NE	0.43

4.4.1.7 Electric and Magnetic Force (EMF)

Electromagnetic field (EMF) are invisible areas of energy, often referred to as radiation that are associated with use of electrical power and various forms of natural and manmade sources. EMF are invisible energy created through the flow of electricity. It exists across a

broad spectrum ranging from low frequency fields to high frequency radiation. Conventionally, the solar power systems only produce low frequency non ionizing EMF, which is fundamentally different from harmful ionizing radiation. It is important to mention that measurable EMF usually comes from other electrical components rather than the solar panels themselves. Thus, the proposed project has the potential to increase the EMF of the proposed project area due to the gamut of electrical cables and systems that would be used. However, such EMF emission is anticipated to be low due to improvements in modern solar systems which have been designed in strict compliance to electrical and safety regulations. With a measured EMF range of 0.36hz to 0.43hz across the monitored locations. The EMF emissions are of no significance to human health.

4.5 Air Quality Assessment

The assessment of the air quality parameters were carried out in line with the global best practice. However, 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. However Volatile Organic Compound (VOC) was detected across the monitored station with a measured range of 0.7ppm to 1.ppm. The detection of the VOC can be attributed to the burning of fossil fuel due to transportation activities and operation of power generating sets which uses petroleum products.

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 (%)	PM10	M2.5	SPM
AQ_1	Bayo Akinnola Road	E4.818553 N7.076505	0.0	400	0.0	0.0	0.0	0.0	0.0	1.1	20.9	12.6	5.0	33.0
AQ_2	Garri Processing Plant	E4.818549 N7.076289	0.0	500	0.0	0.0	0.0	0.0	0.0	0.9	20.9	23.5	9.4	53.0
AQ_3	Proposed Project Location	E4.816049 N7.076108	0.0	500	0.0	0.0	0.0	0.0	0.0	1.0	20.9	23.8	10.3	65.0
AQ_4	Proposed Project Location	E4.815575 N7.076142	0.0	500	0.0	0.0	0.0	0.0	0.0	0.8	20.9	23.4	9.4	24.0
AQ_5	Proposed Project Location	E4.819290 N7.075705	0.0	500	0.0	0.0	0.0	0.0	0.0	0.8	20.9	8.4	3.4	34.0
AQ_6	Proposed Project Location	E4.815567 N7.076142	0.0	600	0.0	0.0	0.0	0.0	0.0	1.1	20.9	15.6	8.2	15.0
AQ_7	Near Borehole Rotimi Close (Residential Quarters)	E4.819290 N7.07924	0.0	500	0.0	0.0	0.0	0.0	0.0	0.9	20.9	23.5	9.5	53.1
AQ_8	Proposed Project Location	E4.816049 N7.076108	0.0	500	0.0	0.0	0.0	0.0	0.0	1.0	20.9	23.8	10.3	65.0
AQ_9	Proposed Project Location	E4.8160452 N7.076101	0.0	500	0.0	0.0	0.0	0.0	0.0	1.0	20.9	23.8	10.3	65.0
AQ_{10}	Proposed Project Location	E4.816049 N7.076112	0.0	500	0.0	0.0	0.0	0.0	0.0	1.0	20.9	23.8	10.3	65.0
AQ_{11}	Proposed Project Location	E4.818540 N7.076261	0.0	500	0.0	0.0	0.0	0.0	0.0	0.8	20.9	23.8	10.3	65.0
AQ_{12}	Proposed Project Location	E4.815545 N7.076142	0.0	500	0.0	0.0	0.0	0.0	0.0	1.0	20.9	18.3	6.8	65.0
AQ_{13}	Proposed Project Location	E4.815581 N7.076141	0.0	500	0.0	0.0	0.0	0.0	0.0	1.1	20.9	12.8	3.9	65.0
AQ_{14}	Proposed Project Location	E4.815564 N7.076140	0.0	500	0.0	0.0	0.0	0.0	0.0	0.7	20.9	22.1	3.2	65.0
AQ_{15}	Proposed Project Location	E4.819291 N7.075702	0.0	500	0.0	0.0	0.0	0.0	0.0	0.9	20.9	15.1	2.8	65.0
AQ_{16}	Proposed Project Location	E4.819275 N7.075791	0.0	400	0.0	0.0	0.0	0.0	0.0	1.0	20.9	13.1	4.3	33.0
AQ_{17}	Proposed Project Location	E4.819278 N7.075702	0.0	400	0.0	0.0	0.0	0.0	0.0	1.1	20.9	8.2	3.2	33.0

AQ_{18}	Proposed Project Location	E4.819294 N7.075702	0.0	400	0.0	0.0	0.0	0.0	0.0	1.1	20.9	11.6	6.2	33.0
AQ_{19}	Opposite Mother and Child Hospital)	E4.815933 N7.076763	0.0	400	0.0	0.0	0.0	0.0	0.0	0.8	20.9	9.5	4.1	34.0
$AQ_{20\ Ctrl}$	Mother & Child Hospital (Laje-Ondo Road) Gate	E4.815485 N7.073812	0.0	600	0.0	0.0	0.0	0.0	0.0	1.1	20.9	13.1	6.1	15.0
Regulatory Limit (NESREA)			0.01	-	0.20, 0.14	0.18, 0.13	0.28	0.07	-	-	-	-	-	-

Also, the results of similar air quality assessment conducted or the Ondo SAPZ (2021) also shows similarities in the measured air quality parameters as pollutants like Nitrogen dioxide (NO_2), Sulphur dioxide (SO_2), Hydrogen sulphide (H_2S), Carbon monoxide (CO), and Lower Explosive Limit (LEL) were not detected at the various sampled locations.

Plate 4.2: Air Quality Sampling Activities During of the ESIA Study

(Source: Ecobinder Services Limited, 2026)

4.5.1 Ambient Noise Level

The measured noise levels (Table 4.4) varied from 45.9 to 78.7dB (A) in the period of survey. The main sources of sound in the study area are vehicular traffic and other anthropogenic activities such as trading, social activities. The results indicate the noise levels in the study area were below the maximum Allowable limit (Hourly 85 dBA) limit of FMEnv.

Table 4. 4: Noise Level of the Study Area

Sampling Station	Noise Level (dBA)
AQ1	45.9
AQ2	78.7
AQ3	46.5
AQ4	55.0
AQ5	66.1
AQ6	76.6
AQ7	78.7
AQ8	66.5
AQ9	68.3
AQ10	63.3
AQ11	65.1
AQ12	60.3
AQ13	60.1
AQ14	65.1
AQ15	75.7
AQ16	73.2
AQ17	75.9
AQ18	72.1
AQ19	76.6
AQ20Ctrl	78.7

(Source: Ecobinder Services Limited Field Work, 2026)

4.6 Geology and Geophysical Investigations

4.6.1 Basement Complex Setting of Ondo Towm, Ondo State

Geology of the Province

Ondo town is situated within the Southwestern Nigerian Basement Complex, which forms part of the extensive Precambrian crystalline shield underlying most of southwestern Nigeria. This basement terrain extends across Ondo State and into neighboring states such as Ekiti, Osun and Oyo.

The basement rocks in Ondo town are predominantly Precambrian to early Paleozoic in age and were formed through multiple tectono-metamorphic episodes, particularly during the Pan-African Orogeny (~600 Ma).

The dominant lithological units include:

- Migmatite-Gneiss Complex (dominant unit)
    - Banded gneiss
    - Granite-gneiss
    - Migmatites (partially melted metamorphic rocks)
- Metasedimentary Rocks
    - Quartzite
    - Mica schist
    - Biotite schist
    - Amphibolite (locally)
- Pan-African Granitoids
    - Older granites
    - Pegmatites
    - Syenite intrusions (localized)

These crystalline rocks are highly deformed and structurally complex due to multiple tectonic events. Structural features observed or inferred within the Ondo basement terrain include:

- Foliation and banding
- Folding
- Faulting
- Jointing
- Fracturing

These structural discontinuities significantly influence surface morphology and groundwater behaviour.

Topographic Expression

The structural and lithological heterogeneity of the basement rocks contributes to the undulating to gently hilly terrain characteristic of Ondo town. Differential weathering of gneiss, schist, and granitoids produces:

- Low ridges and inselbergs

- Shallow valleys
- Gentle slopes with seasonal drainage channels

Overall, Ondo town's subsurface foundation is typical of the Southwestern Nigerian Basement Complex — predominantly hard, crystalline igneous and metamorphic rocks with limited primary porosity but significant structural controls on groundwater occurrence and terrain evolution.

4.6.2 Local Geology and Hydrogeology – Ondo Town

Groundwater Occurrence in Basement Terrains

In crystalline basement terrains such as Ondo town, groundwater does not occur in primary pore spaces as seen in sedimentary basins. Instead, groundwater is hosted in secondary structures and weathered zones.

The principal groundwater-bearing zones include:

1. Weathered Overburden (Regolith/Saprolite Zone)

- Formed through prolonged tropical chemical weathering.
- Consists of clayey to sandy decomposed rock materials.
- Thickness in Ondo town typically ranges from moderate to relatively thick in valley areas.
- Acts as a shallow unconfined aquifer where sufficiently saturated.

2. Fractured Bedrock Zone

- Underlying partially weathered or fresh bedrock.
- Contains joints, fractures, and faults.
- These discontinuities serve as conduits and storage zones for groundwater at depth.
- More productive where fracture networks are interconnected.

Water Table Characteristics

- The water table in Ondo town is generally shallow to moderate, depending on:
    - Local topography
    - Thickness of weathered overburden
    - Seasonal rainfall recharge
- The water table typically mirrors surface relief:
    - Higher beneath uplands
    - Lower within valleys and drainage depressions

Recharge is predominantly through:

- Direct rainfall infiltration (Ondo experiences high annual rainfall typical of southwestern Nigeria's humid tropical climate).
- Percolation through soil and regolith.
- Lateral subsurface flow toward streams and springs where fractures intersect the surface.

Porosity and Permeability

Primary Rock Characteristics

The intact crystalline basement rocks (gneiss, schist, granite) exhibit:

- Very low primary porosity
- Very low primary permeability

Thus, fresh unfractured bedrock is generally non-water-bearing.

Secondary Structural Features

Groundwater occurrence is controlled almost entirely by:

- Thickness of weathered regolith
- Density and connectivity of fracture systems
- Degree of weathering

Permeability is therefore highly variable and localized.

Aquifer Type and Water Supply Characteristics

The hydrogeological setting of Ondo town is classically described as a:

Basement Aquifer System

This system is generally:

- Unconfined to semi-confined
- Hosted in weathered and fractured crystalline rocks

Borehole Yields

Groundwater yield in Ondo town depends strongly on:

- Thickness of the weathered zone
- Degree of fracturing in underlying bedrock
- Structural intersections (e.g., fault zones)
- Annual rainfall recharge

Productive boreholes typically:

- Penetrate thick weathered profiles (saprolite zones), or
- Intersect well-developed fracture networks at depth.

Yields are generally moderate but can be variable due to the heterogeneous nature of basement aquifers.

Summary

Ondo town is underlain by Precambrian crystalline basement rocks of the Southwestern Nigerian Basement Complex, dominated by migmatite-gneiss and granitoids. These rocks possess minimal primary porosity; hence groundwater occurrence is structurally controlled and restricted to weathered regolith and fractured bedrock zones. The aquifer system is predominantly unconfined, with recharge mainly from rainfall infiltration. This geological

and hydrogeological setting is typical of basement terrains in southwestern Nigeria and has significant implications for borehole siting, groundwater development, construction, and environmental assessment studies.

4.7 Soil Physico-Chemical Characteristics

Soil samples were collected at three (3) different stations consisting of two (2) experimental (within the proposed project site) and one (1) control (Opposite Mother & Child Hospital-Laje-Ondo Road) and thus six (6) soil samples were collected and analyzed. 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.

The soil type of the proposed project site is made up of averagely 79.7 ± 5.7 % sand; 5.8 ± 1.9% silt; and 14.5 ± 6.8 % clay as shown on Table 4.5. The ecological characteristics is indicated by the organic carbon richness of the soil with a mean of 1.26 ± 0.14 %. High sand content of soil allows percolation of water through the soil surface due to the relatively high porosity of sandy soil. The pH values of the soil samples on the project site were within acidic range with a mean value of 5.90 ± 0.49. This is typical of soil in southwestern Nigeria. The electrical conductivity of the samples ranged from 100 – 139µS/cm. The total organic carbon which indicates the level of organic matter component of the soil ranged from 0.10 – 1.37 % with a mean of 0.59 ± 0.49. The relative low level of the organic matter in the samples is not uncommon in sandy soils which tend to have low organic matter component. Studies previously carried out by Udo (1986) show that the organic matter content of these soils could be classified as low for the samples.

The availability of plant nutrient species, such as phosphorus and nitrogen, is an indication of the soil's productivity. These nutrients species are usually incorporated in organic matter and released into the soil by the decay process. Atmospheric depositions can also be sources of nutrient enrichment in soil (Abayomi et. al., 2011; Olayinka et al, 2016). Nutrients can also be exchanged in the soil via anion exchange and retained where the soil has a net positive surface charge through surface charge attraction. The mean concentrations of total nitrate (NO_3^-) and sulphate (SO_4^{2-}) concentrations in the soil were 0.114 ± 0029 mg/kg and 6.138 ± 1.740 mg/kg respectively.

Generally, there was a low variability in the values of the physico-chemical parameters determined among the sampled points, as shown by the low standard deviation, except for the Nitrate and Sulphate levels which varied widely.

Detail results of findings from each sampling point is presented in Table 4.5 below.

Table 4.5: Results of Physico-Chemical Analyses of the Soil Samples

Parameter	SS1 (Top)	SS1 (Bottom)	SS2 (Top)	SS2 (Bottom)	SS3Ctrl (Top)	SS3 Ctrl (Bottom)	Mean	Std. Dev.	NESREA Limit
% Sand	78.0	71.5	80.1	89.3	79.2	79.9	79.7	5.7	-
% Silt	3.8	4.2	8.9	6.4	4.8	6.9	5.8	1.9	-
% Clay	18.2	24.3	11.0	4.3	16.0	13.2	14.5	6.8	-
Texture	Sandy Loam	Sandy Loam	Sandy Loam	Sandy	Sandy Loam	Sandy Loam	-	-	-
pH	6.50	6.60	6.60	5.80	6.40	5.90	6.30	0.36	NS
Electrical Conductivity (µS/cm)	118	116	132	100	128	139	122	14	NS
Temperature (°C)	24.00	24.00	24.00	24.20	24.00	24.00	24.03	0.08	NS
TOC (%)	0.10	0.18	0.37	1.37	0.96	0.59	0.59	0.49	NS
O & G (ppm)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	NS
NH_4+ N (mg/kg)	0.981	0.859	0.963	0.916	0.933	0.952	0.934	0.043	NS
NO_3- (mg/kg)	0.152	0.104	0.117	0.068	0.104	0.139	0.114	0.029	NS
SO_4- (mg/kg)	4.260	4.664	7.395	5.068	8.644	6.799	6.138	1.740	NS
Available Phosphorus (mg/l)	1.101	1.563	0.451	0.766	0.850	1.059	0.965	0.375	NS
Total Nitrogen (%)	0.039	0.052	0.046	0.065	0.030	0.049	0.047	0.012	NS
Chloride (mg/kg)	30.41	15.45	10.66	3.88	9.69	12.53	13.77	9.00	NS
Phenol (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	NS
Location of Sampled Station	Proposed Project Site		Proposed Project Site		By Mother & Child Hospital (Laje Road)				-
Eastings Northings	N7.076108 E4.816049		N7.076142 E4.815575		N7.073812 E4.815485				-

*NS: Not Stated

Heavy metals may be present naturally in some soil samples as a result of the original composition of the parent weathered rock which formed the soil, or due to anthropogenic contamination of the soil. The presence of heavy metals at elevated levels, in most cases, is attributed to later.

Also, exposure to heavy metal contamination remains one of the major concerns of environmental pollution due to their debilitating health effects, especially in humans. Heavy metal pollution may occur naturally through releases from metal containing ores or anthropogenically from numerous metals containing products of everyday use to levels higher than the background limits of the metals in the soil and also at levels beyond the threshold limits set by regulatory authorities.

However, when pollution occurs, plant and animals absorb and assimilate these toxic elements, and in most cases bio-accumulate to levels which could impair the proper growth and physiological development of the affected plants and animals within the soil environment. Sources of metal pollution in soil include the discharge of metal containing wastes into the soil environment and pollution from industrial and traffic emissions (Tanee and Albert, 2013; Adesuyi et al., 2015). When present in soil, plant and animals may absorb or ingest these toxic elements which can impair proper growth and physiological development of the affected plants and animals. The soil of the study area was analyzed for the presence of heavy metals to determine their baseline concentration prior to the commencement of the project.

The soil samples obtained were analyzed for lead Iron (Fe), Copper (Cu), Lead (Pb), Zinc (Zn) and Cadmium (Cd) to determine their levels. The results obtained from the three (3) sampling points are as shown in Table 4.6 Mean levels obtained were Cd (0.66 ± 0.30 mg kg^{-1}); Fe (96.4 ± 23.6 mg kg^{-1}); Pb (4.13 ± 1.42 mg kg^{-1}) and Zn (2.01 ± 1.41 mg kg^{-1}). The levels obtained for the heavy metals were lower than the NESREA permissible limit as well as background levels reported by Breault and Grenato (2000). The concentrations were also lower than those reported by Olukanni and Adeoye (2012) and Adesuyi et al. (2015) for soils around the Ondo town. However, the likelihood that these metals could bioaccumulate poses danger to the tissues of plants and animals in contact with the soil, as well as humans in the long run, hence, the need for the executing mitigation plans to reduce or eliminate any enrichment.

Table 4.6: Results of Heavy Metal Analyses of the Soil Samples

Metal	SS_1 (Top)	SS_1 (Bottom)	SS_2 (Top)	SS_2 (Bottom)	SS_3 (Top)	SS_3 (Bottom)	Mean	Std. Dev.	NESREA Limit
Fe (mg/kg)	91.4	85.9	78.2	72.0	122.0	129.1	96.4	23.6	NS
Cu (mg/kg)	1.54	2.22	1.83	1.64	2.80	1.25	1.88	0.55	100
Zn (mg/kg)	1.45	3.47	1.54	4.05	0.68	0.87	2.01	1.41	42
Pb (mg/kg)	4.73	6.27	4.24	1.93	3.67	3.95	4.13	1.42	NS
Cd (mg/kg)	1.06	0.87	0.58	0.68	0.19	0.58	0.66	0.30	3

N.S: Not Stated

However, the pH classification of soil is presented in Table 4.7.

Table 4. 7: 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)

4.7.1 Soil Micro-Organism

The microbiological characteristics of soil within the project area. (TBC) revealed total viable count of $1.09x10^5$ – $3.36x10^5$ cfu/g for both top-soil 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.*

4.8 Biological Environment

4.8.1 Vegetation

For vegetation (flora) study, the whole compound of the University was carefully surveyed and plant were randomly sampled and representative samples were collected and properly identified to the species level; while plant habit, uses and their International Union for Conservation of Nature (IUCN) threat status was determined. The identity of the plant was determined on the field while those that could not be done on the field were taken to the herbarium for nomenclatural determination with the aid of the regional flora (Hutchinson and Dalziel, 1963), use of photographs and monographs.

Ondo state is a state in southwest Nigeria covered predominantly by tropical rain forest and wooded guinea savanna. The soil is agrarian supporting the growth of rice, corn (maize), cassava (manioc), yams, plantains, bananas, cocoa, kola nuts, rubber, palm oil and palm kernels, tobacco, cotton, and timbers. The wild growth and cultivation of medicinal plants are also supported by the soil. However, plants are of great importance in the environment. They help in conserving soil fertility, prevention of erosion, recycling of Oxygen and water. They also provide shade, seeds, fruits, timber, vegetables and medicines for man and his livestock. Herbs, trees, and shrubs dominated the flora. In the studied environments, many of the plants species recorded in the wild such as *Ficus capensis*, *F. polita*, *F. exasperata*, *Elaeis guineensis*,

Morinda lucida, *Albizia lebbeck*, *Anthocleista vogelii*, *Maragaritaria discoides*, *Bridelia micrantha*, *Carica papaya*, *Spondias mombin*, *Blighia sapida*, *Antiaris africana*, *Alstonia boonei*, *Sterculia trigacantha*, *Rauvolfia vomitora*, *Ceiba pentandra*, *Albizia zygia*, *Newbouldia laevis*, *Anthocleista djalonensis* and *Bombax bounopozense* (Durugbo et al., 2012) in Ondo State have been either significantly decimated in number or totally lost due to human habitation, development projects and other anthropogenic drivers. In the same vein wildlife that have been lost to these reasons included elephants, pangolins, vultures, sea turtles, monkeys, chimpanzees and parrots. Nonetheless, within the studied school environments, some representatives of both classes of spermatophytes namely, monocotyledons and dicotyledons were seen covering the landscape, some of which are either exotic or indigenous to West Africa.

A total of 83 of plant species were recorded. The species were found on the site as well as the control locations. The predominant plant species encountered in the study across the studied area are listed in Table 4.8. They are known for their aesthetic, ecological, economic and medicinal purposes. The appearances of the plants were taken as a measure of long-time climatic responses and ranking their leaves as Leptophylls (leaves that are smaller than 25mm^2), Nanophylls (leaves which are between 25 – 225mm^2), Microphylls (leaves whose size varies from 225 – 2,025mm^2), Mesophylls (leaves that are 2,025 – 18,225mm^2 in size), Macrophylls (those that are 18,225 – 164,025 mm^2) and Megaphylls, these have leaves that are larger than 164,025 mm^2. The ranking follows the approach of Daubenmire, 1968. None of the plant species is classified in the threat categories of IUCN (Table 4.8).

The common vegetation species in the study area, their distribution pattern, habits, uses and threat category are presented in the table below;

Table 4.8**:** Identified Plant Species, Their Distribution Pattern, Habits, Uses and Threat Category.

S/N	Species	Common Name	Habit	Uses	IUCN Threat Status
1.	*Abelmoschus esculentus*	Okro	Shrub	Food	Not threatened
2.	*Acalypha crenata*	Cooperleaf	Grass	Medicinal	Not threatened
3.	*Achyranthes aspera*	Chaff-flower	Herb	Medicinal	Not threatened
4.	*Lagenaria siceraria*	Bottle gourd	Twinner	Medicinal	Not threatened
5.	*Ageratum conyzoides*	Billygoat-weed	Herb	Medicinal	Not threatened
6.	*Albizzia ferruginea*	False thorn albizia	Tree	Medicinal	Not threatened
7.	*Alchornea cordifolia*	Christmas bush	Shrub	Medicinal	Not threatened
8.	*Alstonea boonei*	Cheese wood	Tree	Medicinal	Not threatened
9.	*Alternanthera sessilis*	Sessile joyweed	Herb	Medicinal	Not threatened
10.	*Amaranthus hybridus*	Spinach	Herb	Food	Not threatened
11.	*Anacardium occidentale*	Cashew	Tree	Medicinal	Not threatened
12.	*Anthocleista vogellii*	Cabbage tree	Tree	Medicinal	Not threatened
13.	*Aspilia africana*	Wild sunflower	Herb	Medicinal	Not threatened
14.	*Asystasia gangetica*	Chinese violet	Herb	Medicinal	Not threatened
15.	*Azadirachta indica*	Neem tree	Tree	Medicinal	Not threatened
16.	*Bambusa arundinae*	Bamboo	Tree/grass	Medicinal	Not threatened
17.	*Boerhavia diffusa*	Punarnava	Herb	Medicinal/ Food	Not threatened
18.	*Canna indica*	Arrowroot/Indian Shot,	Shrub	Food	Not threatened
19.	*Caesalpinia pulcherrima*	Pride of Barbados	Shrub	Medicinal	Not threatened
20.	*Calotropis procera*	Bombom plant	Herb	Medicinal	Not threatened
21.	*Capsicum annuum*	Pepper	Herb	Food	Not threatened
22.	*Carica papaya*	Pawpaw	Tree	Medicinal/ Food	Not threatened
23.	*Casuarina equisetifolia*	Christmas tree	Tree	Wood	Not threatened
24.	*Chromolaena odorata*	Siam weeds	Herb	Medicinal	Not threatened
25.	*Clerodendron sp.*	Glory bower	Herb	Medicinal	Not threatened
26.	*Cnetis ferruginea*	Dog's nipple	Herb	Medicinal	Not threatened
27.	*Cirus sinensis*	Sweet orange	Tree	Food	Not threatened
28.	*Cocos nucifera*	Coconut	Tree	Medicinal/ Food	Not threatened
29.	*Colocasia esculenta*	Cocoyam	Shrub	Food	Not threatened
30.	*Combretum zenkeri*	Termite plant	Herb	Medicinal	Not threatened
31.	*Croton lobatus*	Senegal croton	Herb	Medicinal	Not threatened
32.	*Cyperus sp.*	Papyrus sedges	Herb	Medicinal	Not threatened

33	*Delonix regia*	Flame of the forest	Tree	Ornamental	Not threatened
34	*Duranta repens*	Yellow bush	Shrub	Ornamental	Not threatened
35.	*Elaeis guineensis*	Oil palm	Tree	Medicinal	Not threatened
36.	*Eleusine indica*	Stubborn grass	Grass	Medicinal	Not threatened
37.	*Euphorbia hyssopifolia*	Hyssop spurge	Herb	Medicinal	Not threatened
38.	*Ficus exasperata*	Sandpaper tree	Tree	Medicinal	Not threatened
39.	*Ficus sp.*	Weeping fig	Tree	Medicinal	Not threatened
40.	*Glyricidia acuminata*	Mouse Killer	Tree	Medicinal	Not threatened
41.	*Gmelina arborea*	Gmelina	Tree	Wood	Threatened
42.	*Hibiscus rosa-sinensis*	Hibiscus	Shrub	Ornamental	Not threatened
43.	*Hibiscus tiliaceous*	Sea hibiscus	Herb	Medicinal	Not threatened
44.	*Hura crepitans*	Sandbox plant	Tree	Medicinal	Not threatened
45.	*Icacina trichantha*	Disappearance plant	Herb	Medicinal	Not threatened
46.	*Ipomoea involucrata*	Frogs gourd	Runner	Medicinal	Not threatened
47.	*Ixora coccinea*	Jungle Geranium	Shrub	Medicinal	Not threatened
48.	*Khaya sp.*	Mighty wood	Tree	Wood/ furniture	Threatened
49	*Lycopersicum esculentum*	Garden tomato	Herb	Food	Not threatened
50	*Mangifera indica*	Mango	Tree	Medicinal/ Food	Not threatened
51	*Manihot esculenta*	Bitter cassava	Shrub	Food	Not threatened
52	*Momordica charantia*	Bitter melon	Herb	Medicinal	Not threatened
53.	*Musa parasidiaca*	Edible banana	Tree	Food	Not threatened
54	*Musa sapientum*	French plantain banana	Tree	Food	Not threatened
55	*Panicum maximum*	Guinea gass	Grass	Medicinal/ Fodder	Not threatened
56	*Pennisetum purpureum*	Merker grass	Grass	Medicinal/ Fodder	Not threatened
57	*Persea americana*	Avocado	Tree	Medicinal	Not threatened
58.	*Phyllanthus amarus*	Carry me seed	Herb	Medicinal	Not threatened
59.	*Physalis angulata*	Cutleaf groundcherry	Herb	Medicinal	Not threatened
60.	*Plumeria alba*	Fragipani	Tree	Medicinal	Not threatened
61	*Plumeria rubra*	Fragipani	Tree	Medicinal	Not threatened
62.	*Portulaca oleracea*	Duckweed	Herb	Medicinal	Not threatened
63.	*Randia lucida*	Indigoberry	Tree	Medicinal	Not threatened
64.	*Rauvolfia vomitoria*	Poison devils pepper	Tree	Medicinal	Not threatened
65.	*Rhoeo spathacea*	Moses-in-the-cradle	Shrub	Medicinal	Not threatened
66	*Roystonea oleracea*	Royal palm	Tree	Wood	Not threatened

67	*Senna obtusifolia*	Sicklepod	Herb	Medicinal	Not threatened
68	*Sida acuta*	Wireweed	Herb	Medicinal	Not threatened
69.	*Solenostemon monostachyus*	Monkeys' potato	Herb	Medicinal	Not threatened
70.	*Spigelia anthelmia*	West indian pinkroot	Herb	Medicinal	Not threatened
71.	*Spondias mombin*	Yellow mombin	Tree	Medicinal	Not threatened
72.	*Starchtarpheta jamaicensis*	Jamaica vervain	Shrub	Medicinal/ Food	Not threatened
73.	*Strelitzia reginae*	Crane flower	Flower	Ornamental	Not threatened
74.	*Synedrella nodiflora*	Cinderella weed	Herb	Medicinal	Not threatened
75.	*Talinum triangulare*	Waterleaf	Herb	Food	Not threatened
76.	*Terminalia catappa*	Almond	Tree	Medicinal	Not threatened
77.	*Terminalia mataly*	Shade tree	Tree	Medicinal	Not threatened
78.	*Tectona grandis*	Teak	Tree	Wood/ furniture	Not threatened
79.	*Thevetia peruviana*	Yellow oleande	Tree	Ornamental	Not threatened
80..	*Thuja sp.*	Green giant	Tree	Medicinal	Near threatened
81.	*Vernonia amygdalina*	Bitter leaf	Shrub	Medicinal/ Food	Not threatened
82.	*Vernonia cinerea*	Little ironweed	Herb	Medicinal	Not threatened
83.	*Waltheria indica*	Sleepy morning	Shrub	Medicinal	Not threatened
84.	*Zea mays*	Corn	Grass	Food	Not threatened

Plate 4.2: Vegetation and Artisanal Timber Lumbering Activities in AFUED Area.

4.8.2 Wildlife

The fauna species of the project area include domestic animals such as cows, goats, dogs, sheep, ram, and chickens including some species of bird life. The consultations with the local residents and hunters during the fieldwork revealed that some of the lower wildlife species identified in the project area includes; birds, butterflies, flies, bees, wasps, rats (*Rattus Cricetomys* (Cane rat), *Xerus erythropus* (Ground squirrel), *Thryonomys swindereanus* (grass cutter)), snakes and other reptiles such as lizards and alligators and snails. The population of wildlife in the area has significantly decimated due to hunting, loss of vegetation and a host of other unwholesome anthropogenic activities. Majority of these animals have become diurnal with restrictive burrowing characteristics.

Table 4.9: Some of the Wildlife Identified in the Study Area

S/No	Zoological Name	Common Name	Conservation Status
Reptiles			
1.	*Boa constrictor*	Boa	LC
2.	*Elgaria multicarinata*	Alligator lizard	EN
3.	*Kinixys belliana*	Water Turtle	EN
4.	*Naja nigricollis*	Red splitting Cobra	NL
5.	*Opheodrys vernalis*	Green snake	LC
6.	*Python regius*	Royal python	LC
7.	*Testudo hermanni hermanni*	Tortoise	EN
Birds			
1.	*Apus affinis*	Little swift	LC
2.	*Ardea alba*	White egret	LC
3.	*Bubulcus ibis*	Cattle egret	LC
4.	*Centropus senegalensis*	Senegal coucal	LC
5.	*Corvus albus*	Pied crow	LC
6..	*Delichon urbicum*	Common house martins	LC
7.	*Egretta ardesiaca*	Black egret	LC
8.	*Ispidina picta*	African pygmy king fisher	LC
9.	*Kaupifalco monogrammicus*	Lizard buzzard	LC
10	*Microcarbo africanus*	Reed Cormorant	LC
11.	*Milvus migrans*	Black Kite	LC
12.	*Ploceus cucullatus*	Village weaver	LC
Crawling Mammals			
1	*Paraxerus lucifer*	Black and red bush squirrel	LC

Note: E (Extinct), EW (Extinct in the Wild), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Conservation Dependent (CD), Least Concerned (LC), Not Listd (NL)

4.9 **Socio-Economics and Health conditions of the study Area**

Baseline socio-economic characteristics and the results of the survey carried out at the Adeyemi Federal University of Education (AFUED) Ondo town 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.

4.9.1 Methodology of Data Collection

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.

4.9.2 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 AFUED 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) were 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.

4.9.3 Data Processing

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.

4.9.4 Background of the Study Area (AFUED) Ondo Town Ondo State

The Adeyemi Federal University of Education is a federal government higher education institution located in Ondo City, Ondo State, Nigeria Formerly Adeyemi College of Education named after Canon M. C. Adeyemi (one of the earliest educationists in Yorubaland in recognition of his immense contribution to educational development in the then Ondo Province. The institution was established in 1963 to produce qualified teachers to teach in secondary schools and teachers' training colleges and to conduct research and experiments on methods of teaching at all levels of education in Nigeria. It formally commenced operations on 22 May 1964 with 93 students, 24 women and 69 men, and has metamorphosed into a first-class College of Education in Nigeria and in the West Africa sub-region.

The college was a combination of the various institutions that sprang up in the sixties to cater to the development of Manpower in secondary schools and teacher training colleges in the Western region. However, the federal government of Nigeria under the Goodluck Jonathan presidency upgraded the College to a full-fledged university of education in May 2015.However, the administration of former President Mohammed Buhari decided to put the new status on hold till the National Assembly finally passed the Adeyemi Federal University Establishment bill in December 2018 and the bill was assented by the former President of the Federal Republic of Nigeria Mohammed Buhari in December 2021.

Plate 4. 4: AFUED, Ondo Main Gate

Source: Field Survey for the Proposed EEP, April 2026.

4.9.5 The University Community Administrative Structure

Administrative leadership structure of AFUED, Ondo town is shown in Figure 4.2. 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.

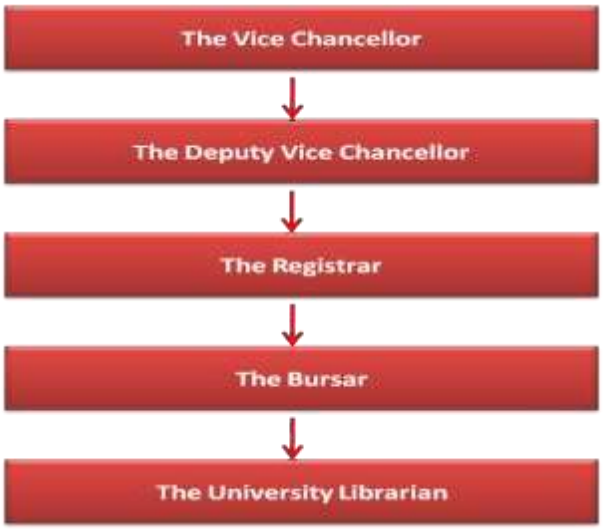


Figure 4. 2: Administrative Structure of AFUED Ondo Town
Source: Field Survey for the proposed EEP, April 2026

4.9.5. 1 ***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 AFUED Ondo town 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.

4.9.6 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 Adeyemi Federal University of Education, Ondo Town. In other words, the AFUED land where the proposed project is located was provided by the Ondo State Government.

4.9.7 Population Characteristics of the Project Area

The AFUED Ondo town 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 AFUED 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.

4.9.8 Sampled Population/AFUED Socio-Economic 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.

Farming and petty trading remains the predominant occupations of the people of Ondo town and by extension the entire Ondo State. Some of the crops include food and cash crops such as; yam, cassava, rice, plantain, banana etc while some of the cash crops are kolanuts, cocoa etc. Suffice it to mention that size population of the people of Ondo State (including the project area) engages in timber lumbering due to the availability of forest reserves such as the Oluwa, Idanre, Akure-Ofosu and Ifon abundance of forest, this is evident by the large number of sawmills and wood processing factories which provides employment opportunities to large population (male and female) while the larger population of especially in the southern part (Ikale-Ilaje-Ijaw axis) also engage in fishing including the abundance of minerals resources such as bitumen, oil and gas has put the State (Ondo) on both the national and global maps of oil producing State. Worthy of note is the engagement of large population of people of Ondo town and the entire State in white collar profession; this is however attributable to early exposure Western education and the continuous funding and free education policy of successive governments of the State.

Plate 4.5: Cassava Processing and Agricultural Activities in AFUED Area

4.9.9 Respondents Socio-Economic Characteristics: Gender Distribution

Reflected in figure 4.3, male respondents account for about 60% while the female gender represents 40% of the total sampled population.

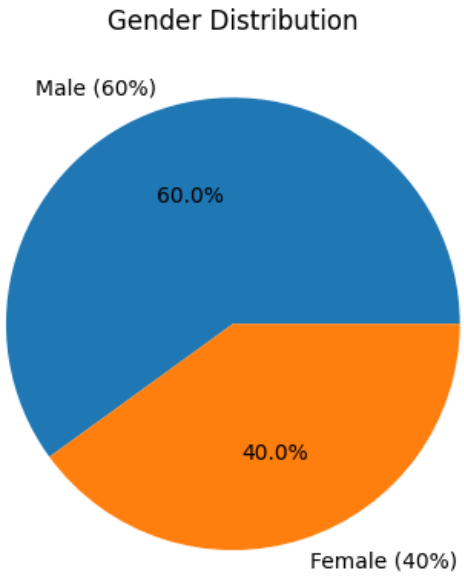


Figure 4. 3: Gender Distribution in the Project location

4.9.10 Age Distribution

As indicated in figure 4.4, 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.

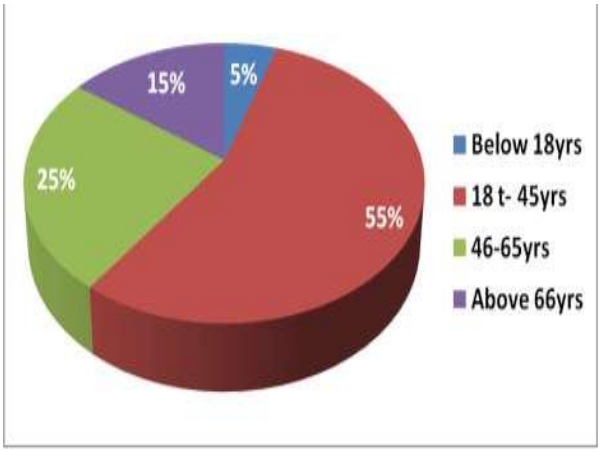


Figure 4.4: Age Distribution in the Project Location

Source: Field Survey for the Proposed EEP, February 2026

4.9.11 Marital Status

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 AFUED are married and have sense of commitment. Married people are presumed to be more responsible in our society.

Civil servants (government workers) are the dominant livelihoods indicated by the sampled population. 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.

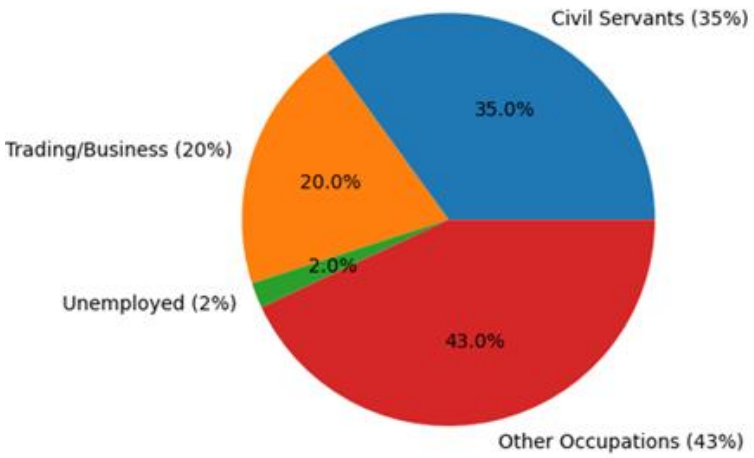


Figure 4. 5: Occupation Distribution within the Project Location

4.9.12 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.

4.9.13 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 Ondo State. However, a federal establishment such the AFUED is expected to have multi-ethnic compositions.

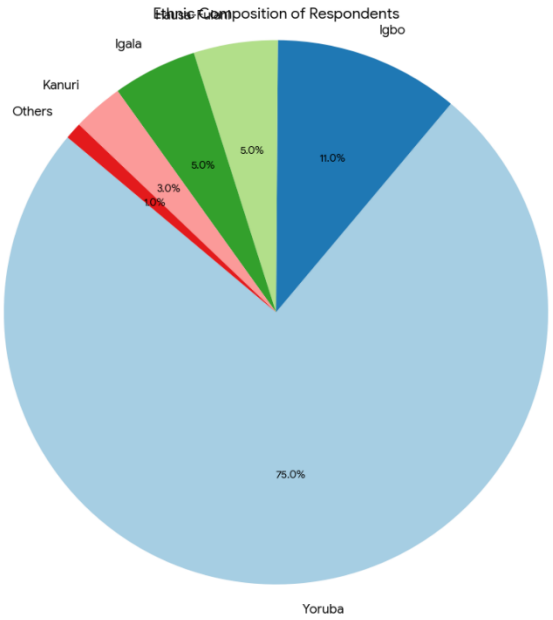


Figure 4. 6: Ethnic Distribution of Respondents within the Project Location

4.9.14 Religious Groups

As shown in figure 4.16, those that indicated Christianity are the majority which constituted 60% of the Respondents, Islam 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.

4.9.15 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. As expected of a university community, it could therefore be noted that there is a high level of literate people within the study area.

4.9.16 Income

Monthly income indicated by the respondents 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.

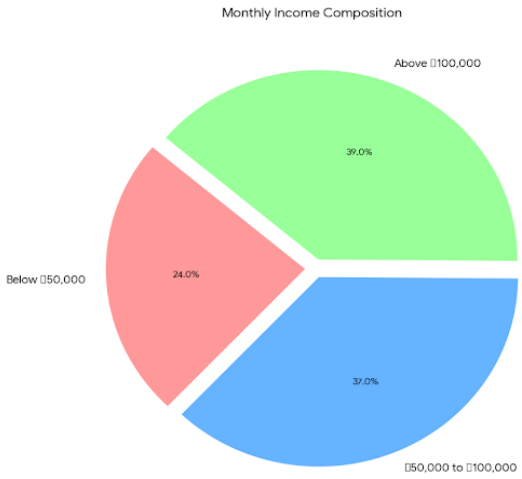


Figure 4. 7: Percentage Income Distribution within the Project Area

4.9.17 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 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.

4.9.18 Respondents Land and House Tenures

The tenure of the housing and land is presented in Figure 4.8. 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. 8 Respondents' Land and Housing Tenure Characteristics

4.9.19 Household Solid Waste Management

As shown in Figure 4.9, 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 Ondo 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 Ondo town 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".

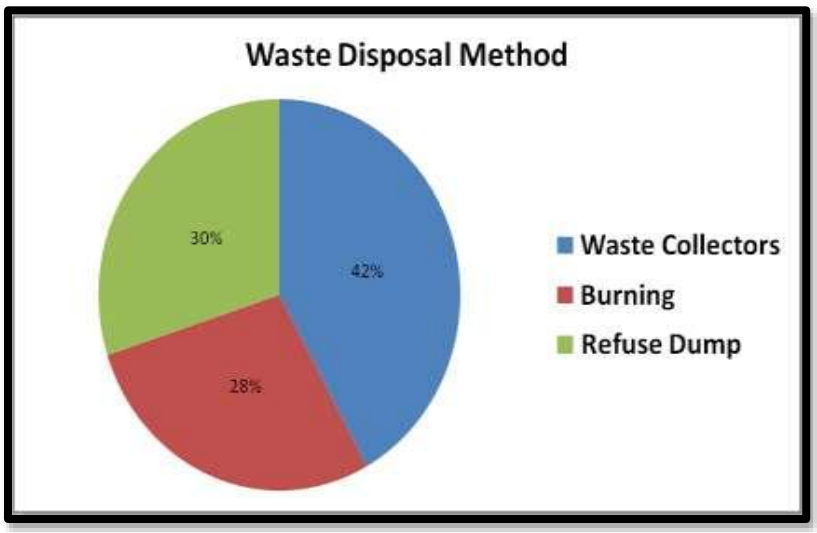


Figure 4.9: Disposal of Households Solid Waste

4.9.20 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. Ondo State is connected to the Benin Electricity Distribution Company (BEDC).

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.

4.9.21 Sources of Water

Indicated sources of water for household use in the study area is majorly borehole and hand dug wells 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 boreholes and hand dug wells, this is typical of modern settlement across Nigeria.

4.10 Summary of Socio-Economics Study and Stakeholders 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 AFUED will be sited within the university site which is located in Ondo town community of Ondo 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.

4.10.1 Stakeholders' 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. The stakeholder consultation meeting was held in 30th of April 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.

Plate 4.6: Photo Session with Some Members of Adeyemi Federal University, Ondo Headed by Prof. Babayode Popoola (V/C) and the Students' Union Executives

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, 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.

5.4 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 (six months), reversible and intermittent/occasional in nature
6. **Short-term**: Short term impacts are predicted to last only for a limited period of one year 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.

5.5 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.

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

Summary of Project Activities at Various Phases	Receptors															
	Physical					Biological		Socio-economic						Others (Health and Safety)		
	Air Quality	Ambient Noise	Soil	Groundwater and 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. 2: EEP II Solar Power Plant Impacts Categorization

Task	Activities	Direct	Indirect	Adverse	Beneficial	Reversible	Irreversible	Cumulative	Long term	Short term
Pre-Construction Phase										
• Permitting • Stakeholders' engagement • Landuse • Recruitment • Mobilization to site	Clearing of vegetation	■		■	■	■				■
	Equipment mobilization and transportation	■				■				■
	Noise, vibration and air pollution including emission of SPM	■				■				■
	Transportation of men and materials to site		■		■	■				■
	Excavation and dumping of excavated soils		■			■				■
	Waste generation and management	■				■				■
	Dumping of hazardous/special wastes including electricals	■		■		■				■
	Employment opportunities arising from recruitment of workers	■			■	■			■	■
	Commissioning of the solar mini grid project	■			■				■	■
	Business opportunities for local contractors through sub-contracting	■	■		■	■			■	■
	Skill acquisition and enhancements to locals and future workforce	■	■		■		■		■	
	Improvement in quality of life for adequately compensated individuals	■			■				■	
	Conflicts over employment issues (quotas and methods)	■	■	■		■	■		■	■
	Issues/ dispute on memorandum of understanding with project proponent	■		■		■			■	■
	Influx of people (migrant workers, sub-contractors and suppliers) and increased pressure on existing social infrastructure		■	■		■		■	■	■
• Land clearing	Potential incidences of GBV, sexual molestation and abuse		■	■		■			■	■
	Traffic infractions and non-adherence to safety measures			■					■	■
	Agitations over land disputes, wrong stakeholder identification,	■		■					■	■
	Loss of vegetation covers and forest products (fuel wood, timber, medicinal plants) due to site clearing and preparation activities	■		■			■			■
	Increased risks of accidents leading to injury/ death and loss of asset during mobilization		■	■		■	■			■
	Risks of armed robbery attack and hostage taking leading to injury/death of personnel		■	■		■				■
	Nuisance (noise and vibrations) from movement of equipment and vehicles affecting site workers and wildlife	■		■		■		■		■
	Dust particles and vehicular mission from increase in transportation activities	■		■		■		■		■
	Generation of wastes such as scrap metal, wood, sand, concrete, paper, domestic waste etc.	■		■		■		■		■
Commissioning and Operational Phase										
• Testing and commissioning	Generation of electricity supply	■			■	■			■	
	Increased opportunities and quality of life (small, 2medium, large scale) due to enhanced power delivery		■		■	■			■	
	Improvement in air quality due to reduced emission from privately		■		■	■	■		■	

• Power generation • PV Base solar power maintenance and service	Reduced demand on petrol and diesel used for power generation									
	Injuries/ fatalities of personnel due to incidents/ accidents from operating the power plant									
	Soil/ groundwater contamination from accidental petrol /engine oil spill during refueling of vehicle									
	Workplace accidents/ incidents (cuts, trip, falls etc) leading to injury/ death of personnel during operations									
	Acquisition of skills by individuals to be employed to operate the plant									
	Depletion of groundwater resources for washing solar modules									
Decommission Phase										
• Mobilization of personnel and equipment • Decommissioning of power plant • Abandonment/restoration	Loss of employment, business opportunities and decreased economic activity									
	Reduced power generation to the University and low power supply									
	Risks of injuries from possible collision with abandoned structures									
	Risk of accident and injury to workers during demolition of structures									
	Increased dust and vehicular emissions from decommissioning									
	Traffic obstruction on major roads from movement of vehicles during decommissioned process									
	Availability of land for alternative uses									
	Loss of site aesthetic qualities due to abandoned and dilapidated structures									

5.6 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.

5.7 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.

5.8 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.

5.9 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: Social 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
	• Minor disruption to livelihoods or living conditions resulting in a localized, 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.
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. • Increase in noise and level of pollution/emission due to project
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. • Change in solid waste characteristics due to the proposed project • Incidences of flooding/erosion due to sudden change in topography • 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 stakeholders associated with the project. • Businesses with a marginal economic existence which are not able to easily adapt to change. Also; • Important flora and fauna species may be loss due to clearing of vegetation • Soil excavation may result in erosion or change in topography • Construction activities may result in environmental challenges such as improper waste management, noise and air pollution including emission of SPM.

5.10 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 5.4.

Table 5. 4: 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.

5.11 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 5.5.

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

Summary of Project Activities at various Phases	Receptors															
	Physical					Biological		Socio-economic						Others (Health and Safety)		
	Air Quality	Ambient Noise	Soil	Groundwater and 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, upgrade of 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)

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

5.11 Impacts Discussion

5.11.1 Potential Positive Impacts

The proposed Project seeks to provide independent and reliable power supply to Adeyemi Federal University of Education, Ondo Town 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 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.

5.11.2 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.

5.11.3 Pre-Construction/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 10.576 acres of land within the AFUED 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.

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:

5.11.4 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 (10.576 acres) 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 10.576 acres of land allocated for the Project. The potential impact is direct, irreversible, short term and localized. The impact significance is thus considered **minor**.

5.11.5 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**.

5.11.6 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**.

5.11.7 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**.

5.11.8 Mobilization o 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:

5.11.9 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**.

5.11.10 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**.

5.11.11 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

5.11.12 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.

5.11.13 Civil and Electrical Works, and Installation of Plant Facilities

5.11.13.1 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**

5.11.13.2 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.

5.11.13.3 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**.

5.11.13.4 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**.

5.11.13.5 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.

5.11.13.6 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.

5.11.13.7 Potential Impact on Socio-Economic and Health

The Potential 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**.

5.11.13.8 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 streetlights 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**.

5.11.13.9 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

5.11.13.10 Potential Impact on Soil

The proposed construction activities will lead to the generation of waste. 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 waste to be generated includes scrap metals, electrical cables, spent oils, wood/planks, paper waste, leftover sand and gravel, etc. The impact magnitude of the waste on the soil is considered to be **low**. Thus, the impact significance is considered to be **minor**.

5.11.13.11 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 groundwater is a major source of potable water within the Project AoI. The potential for groundwater contamination as result of waste disposal is rated **minor**.

5.11.13.12 Potential Impact on Infrastructure (Waste Management Facility)

Construction waste can potentially have impact on the existing waste management facility of the University. Domestic waste in AFUED is collected in the University and disposed through the State's waste collection system. Construction waste 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 waste 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, SO_2 and NO_2) 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

5.11.14.1 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.

5.11.14.1 Potential Impact on Soil

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**.

5.11.14.2 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.

5.11.14.3 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 Occupants' 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

5.11.15 Operational Phase

Power Generation and Distribution

5.11.15.1 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**.

5.11.15.2 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.**

5.11.15.3 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**.

5.11.15.4 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

5.11.15.5 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**.

5.11.15.6 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 panel 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**.

5.11.15.7 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 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 Disposal	Soil water & Ground	Groundwater and soil contamination	Negligible
	Health, safety and welfare of staff during maintenance	• Electric shock, injuries to personnel during maintenance	Minor

5.11.15.8 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**.

5.12 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 unacceptable Risk		Severity of the Potential Injury/Damage				
		Insignificant damage to Property, Equipment, or Minor injury **1**	Non-reportable injury, minor loss of Process, or slight damage to Property **2**	Reportable Injury, moderate loss of Process or limited damage to Property **3**	Major injury, Single Fatality, critical loss of Process/ damage to Property **4**	Multiple Fatalities, Catastrophic Loss of Business **5**
Likelihood	Almost Certain **5**	**5**	**10**	**15**	**20**	**25**
	Will probably occur **4**	**4**	**8**	**12**	**16**	**20**
	Possible occur **3**	**3**	**6**	**9**	**12**	**15**
	Remote possibility **2**	**2**	**4**	**6**	**8**	**10**
	Extremely unlikely **1**	**1**	**2**	**3**	**4**	**5**

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

5.12.1 Project Specific Risks and Hazards

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

5.12.1.1 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.

5.12.1.2 Electricity

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.

5.12.1.3 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.

5.13 Summary of Anticipated Cumulative Impacts

The anticipated direct and indirect impacts (environmental and social) no doubt culminates in cumulative impact and thus requires the development and implementation of the necessary mitigation measures. Thus, the summary of the direct, indirect and cumulative impacts of the proposed project is presented below.

Table 5. 12: Summarized Environmental and Social Impacts of Solar Power Plant

Social Impacts		
Direct Impacts	Indirect Impacts	Cumulative Impacts
✓ Improved teaching and learning including research activities ✓ Availability of constant, cheap and sustainable power supply ✓ Improved illumination and security including improved livelihood ✓ Trigger socio-economic activities and improved livelihood ✓ Improve access to information (ICT), social media and public enlightenment through due to availability of power supply	✓ Promotes efficiency within the University community. ✓ Eliminate noise, environmental pollution and incessant burning of fossil fuel for power generation including tremendous reduction in cost of power generating/access. ✓ Increase profit of formal and informal business in the University. ✓ Enhance security of lives and properties in the university. ✓ Contribute to a more informed, and patriotic citizens due to access to ICT.	✓ Contribute to transfer of technology and improved academic environment.
Environmental Impacts		
Direct Impacts,	Indirect Impact	Cumulative Impacts
✓ Reduced noise and pollution-free environment ✓ Reduce over-dependence of fossil fuel powered alternative power supply ✓ Increased and alteration in solid waste characterization ✓ Flood/erosion due to altered topography ✓ Occupational, Health and Safety challenges due to diverse activities of the project	✓ A serene academic environment devoid of undue noise and air pollution (due to operation of fossil fuel generators) ✓ Reduced local consumption of petroleum products	✓ Upscaled standard of education due to friendly environment ✓ Reduced GHG emission and contribute to climate resilience ✓ Reduce depletion of mineral resources (petroleum products) due to project

CHAPTER SIX

Mitigation Measures

6.1 Introduction

This chapter presents the mitigation measures proffered for the associated and potential impacts of the proposed 1MW solar based power plant project in Adeyemi Federal University of Education, Ondo Town. 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.

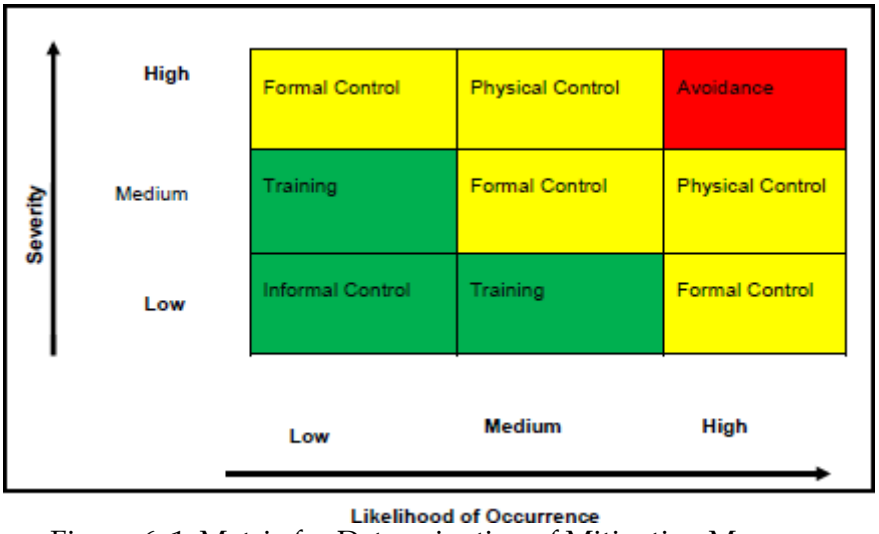


Figure 6. 1: Matrix for Determination of Mitigation Measures
(Source: www.researchgate.net/risk assessment matrix)

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)

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 Proposed Project

Project Activities	Receptors	Summary of Potential Impacts	Potential Impact Significance (Before Mitigation)	Mitigation Measures	Residual Impact (After Implementation Mitigation Measures)
Pre-Construction Phase					
Site clearing and preparation	Terrestrial flora and fauna	Removal of top soil and soil compaction associated with clearing of site Loss of top soil Loss of vegetation 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
	Solid	Removal of top soil and soil compaction associated with clearing of site Loss of top soil Increased the potential 'for erosion 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 Increase in ambient noise levels	Minor	Site clearing equipment / machinery shall be operated and maintained under optimum fuel-efficient conditions. 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.	Negligible
	Workers Safety	Injuries and accidents to workers during site clearing and preparation.		• 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	• 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. • 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.	Negligible

				• 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.	
	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. • 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.	Negligible
	Workers Safety	Injuries and accidents to workers during loading and off-loading construction materials.	Minor	• Mobilization of materials shall be limited to the daytime as much as possible.	Negligible

				• Provision of adequate PPE especially gloves and hard hats to workers, shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties. • Unregistered labourers and touts shall not be patronised for off-loading materials. • The site shall be secured with perimeter fencing and/or security. • Sanitary amenities and potable water shall be provided.	
Construction Phase					
Civil and Electrical Works/ Installation Activities	Soil	• Increased erosion potential as a result of construction activities such as excavation • Reduction in structural stability and percolative ability of soil resulting from compaction during civil works and installation activities	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.	Negligible

				• Routine water sprinkling shall be carried out to minimize dust generation during construction.	
	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. • 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.	Negligible
	Groundwater	• Increased sediment load in the stream beside the site as a result of erosion • Increased runoff from hard-standing 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.	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;	Negligible

		• Decreased amount of groundwater as a result of groundwater abstraction for project activities.		• 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. • 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 developed and implemented. This will include date/time, location, reason for accident, corrective measures, etc.	Negligible
	GBV	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.	
	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	Minor

				induction programme for workers. • A mechanism procedure for receiving and addressing the concerns of workers shall be put in place and implemented. • The site shall be secured with perimeter fencing and/or security. • Sanitary amenities and potable water shall be provided.	
	Socio-economic and health	Influx of people, increase in sexually 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 educationabout 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	Minor

				workers within the local community. • Public access shall be restricted to construction area via security fencing and appropriate signage. • Substance abuse prevention and management programs shall be implemented for workers. Sanctions (e.g., suspension and dismissal) shall be introduced for workers involved in criminal activities • Procedure for receiving and addressing community concerns shall be developed and implemented.	
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 hard standing 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.	Negligible

				Construction vehicles and equipment shall be serviced regularly.	
	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 hard-standing 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. The inverters and batteries to be used for the Project shall meet industry best standard in relation to noise attenuation	Negligible
	Workers	Occupational health and safety hazards	Moderate	Plant testing shall be carried out by experienced personnel. Adequate PPE shall be worn.	Negligible

		(e.g. injuries, electrocution, etc) as a result of any wrong electrical connection.		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.	
	Safety of Campus Occupants	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					
Occupational Health & Safety (OHS)	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.	Minor

				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.	
	GBV	Discrimination during employment and training opportunities, GBV (sexual harassment, intimate partner Violence & poor working conditions).	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. All workers shall be required to undergo regular training and refreshers on GBV The O&M Contractor shall provide separate facilities for men and women and add GBV- free signage at the project site. All Gender-Based Violence (GBV) incidents shall be reported and dealt with as per the law.	Minor
Routine Maintenance,	Soil	Soil contamination from spent batteries and inverters	Minor	General housekeeping to ensure the site is not overgrown with grasses shall be maintained	Negligible

Waste Generation and Disposal				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.	
	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
	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 Management 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	Monitori			Responsible Party		Cost (US Dollars)
		Requirements /	Frequency	Performance	Implementation	Monitoring	
Site Clearing and Preparation							
Vegetation loss; direct on vegetation and soil And soil-organisms organisms; indirect impacts Fauna species	Vegetation clearing shall be limited to the areas within the site needed for the Project. Use of herbicides for clearing shall be avoided. Site clearing and preparation shall be done mechanically.	Inspection	Daily	Adherence to measures	EPC Contractor	REA (PMU) AFUED (Site Engineer)	-
	Bush burning shall be avoided.	Inspection	Daily	Adherence to measures			
	The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited.	Inspection	Monthly before the site clearing activities	Adherence to measures			
	Hunting or deliberate killing of animals by workers shall be prohibited and monitored. Workers shall be sensitized on ecological protection	Inspection	Daily before the site clearing activities	Adherence to measures			
	Any cleared areas which are not used will be re-vegetated using plants or seeds of locally occurring species.	Inspection	Monthly after the site clearing phase	Re-vegetated land			
Removal of top soil and soil compaction; loss of top soil; increased erosion potential; reduction in structural stability and soil	Removal of vegetation and soil cover shall be restricted to the areas required for the Project. Soil conservation measures shall be implemented such as stockpiling topsoil or for the remediation of disturbed areas.	Inspection	Daily	Re-vegetated land	EPC Contractor	REA (PMU) AFUED (Site Engineer)	200
	Use of silt traps or similar systems to reduce discharge of silt shall be ensured.	Inspection	Monthly before the site clearing	Re-vegetated land			
Air quality impacts due to emission from site clearing	Site clearing equipment / machinery shall be operated and maintained under optimum fuel efficient conditions.	Maintenance records; consumption	Daily	Adherence to measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
equipment; increase in ambient noise levels		records					
	Noise suppression equipment shall be fitted on machinery.	Inspection	Daily	Adherence to measures			
	Site clearing activities shall be carried out only during the daytime (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr)	Inspection	Daily	Adherence to measures			
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	Inspection; Maintenance records	Once before vehicle commences journey	Adherence to measures	EPC Contractor	REA (PMU) AFUED (Site Engineer)	500
	All materials with potential to result in dust emissions shall be covered during transport.	Inspection	Once before vehicle commences journey	Adherence to measures			
	Onsite vehicle speed on unhardened roads and surfaces shall be limited to about 20hm/hrr	Inspection	Daily	Adherence to measures			
	Unnecessary engine idling shall avoided.	Inspection	Daily	Adherence to measures			
	Site roads and access roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures			

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

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements /	Frequency	Performance	Implementation	Monitoring	
Stakeholders' engagement	- Stakeholders' Engagement Plan activities	Inspection	clearing and construction	(OP/BP 4.12)	AFUED Management	REA	2,000
		Inspection	Prior to mobilization to site /site clearing and construction	Alternative farmlands for the affected farmers	AFUED Management EPC Contractor	REA (PMU)	
Exposure to infectious diseases (e.g. COVID-19)	The EPC contractor shall implement the Nigeria Centre for Disease Control (NCDC) safety Guidelines during site clearing works.	Implementation of NCDC guidelines	Prior to mobilization to site / site clearing and construction	Adherence to measures	AFUED Management EPC Contractor	REA (PMU) AFUED (Site 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 implementation of infection prevention measures	Prior to mobilization to site / site clearing and construction	Adherence to measures			
Vegetation loss; direct impacts on vegetation and soil-dwelling organisms; indirect impacts on faauna species	Vegetation clearing shall be limited to the areas within the site needed for the project Use of herbicides for clearing shall be avoided. Site clearing and preparation shall be done mechanically.	Inspection	Daily	Adherence to measures	EPC Contractor	REA (PMU) AFUED (Site Engineer)	-
Mobilization of Materials and Equipment to Site							
Injuries and accidents 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	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU) AFUED (Site Engineer)	1000
	Unregistered labourers and touts shall not be patronised for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		
Increase in vehicular		TMP		Benchmarks		REA (PMU)	

movement and traffic including potential for road accident	A TMP shall be developed by the EPC contractor and implemented	implementation records	Daily	stated in the TMP	EPC Contractor	AFUED (Site	500

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

	Appropriate signage and safety measures (barrier, formalized crossing points) to reduce the risk of accidents in the	Safety signs and barriers	Before and during mobilization	Adherence to measures	EPC Contractor	Engineer)	
	Speed limit along roads to the proposed project site shall be limited	Evidence of consultation with local community	Before and during mobilization	Adherence to measures	EPC Contractor		
	Drivers' competency shall be assessed and where required, appropriate training shall be provided.	Drivers' competency assessments; training records	Once before commencement of mobilization	Passing of competency assessment or training completion certificates	EPC Contractor		
	Engage the services of Traffic Officers to monitor and control traffic including enforcement	Drivers' competency	Daily	Observation	EPC Contractor		
	Employee violations of speed limit and other traffic rules will result in disciplinary action ranging from warning to dismissal.	Incident forms, GRM	Daily	Completed incident forms	EPC Contractor		

Summary of Potential Impact	**Mitigation Measures**	**Monitoring**			**Responsible Party**		**Cost (US Dollars)**
		Requirements /	**Frequency**	**Performance**	**Implementation**	**Monitoring**	
Civil and Electrical Works/ Installation Activities							
Air quality due to emission from construction equipment; Increase in dust from cleared land windblown stockpiles	Regular maintenance and servicing of construction equipment /machinery shall be ensured	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor	REA (PMU) AFUED (Site Engineer)	500
	Routine water sprinkling shall be carried out to minimize dust generation during construction.	Inspection	Daily civil activities				
Increase in noise level	Construction activities shall be limited to office hours (8-5pm).	Inspection	Daily during				

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements /	Frequency	Performance	Implementation	Monitoring	
	day-time (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr).		construction phase				
	Construction machinery shall be turned off	Inspection	Daily construction phase				
	Construction equipment shall be properly	Maintenance records	Monthly during construction phase				
	Noise complaints related to construction activities shall be and appropriately addressed.	Complaint records	Weekly during construction phase				
	Noise monitoring at locations persistent noise complaints shall maintained.	Noise monitoring records	Monthly during construction phase	World Bank Good Practice Note Addressing Grievances	EPC Contractor	REA (PMU) AFUED (Site Engineer) FMEnv OSEPA	500
	Machinery/equipment to be used for construction work shall meet industry best standard in relation to noise attenuation	Inspection	Before commencement of construction phase	FMEnv limit World Bank Noise Limit	EPC Contractor	REA (PMU) AFUED (Site Engineer) FMEnv	
Increased soil erosion potential; reduction in Structural stability and percolative ability of soil	Excavation works shall not be executed under aggressive weather conditions	Inspection	Daily excavation activities	Adherence to measures	EPC Contractor	REA (PMU) AFUED (Site Engineer)	-
	Stockpiles shall be appropriately covered to reduce soil loss as a result of wind	Inspection	Daily civil work activities	Adherence to measures			
Loss of plant species due to the introduction of Alien specie	Construction workers shall be provided with appropriate training on ecological awareness, as appropriate to their work activities.	Training records	Once before start of construction phase	Certificates of Training	EPC Contractor	REA (PMU) AFUED (Site Engineer)	1000
	All construction equipment shall be cleaned (mud and soil removed) being brought to the site to avoid introduction of	Inspection	Daily during	Adherence to			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements /	Frequency	Performance	Implementation	Monitoring	
	alien species. If sand or other natural materials for building are required and brought onto site, the stored heaps will be monitored for the growth and germination of alien species and will be regularly cleared during construction.		construction phase	measures		FMEnv OSEPA	
	Regular monitoring will be undertaken to ensure that alien plants are not increasing as a result of the disturbance that has taken place.	Monitoring records	Monthly during construction phase	Adherence to measures	EPC Contractor	REA (PMU) AFUED (Site Engineer)	
Waste Disposal and Generation							
Soil contamination from solid and liquid Construction waste streams.	Hazardous substances and materials shall be stored in appropriate locations with impervious hard standing and adequate secondary containment. Portable spill containment and clean-up kits shall be available onsite.	Inspection	Daily construction phase	Adherence to measures World Bank General EHS Guidelines	EPC Contractor	REA (PMU) AFUED (Site Engineer) FMEnv	1000
	Construction workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Once before commencement of construction	Certificates of completion of trainings		OSEPA	
Groundwater contamination of liquid construction waste streams.	Training shall be provided for workers on safe storage, use and handling of hazardous materials (e.g. fuel, lubricating oil) on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	REA (PMU) AFUED (Site Engineer) FMEnv	1000
	Hazardous substances and materials shall be stored in appropriate locations with impervious hard-standing and adequate secondary containment. Portable spill containment and clean-up kits shall be available onsite.	Inspection	Daily construction phase	Adherence to measures General EHS Guidelines			
	Waste management plan (WMP) shall be developed and implemented.	WMP implementation records	Daily construction phase	Benchmarks stated in WMP			

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

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements	Frequency	Performance	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented for the Project	Implementation by the Contractor	Once before start of construction	Evidence to show implementation of EEP action plan	EPC Contractor	REA-PMU AFUED (Site Engineer) FMEnv OSEPA	2000
	All workers shall be required to undergo regular training and refreshers on GBV	Organize regular onsite training and refreshers	Monthly during construction phase	Records of regular training and attendance	EPC Contractor		
	All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/Sexual Exploitation and Abuse	Develop forms for workers	Once before start of construction	Signed CoC forms	EPC Contractor		
	GBV sensitive channels for reporting in GRM shall be implemented for the Project	Establish accessible GRM reporting channels	Monthly during construction	GRM records	EPC Contractor		
	The EPC Contractor shall be required to hire a Gender/GBV officer	Employ Officer	Once before start of construction	Employment Records and job description	EPC Contractor		
	Collaboration with government Government institutions or GBV service providers on potential GBV case management shall be ensured	Engagement of GBV provider	Once before start of construction	Records of ongoing engagement and consultation with GBV service providers	EPC Contractor		
	The EPC Contractor shall provide separate facilities for men and women and add GBV free signage at the project site	Erection of Separate toilet Facilities and display of GBV signages	Once before start of construction	Inspection of facilities to ensure adequacy	EPC Contractor		

Summary of Potential	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements	Frequency	Performance	Implementation	Monitoring	
Influx of increase 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 developed and implemented	Employment records	Once before start of construction	Adherence to Measures	EPC Contractor	REA (PMU) AFUED (Site Engineer) FMEnv OSEPA	3000
	An induction and sensitization programme, including a Code of Conduct, for all construction workers shall be including a Code of Conduct or all construction workers shall be carried out prior to construction activities to enable increased sensitivity to local norms and customs, provide awareness to construction workers of appropriate and acceptable behaviours, and will govern workers 'interaction with the local community.	Induction records and training on the Code of Conduct	Once before start of construction	Adherence to measures	EPC Contractor		
	Awareness education about GBV/SEA/HIV/AIDS and other Sexually Transmitted Diseases shall be transmitted diseases shall be created among the workforce and extended to the local community	Training records	Once before start of construction	Adherence to measures	EPC Contractor		
	Public access shall be restricted to construction area via security fencing and appropriate signage	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		
	All workers on the project shall be required to sign a code of conduct to prohibit any form of Gender Based Violence/Sexual Exploitation and Abuse	Signed code of conduct record	Once before start of construction	Adherence to measures	EPC Contractor		
	Procedure for receiving and addressing community concerns shall be developed and implemented.	Consultations and grievance records	Weekly during construction phase	World Bank Good Practice Note Addressing Grievances	EPC Contractor		
Road and safety impacts	TMP shall be implemented.	TMP implementation	Daily construction	Benchmarks stated in the TMP	EPC Contractor	REA (PMU)	1000

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

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

Table 7.3a: Environmental Management Plan for Commissioning Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements /	Frequency	Performance	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 manufacturer recommendations	SOPs	Once before commissioning	Adherence to measures	EPC Contractor	FMEnv OSEPA	
Plant testing							
Increase in ambient noise level due to Plant testing	Strict compliance to the Operating Procedures (SOPs) shall ensured.	SOPs	Once before commissioning	Adherence to measures	EPC Contractor	REA (PMU) AFUED (Site Engineer and Director of	500
	The EPC contractor shall develop Standard	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		

Table 7.3b: Social Management Plan for Commissioning Phase

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

Table 7.4a: Environmental Management Plan for Operational Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Power Generation and Evacuation							
Air emissions from the diesel generators	Strict compliance to the standard operating procedures for the diesel generators shall be ensured.	Inspection	Monthly during operations	Adherence to measures	O&M Contractor	AFUED (Site Engineer)	-
	Regular maintenance of diesel generators shall be ensured as required by the manufacturer	Inspection	Monthly during operations	Adherence to measures	O&M Contractor		
	A cleaning schedule shall be developed and implemented for cleaning the panels installed at the project site during operations	Inspection	Monthly during operations	Adherence to measures	O&M Contractor		
	The solar panels shall be inspected regularly for dust and rain damages and maintained according to manufacturer's instructions.	Inspection	Monthly during operations	Adherence to measures	O&M Contractor		
Noise from diesel generators and inverters during evacuation	Inverters shall be maintained as manufacturer's recommendations and operated as per original specifications.	Inspection	Monthly during operations	Adherence to measures	O&M Contractor	AFUED (Site Engineer)	-
	The diesel generators shall be operated with the sound proof covers at all times.	Inspection	Monthly during operations	Adherence to measures	O&M Contractor		
	Project personnel shall use use appropriate PPE (e.g. ear muffs) to reduce exposure to noise impact.	Inspection	Monthly during operations	Adherence to measures	O&M Contractor		

Landscape alterations resulting in unpleasant changes in the visual character of the area		All lighting will be kept to a minimum within the requirements of safety and efficiency. Where such lighting is deemed necessary, low-level lighting, which is shielded and directed downward to reduce light spillage will be used.	Inspection	Monthly during operations	Adherence to measures	O&M Contractor	Engineer)	-
Routine Maintenance, Waste Generation and Disposal								
E-waste generation and disposal		Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	At induction of new staff and in annual Refresher her training meetings	Certificates of completion of	O&M Contractor	AFUED (Site Engineer) FMEnv	2000
		E-wastes generated shall be stored in appropriate locations prior to recycling; consignment notes will be maintained Waste receptacles shall be provided within a secured area for collection of solid waste consignment.	Waste consignment notes, waste receptacles on site	Continuous during operations	Adherence to measures	O&M Contractor	NESREA OSEPA	
			Waste consignment notes, waste receptacles on site		Adherence to measures	O&M Contractor		
Soil contamination from spent batteries and inverters	Waste that cannot be reused or recycled shall be disposed of at an approved dumpsite. Spent batteries and inverters shall be sent to manufacturers in line with the Extended Producer Responsibility (EPR) policy.	Waste that cannot be reused or recycled shall be disposed of at an approved dumpsite. Spent batteries and inverters shall be sent to manufacturers in line with the Extended Producer Responsibility (EPR) policy. WMP shall be implemented. Water management/conservation plan shall be implemented.	Yearly notes for spent batteries to manufacturers for recycling WMP implementation records. Records of water management plan	World Bank Yearly Quarterly/During operation phase During operation	O&M Contractor General EHS Guidelines Water conservation plan World Bank General EHS Guidelines			
Groundwater abstraction from the cleaning						O&M Contractor Benchmarks stated in WMP	AFUED (Site Engineer) FMEnv	1000

					World Bank General EHS O&M Contractor	NESREA OSEPA AFUED (Site Engineer) FMEnv/ NESREA	500

Table 7.4b: Social Management Plan for Operational Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements /	Frequency	Performance	Implementation	Monitoring	
Power Generation and Evacuation							
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented during operations	Implementation by the Contractor	Continuously during operations	Evidence to show implementation of EEP action plan	O&M Contractor	AFUED (Site Engineer) FMEnv	2000
	All workers shall be required to undergo	Organize regular onsite training and refreshers	Monthly during operation phase	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 (GBV/ SEA)	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 Project	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 before start operations	Employment records and job description	O&M Contractor		
	Collaboration with appropriate government institutions or GBV providers on potential GBV case management shall be ensured	Engagement of GBV provider	Once before start operations	Records of ongoing engagement and 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 of separate convenience facilities and display of GBV	Once before start operations	Inspection of facilities to ensure adequacy	O&M Contractor		
Health, safety and welfare of staff during Plant operation	Provision of medical insurance scheme for employees shall be ensured.	Employment forms of employees	Quarterly during operations	Adherence to O&M Contractor measures		AFUED (Site Engineer) FMEnv	4000
	Appropriate safety signage shall	Safety signs	Quarterly	Adherence to	O&M Contractor		

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

AFUED Director of Physical Planning

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

REA-PMU

- 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

AFUED 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 AFUED 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 AFUED 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:

AFUED 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 AFUED Director of Physical Planning to address non-compliance and upcoming issues
- Monitors the implementation of the ESMP

AFUED Site Engineer

- Supervise the activities of the EPC contractor and ensure compliance ESMP with mitigation measures
- Report to AFUED 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 AFUED 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 AFUED Director of Physical Planning and REA-PMU to address non-compliance and upcoming issues

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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, AFUED Director of Physical Planning, and REA-PMU to address non-compliance and upcoming issues.

7.4.3 Operational Phase

AFUED 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 AFUED Director of Physical Planning to address non-compliance and upcoming issues

AFUED Site Engineer

- Supervise the activities of the O&M Contractor and ensure compliance ESMP with mitigation measures
- Report to AFUED 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 AFUED 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, AFUED 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 AFUED 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, AFUED 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 plan 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 group 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 proposed project'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 AFUED 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.

7.5.1.2 Indicators to Evaluate the Functionality and Effectiveness of GRM for this Project

There is no one-size-fits-all approach to grievance resolution, however workable GRM are designed based on the outcomes of consultations of stakeholders. Thus, the GRM takes into cognizance specific issues of the proposed project environment viz-a-viz; the prevailing socio-cultural contexts, industry best practice and the project conditions. However, an outline of the indictors that can be tracked in order to evaluate the functionality and effectiveness of Grievance Redress that can be adopted for this sub-project is presented below:

- Submission (in person, by phone, text messages or via, mail, email or via a website)
- receive, register and acknowledge complaint;
- screen the complaints using the benchmark of legitimacy of the complaints and whether it is within the Project's GRM scope to establish the foundation of the grievance;
- implement and monitor a redress action;
- advise for judicial proceedings (as last option, if necessary);
- itemize the experience for future reference essentially.

However, the indicators to evaluate the functionality and effectiveness protocol for the registration of complaints, acknowledgment, follow-ups, mediation and corrective actions for the management of Grievances is as presented below.

Table 7.6: Steps in Evaluating the Functionality and Effectiveness of Grievance Management Process

Process	Description of Activities	Timeline	Other Information
Identification of grievance	Face to face, phone, letter, mail, email, website, recorded during public/community interaction etc.	1 day	Email address, hotline number(s)
	The responsible party to receive the grievance will be REA and the sub-project implementation.		
	The grievance can also be passed through other parties, e.g. palace of community heads etc.		
	The grievance receiver would then pass the complaint to REA contact person.		
Grievance assessed and logged	Significance assessed and grievance recorded or logged (i.e. in a log book)	3 – 6 days	Significance criteria: Level1-one of event Level 2= complaint is widespread or repated Level 3-any complaint (one-off or repeated) that indicates breach of law/policy or ESMF provisions
	It will be prudent to have a grievance recorded for follow-up.		
Grievance is acknowledged	Acknowledgement of grievance through appropriate medium	3-days	
	Response development with input from management relevant stakeholders.		
Development of response	Grievance assigned to appropriate party for resolution	4-8 days	
	Response development with input from management/relevant staeholders3 – 6 days		
Response signed off	Redress action approved at appropriate desk	8-15 days	
Implementation/communication of response	Redress action implemented and update of progress on resolution communicated to complainant	5-9 days	

Source: REA, 2023.

However, if the complainants are not satisfied with the grievances process after arbitration, the affected person(s) still have the right to challenge the complaint through the court system.

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 issues.

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 job 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 have 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 7.7: 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
Total			13,500

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 7.8: Environmental Monitoring Programme for the Proposed Project

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

i. The Ondo State Environmental Protection Agency (OSEPA) requires institutional capacity support and it will be provided by Ministry of Environment.
ii. The agency needs assistance in the enforcement of development control regulations;
iii. Ondo 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 7.9: 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 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, Investigation & Reporting ● Excavation Safety ● First Aid, Defensive Driving etc. ● Project/Site Specific OHS ● Construction Site Inspection ● Personal Protective Equipment	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 & healthy working conditions for workers and monitoring officers	1 day	1,000.00
Total				2 days	3,000.00

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

7.9 ESMP Costing

Table 7.10 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 7.10: ESMP Costing

S/N	Fundamental ESMP Activities	Cost Estimates (US $)
1.	Pre-construction phase E&S management activities	4,700
	Construction phase E&S management activities	13,500
	Commissioning phase E&S management activities	700
	Operational phase E&S management activities	11,000
2.	Preparation of additional management plans	15,500
3.	Institutional Capacity Strengthening Plan	3,000
4.	Monitoring and Evaluation Programme	19,000
5.	GRM Implementation	6,550
Total		**73,950**

CHAPTER EIGHT

Remediation Plan After Decommissioning/Closure

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

8.1 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 25 years (which can be extended through regular maintenance) while the training centre can last for 40 years or more. Even after the 25 years, the PV panels can still generate up to 90% of the design capacity.

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.

8.2 Management of Decommissioning Activities

In the event of decommissioning, REA, in conjunction with the leadership of the AFUED, 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.

8.3 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 AFUED, the Federal Ministry of Environment (FMEnv) and the Ondo 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.

8.4 Roles, Responsibilities and Accountability

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 AFUED to address non- compliance and upcoming issues.

C.Adeyemi Federal University of Education 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 AFUED on contractor's performance regarding the implementation of environmental and social measures.

D. Director of Works and Physical Planning Department in AFUED

- 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/Ondo State Ministry o 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 (GRM)

9.1 Introduction

For a smooth and possible 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 the 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 AFUED 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 Summary of Stakeholders' Consultation

Furtherance to the completion of Focus Group Discussions (FGDs) with strata of stakeholders such as students (male and female), staff (academic and non-academic) and the University's management team between the 24th and 25th of April, 2026 the summary of the general response of stakeholders are presented in Table 9.1.

Table 9.1: Summary of Stakeholders' Engagements

Description	Summary of Stakeholders' Engagements for Proposed Beyond 1MW Solar Hybrid Power Project at the Adeyemi Federal University of Education, Ondo	
Date of Consultations	24th and 25th of April, 2026	
Language(s) of Communication	English	
Introduction	The purpose of the meeting, i.e., the proposed beyond 1MW solar hybrid project including the rationale of conducting the ESIA study were explained to the various stakeholders within the Adeyemi Federal University of Education, Ondo	
Group of Stakeholders	**General Concerns of Stakeholders**	**Response**
Staff (academic and non-academic)	1. Concerns of possible noise and air pollution were raised. 2. The commencement date of the project and possible abandonment 3. Issue of maintenance and sustainability of the solar hybrid project	1. The staff (academic and non-academic) were informed that adequate mitigation measures would be developed and also ensure that issues of noise and air pollution are mitigated. 2. The consulting team informed the staff that civil works will commence after the completion of the ESIA while they were also assured that the project will be completed. 3. The staff were informed that the REA will make provision for maintenance and also build the capacity of institution's personnel to enable sustainability of the project.
Students (male)	1. Accidents due to the equipment mobilization, transportation of workers and materials were raised across the project areas, 2. Also, issue of noise during rehabilitation activities was raised 3. Issues of possible exposures of students to abuse, influence to alcohol and substance abuse during rehabilitation were raised.	1. The students (boys) were informed that appropriate traffic management plan has been developed including road signages will be installed and speed limits will be enforced to reduce vehicular speed and avert accidents 2. Contractors will be advised to restrict the mobilization of

	4. Exposure to injuries due to unwholesome dumping of materials	equipment and transportation of workers/materials to off-school hours and weekends. 3. Access to the construction sites would be restricted and marked with tapes. 4. Also, the students were told that speed limits will be enforced by the contractors to reduce vehicular speed and ultimately avert accidents. 5. The students were informed that site workers would be required to maintain much silence as possible while major works such as digging, operation of concrete mixer, logging of planks and operation of noise-induced equipments would be restricted to off-school hours or weekends. 6. Also, workers shall sign the code of conduct to ensure compliance against sexual molestation and abuse. 7. More importantly, the students were assured that the site workers would be restricted to the site. 8. The students were also assured that site workers would wear means of identification and will not be allowed to stay near lecture rooms or to loiter unnecessarily. 9. The students were assured that materials and construction-induced waste would be handled appropriately. 10. Also, the students were informed of the availability of

		mechanisms for monitoring of the contractors by REA. 11. The students were also informed of the availability of GBV-GRM platforms.
Students (female)	1. The date of commencement of project. 2. The fear of disruptions of lectures and library activities due to the proposed project activities was raised. 3. Availability mechanisms to restrict movements to site. 4. Exposure to injuries due to unwholesome dumping of materials. 5. Possible accidents due to the mobilization of equipment, workers and materials were raised. 6. Also, issue of noise during civil works. 7. Fear of possible exposures of students to SEA/SH, influence to alcohol and substance abuse during implementation were raised.	1. The students (boys) were informed that appropriate traffic management plan has been developed including road signages will be installed and speed limits will be enforced to reduce vehicular speed and avert accidents 2. Contractors will be advised to restrict the mobilization of equipment and transportation of workers/materials to off-school hours and weekends. 3. Access to the construction sites would be restricted and marked with tapes. 4. Also, the students were told that speed limits will be enforced by the contractors to reduce vehicular speed and ultimately avert accidents. 5. The students were informed that site workers would be required to maintain much silence as possible while major works such as digging, operation of concrete mixer, logging of planks and operation of noise-induced equipment would be restricted to off-school hours or weekends. 6. Workers shall abide to the rules guiding against child abuse. 7. More importantly, the students were assured that the site workers would be restricted to the site.

		8. The students were also assured that site workers would wear means of identification and will not be allowed to stay move close to lecture rooms, library and health centre while none will be allowed to loiter unnecessarily. 9. The students were assured that materials and construction-induced waste would be handled appropriately. 10. The students were informed of the availability of mechanisms for monitoring of the contractors by REA. 11. The students were also informed of the availability of GBV-GM platforms.
Students' Union	1. Commencement date for the project. 2. Disturbance of academic activities due to noise from the project. 3. The potential for employment opportunities for some youths in the community and indigent students. 4. The men also expressed their concerns about the possibility of the project to result in traffic and possible accidents especially amongst the students and vulnerable groups.	1. The stakeholders were informed that the construction works will commence after the ESIA implementation. 2. Contractors will be advised to restrict the major activities to off-school hours and weekends. 3. Movements will be restricted while workers would sign code of conduct documents. 4.The consultant assured that concern will be noted in the ESMP report for the Contractor's attention. 5. The stakeholders were assured that necessary traffic management plan including limiting speed limits will be enforced by the contractors to reduce vehicular speed and ultimately avert accidents.

University's Management	1. The exposure of the University community members and other vulnerable groups to accidents. 2. Possible employment opportunities for youths in the community; 3. Possibility of supplying materials such as granite, stone etc	1. The consultant assured the stakeholders that appropriate mechanism for traffic management including speed limits, will be enforced while road signs and speed breakers will be installed especially near critical locations within the University etc. 2. Also, they were informed that the Contractors would employ Traffic Marshals who will also ensure adherence to traffic laws during the construction phase.
Remarks/Commitment	All the stakeholders affirmed their disposition and verbal commitment during the meeting to cooperate with the project workers.	

The evidences of stakeholders' engagement activities are shown in plates 9.1 and 9.2 below.

Plate 9.1: Photo Session with Some Members of University's Management, Adeyemi Federal University, Ondo Headed by Prof. Babayode Popoola (V/C)

Plate 9.2: Photo Session with Executives of Students' Union Government

9.1 Stakeholders' Engagement

A Stakeholder Engagement Plan (SEP) is the process of managing stakeholder expectations which influences project decisions throughout the life cycle of the project. This process provides a plan to interact effectively with stakeholders and support the project interest.it is very important to plan these activities well so that they appraise the contribution of stakeholders on projects, manage their expectations also achieve project objectives. Stakeholder engagement process focusing on free, prior and informed consultation (FPIC) shall be conducted with the community and other stakeholders, and take into account modalities of vulnerable and marginalized communities may be involved. The consultation shall include prior disclosure of information in a manner accessible and understandable to communities, key informant interviews, focus group discussion (male& female, youth) and public consultation. The consultation shall be documented with required facts, figures and evidence including participant list with contact details, photographs. Information shall be disclosed as per the requirement of National Regulations EIA Act No. 86 of 1992 (as amended by the EIA Cap E12 LFN 2004) and the African Development Bank's Integrated Safeguards System.

9.4 Objective of Stakeholders' 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.

9.5 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.

9.5.1 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.

9.5.2 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,
- Adeyemi Federal University of Education, 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.

9.5.3 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 (AFUED) • Electronic publications and press releases on the Project web-site. • Dissemination of hardcopies 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.

9.5.4 Stakeholders' 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.

9.6 Grievance Redress Mechanism (GRM)

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.

9.6.1 Grievance Redress Mechanism (GRM) Process

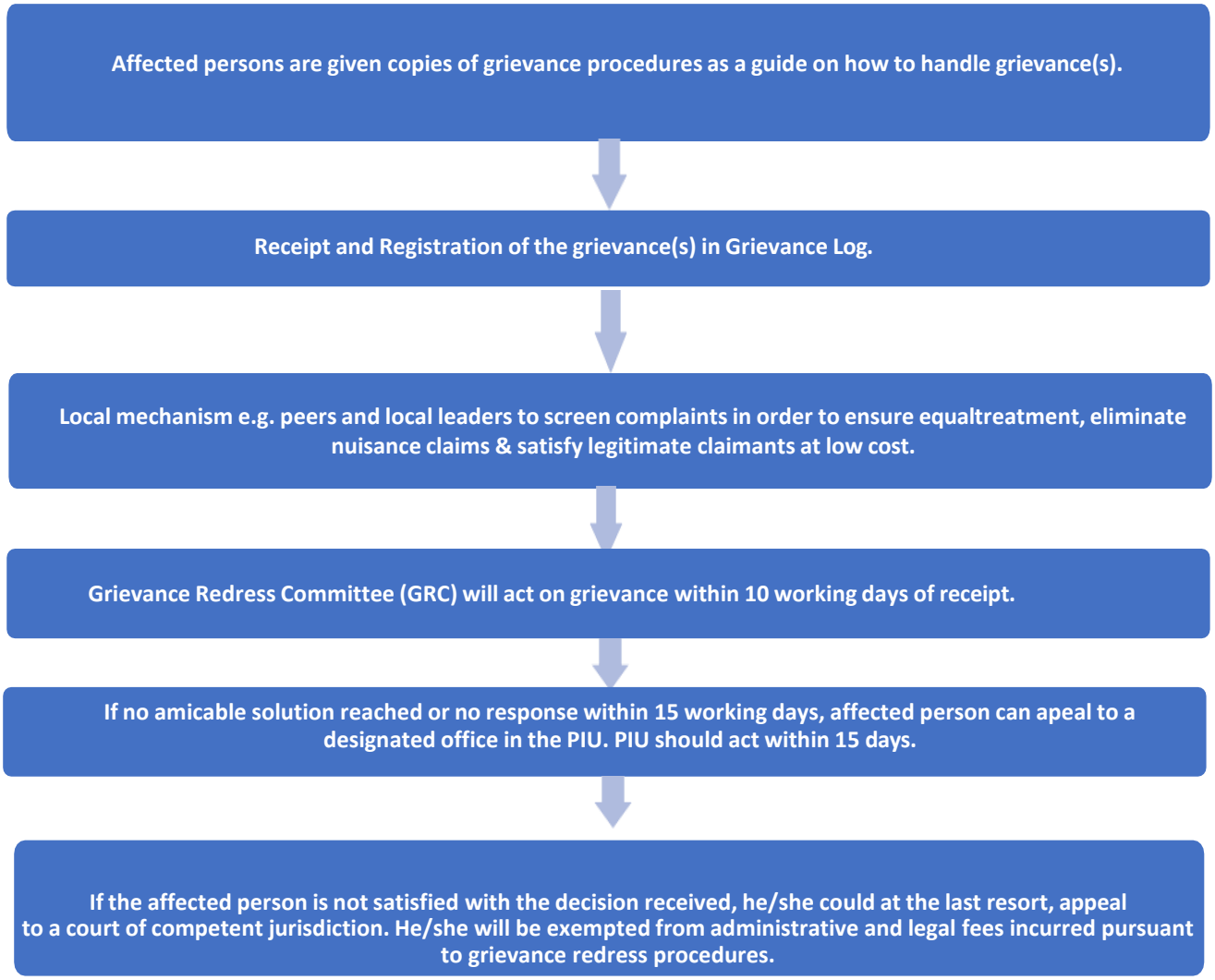

Figure 9. 1: GRM Process

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

9.5 Publicizing and Disclosure of GRM

The University will set up a project-specific Grievance Redress Mechanism (GRM) for people to report concerns or complaints, if they feel unfairly treated or are affected by any of the subprojects.

The mechanism will amongst other things:

(a) provide information about project implementation;
(b) provide a forum for resolving grievances and disputes at the lowest level;
(c) resolve disputes relatively quickly before they escalate to an unmanageable level;
(d) facilitate effective communication between the project and affected persons;
(e) win the trust and confidence of project beneficiaries and stakeholders and create productive relationships between the parties.

The mechanism is envisaged to be at multiple levels and will address such complaints, including logging, tracking, and resolving grievances promptly during and after the implementation of the Project.

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 Estimated Budget for GRM Implementation

The implementation of a roboust GRM depends majorly on the availability of fund. There, the estimated budget for successful implementation of GRM for the proposed project is presented in Table 9.2 below.

Table 9.2: Estimated Budget for GRM Dissemination

S/n	Description	Quantity	Unit Cost (US$)	Extended Cost (US$)
1.	Provision of Complaint Boxes	Lot	Lumpsum	400.00
2.	Capacity Building	Lot	Lumpsum	3,000,00
3.	Printing of forms and procurement of phones, hotline, communication material etc	Lot	Lumpsum	2,300.00
4.	Miscellaneous	Lot	Lumpsum	850,000
Total				**9,950**

9.7-Receiving and Recording Grievances

The PMU is responsible for setting up and maintaining the GRM that allows general public and affected communities or individuals 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.

The GRM will be communicated to all stakeholders in the course of REA's stakeholder engagement activities and remain available throughout the project cycle. It is expected to address concerns promptly an effectively, in a transparent manner that is culturally appropriate and readily accessible to all project affected parties, at no cost and without retribution. It also will allow for anonymous complains to be raise and addressed.

The PMU will assign a specific staff member to oversee that this is functioning properly. The consultants should review any existing GRM systems (government/traditional) that are operative in the area and propose ways that the GRM may fit within these systems. Ideally, the GRM should have second and third levels of appeal (including the court system, if appropriate, for legitimate claims that cannot be resolved at lower levels). The functioning of the GRM system, how to register complaints (written, by phone, or in person), where to go and hours of service, all should be clearly explained in local language during initial public consultations on the project. For the purpose of clear procedure below table present a typical grievance redress process and modality.

The GRM will entail the following;

i. Different ways in which users can submit their grievances, which may include submission in person, by phone, text message, mail, email or via a website;
ii. A lot where grievances are registered in writing and maintained as a database;
iii. Publicly advertised procedures, setting out the length of time users can expect to wait for acknowledgement, response, and resolution of their grievances;
iv. Transparency about the grievance procedure, governing structure and decision makers; and
v. An appeals process (including the national judiciary) to which unsatisfied grievances may be referred when resolution of grievance has not been achieved.

However, details of the Grievance Management Process for the proposed project is presented in Table 9.3: below.

Table 9.3: Grievance Management Process

Process	Description	Time Frame	Other Information
Identification of grievance	Face to face; phone; letter; mail; e-mail; website; recorded during public/ community interaction; others	1 day	Email address; hotline number
	The responsible party to receive the grievances will be REA and the subproject implementers		
	The grievance can also be passed through other parties, such as the chief office because the public are more conversant with this office.		
	The grievance receiver would then pass the complaint to REA contact person.		
Grievance assessed and logged	Significance assessed and grievance recorded or logged (i.e. in a log book)	3-6 Days	Significance criteria: i. Level 1 –one off e ii. Level 2 – comp widespread or rep iii. Level 3- any co (one off or repeat indicates breach policy or these provisions
	It will be prudent to have a grievance record book where the grievances are recorded for follow up		
Grievance is acknowledged	Acknowledgement of grievance through appropriate medium	3 Days	
		4-8 Days	
Development of response	Grievance assigned to appropriate party for resolution		
	Response development with input from management/ relevant stakeholders		
Response signed off	Redress action approved at appropriate	8-15 Days	Response signed off
Implementation /communication of response	Redress action implemented and update of progress on resolution communicated to complainant	5-9 Days	

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 9.4) 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. 4: 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.

9.7.1 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.

9.7.2 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

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.

9.7.3 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 9.5.

Table 9. 5: Classification and Categorization of External Grievances

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

9.7.4 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.

9.7.5 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.

9.8 Gender Based Violence (GBV) and Sexual Exploitation, Abuse and Harassment (SEAH)

All complaints related to GBV shall be treated in a private and confidential manner, limiting

information to what the survival or complainant is freely willing to provide. A separate register shall be opened for this category of cases and shall ONLY be accessed by the community-based GRC secretary, the GRM coordinator at the PMU (and any female GRC member empowered to handle GBV cases where the Chairman and Secretary are all male).

The complainant (if a survival) shall be attended to with empathy, assurance of safety and

confidentiality. In the event that the complainant is not willing to divulge any information, the GRM officer should respect this view, and the complainant referred to the appropriate nearest medical centre, approved with available GBV service provider or police, depending on the complainant's choice. Such a complaint should be reported to the World Bank Task Team as well by the PMU GRC.

Other considerations for the handling of GBV/SEA grievances include:

i. No GBV data on anyone who may be a survival should be collected without making referral services available to support them.
ii. All GBV complaint should be referred to the right service provider and other relevant

institutions, information to be requested should be limited to: The nature of the complaint (what the complainant says in her/his own words without direct questioning) If, to the best of their knowledge, the perpetrator was associated with the project.

9.9 Monitoring and Evaluation

These activities (M & E) are crucial and shall be carried out at regular intervals to ensure prompt resolution of complaints throughout the life-cycle of the project. The Project's Safeguards and Gender Leads in collaboration with the Sector's PM or designated Sector's GM Desk Officer will be vested with the responsibilities of leading the Monitoring and Evaluation (M&E) of the GRM.

However, the Key Performance Indicators (KPIs) that are necessary to be used to track the effectiveness of an existing (GRM) adapted from the World Bank's Evaluating a GRM (Dispute Resolution & Prevention), is presented in Table 9.6. The adapted KPI (as presented below) will be used for the monitoring and evaluation of the GRM for this proposed project.

Table 9.6: Key Performance Indicators (KPIs) for an Existing GRM

Key Performance Indicators (KPIs)	Questions
1.	Organizational Commitment
	Recognition disposition of the project's management and staff to the GRM process as a means of improving public administration and enhancing accountability and transparency.
	Assessment of the integration of GRM into the project's core activities?
	Level of integration of grievance redress into staff job descriptions and responsibilities.
	Availability of fund and personnel for monitoring GRM implementation
2. Principles	
2.1 Legitimacy	Degree of independence of the GRM (irrespective of the perceived interests).
	Perception of level of independence of the GRM.
2.2 Accessibility	Accessibility of the GRM to all stakeholders, irrespective of their distance of their locations, language or socio-economic status.
	Level of understanding and simplicity to file grievances and seek action by project beneficiaries
	Possibility of filling grievances without full disclosure of identity(ies) of aggrieved PAPs.
	Availability of options of access (emails, sms, calls, drop box etc)
	Level of awareness/publicity of the availability of a GRM to Project Affected Persons (PAPs).
2.3 Predictability	Responsiveness of the GRM responsive to the needs of all complainants?
	Availability of a clear procedure for GRM with time frames for each stage and clarity on the types of results it can (and cannot) deliver.
2.4 Fairness	Level of confidentiality, transparency and sincerity of the GRM.
2.5 Rights Compatibility	The consistency of the outcomes of the GRM with applicable national and international standards.
	Provision of other redress mechanisms.
2.6 Transparency	Degree of transparency of the GRM's procedures and outcomes in order to meet the desires of the public.
2.7 Capability	Availability of relevant skills (technical, human and financial) of personnel/team including the means and powers to investigate.
3. Staff	
	Availability of dedicated and trained staff to handle the GRM.
	Proficiency of staff/team in GRM including the availability for further training for review and improve performance.
4. Process	
4.1 Uptake	Availability of multiple uptake channels.
4.2 Sorting and processing	Availability of a system to categorize, assign priority and route grievances to the appropriate entity.

4.3. Acknowledgement and follow-up	Modus of available means of acknowledgement of complaints (whether in writing, calls etc).
	Details of the acknowledgement (whether it outline the GRM process, provide contact details) including time-frame to resolve the grievance.
	Availability or otherwise of a clear and publicized timetables.
4.4 Verification, investigation and action	Level of judgement of grievance against clearly defined standards.
	Level of neutrality of investigators neutral or the availability of conflict of interest.
	Time taken to address every grievance
4.5. Monitoring and Evaluation	Availability of tracking progress to track grievances and assess progress being made to resolve grievances.
	Availability of indicators to measure grievance monitoring and resolution.
	Possibility of data collection (if any) for policy and/or process changes to minimize similar grievances in future projects.
4.6. Feedback	Availability of a user-survey to obtain responses on the credibility of the GRM.
	Level of disclosure feedback to the public.
	Availability of rights to appeal (if yes) to GRM users.
4.7. Analysis	Possibility of process to analyze the effectiveness of the GRM
	Availability of time-frame to analyze the effectiveness of the GRM.

Adapted from: Evaluating a GRM (Dispute Resolution & Prevention), The World Bank

The report of such monitoring and evaluation activities would be presented and shared with the relevant Officers and departments within the PMU for necessary action(s).

CHAPTER TEN

Conclusion and Recommendations

10.1 Conclusion

The Environmental and Social Impact Assessment (ESIA) of the proposed 1MW based solar power Plant in Adeyemi Federal University of Education 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.

10.2 Recommendations

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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Appendices

Appendix 1: Terms of Reference for the preparation of Environmental and Social Impact Assessment in Adeyemi Federal University of Education, Ondo Town, Ondo State.

1. Introduction

The Federal Government of Nigeria (FGN) has received financing from the African Development Bank for the Nigeria Electrification Project (NEP) and intends to apply part of the proceeds for Consultancy Services for the preparation of an Environmental & Social Impact Assessment (ESIA).

2.0 Description of the Project

The Nigeria Electrification Project (NEP) is focused on practical, medium-term opportunities to significantly upscale electricity access through off-grid with different components. i.e., ***Component 1: Solar Hybrid Mini Grids for Rural Economic Development; Component 2: Productive Use Appliances and Equipment;*** and ***Component 3: Energizing Education Programme (EEP).***

Component 3: Energizing Education Programme (EEP)

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

- Energizing Education Programme: Electrification of 24 Federal Universities and Teaching Hospitals with solar-hybrid mini-grids exceeding 1 MW capacity per site.
- Energizing Healthcare Facilities: Deployment of reliable energy to health centres in underserved regions.
- 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 REQUIREMENT

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

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:

	Deliverables	Timeline *(After contract signing in weeks)*	*Payment (%age of Total Remuneration)*
.	**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.	2 weeks	20%

	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		
.	**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
	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
.	**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.

Report 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.

1.2 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	MSc 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	MSc 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	MSc in	• Minimum 7 years' post-graduation experience.

	Noise specialist	Environmental Sciences, 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	MSc 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	MSc 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	BSc 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	MSc 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	MSc or BSc 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	MSc 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	BSc in Social Sciences, Geography,	• Minimum 3 years post-graduation experience. • Two (2) years specific experience in land

	positions): 2 each to support the social survey and land survey	Statistics, or related discipline	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 Adeyemi Federal University of Education, Ondo

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. What type(s) of energy do you use for cooking?
    (a). Fuel wood ____; (b). Coal___; Kerosene____; (d). Gas____; Others (specify)_____
19. Means of transportation? (a). Road_; (b) Water__ (c). Motor bike (okada)___; (d). Others (specify)____
20. 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	

21. Is there any educational facility in your community? Yes_____; No_____
22. How far is the educational facility to your house? <200m___; 200-500m____;500- <1km____, 1km + above____
23. What are the most common crime(s) in this community?

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

24. Is there are police station in this community? Yes_____; No_____
25. How far is the police station to your house? <200m___; 200-500m____;500- <1km____, 1km + above____

Section C: Anticipated impact of the proposed project

26. In what way do you think the proposed solar mini grid project will affect your daily activities? (a). Positively_; (b); Negatively _____
27. 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)	

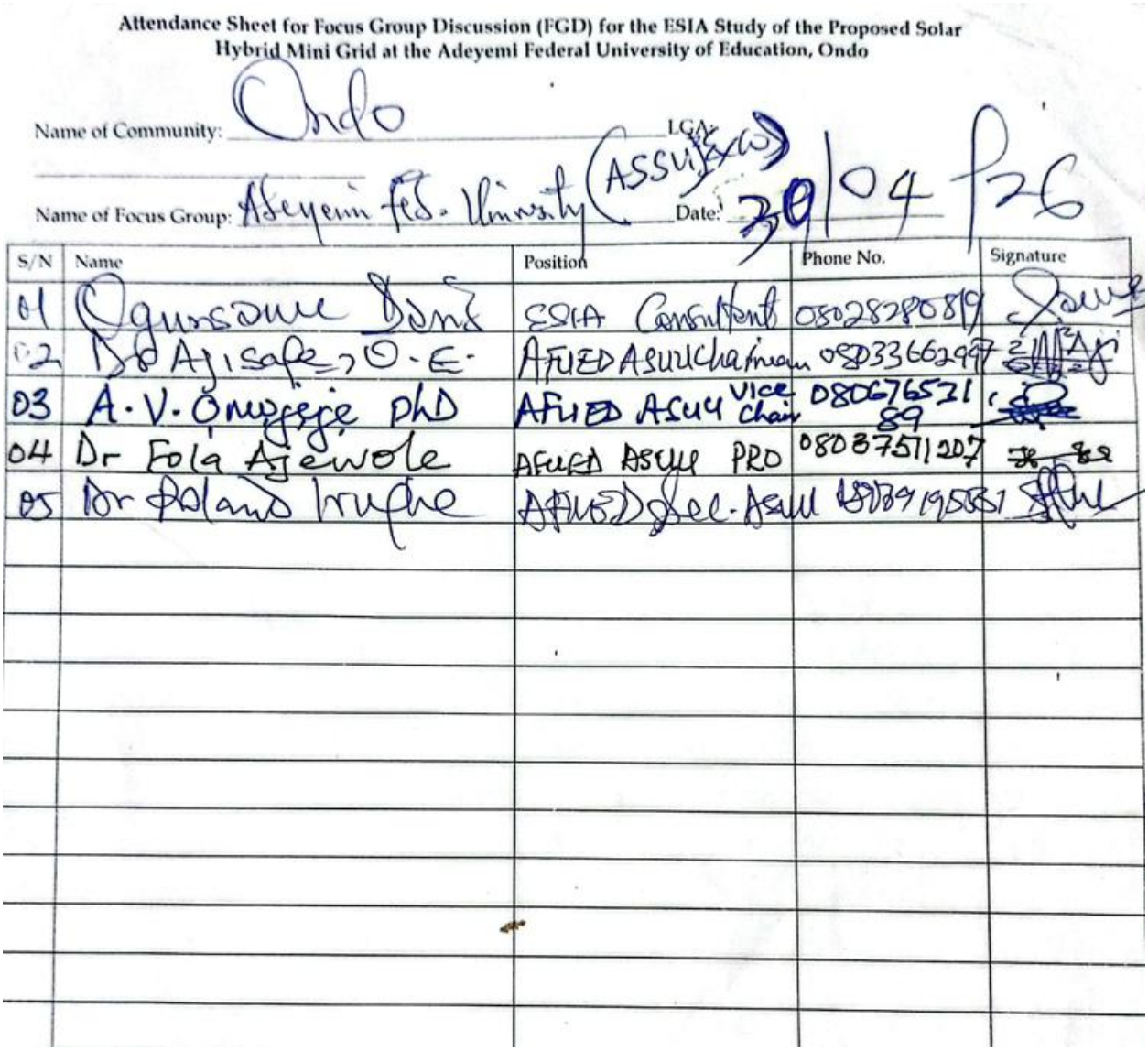
Appendix 2B

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 Adeyemi Federal University of Education, Ondo

Name of Community: Ondo LGA: (ASSU)

Name of Focus Group: Adeyemi Fed. University Date: 30/04/26

S/N	Name	Position	Phone No.	Signature
01	Ogunsanwo Dare	ESIA Consultant	08028780819	
02	Dr Ajisafe O.E.	AFUED ASUU Chairman	08033662997	
03	A.V. Omojeje PhD	AFUED ASUU Vice Chair	08067652189	
04	Dr Fola Ajewole	AFUED ASUU PRO	08037571207	
05	Dr Poland Irughe	AFUED Sec. ASUU	08039195881	

Attendance Sheet for Focus Group Discussion (FGD) for the ESIA Study of the Proposed Solar Hybrid Mini Grid at the Adeyemi Federal University of Education, Ondo

Name of Community: Ondo LGA:

Name of Focus Group: Adeyemi Fed Uni (SUG Exco) Date: 30/04/26

S/N	Name	Position	Phone No.	Signature
01	Ogunsawe Dare	Consultant (ESIA)	08028380819	
02	Adeyeni Oluwayo O	Deputy Senate Rep	09016735296	
03	Olanrewaju Olajumoke Destiny	Dir. of Social/Culture	07042414955	
04	Orelhinrere Oluwasemilaru E.	Dir. of Finance	09162304402	
05	Babalola Samson Olaya	General-Secretary	07048066156	
06	SIKIRU Taheed Adeyemi	Director Transport	09128558387	
07	Olasunkanmi Hammed O	Treasurer	08142238294	
08	James Friday	President	09156385985	
09	Adesemoye Segun A.	Chief Justice	08169161119	
10	Agbeye Modupe	Chief whip	07060593659	
11	Oyebanji Titilayo	Vice President	08027980	
12	Oyenpemi Ayuba A.	Chief clerk	07068608067	
13	Fadugbagbe precious O.	Asst. gen. sec	09063806003	

Appendix 4: Measured Meteorological and Noise Quality of the Study Area

Location(s)					Parameters									
Location Names	Description	Coordinates		Elevation (m)	SPM (µg/m³)		PM10 (µg/m³)	PM2.5	Meteorological Data		Gaseous Parameters		Noise Level (dB)	
		Latitude	Longitude											
ADEYEMI FEDERAL UNIVERSITY OF EDUCATION, (AFUED) Ondo State	AQ1-Bayo Akinnola Road	7.076505	4.818553	232.9	Max	33	12.6	5.0	Wind Speed (m/s)	0.8/1.1	CO (ppm)	0.0	Max	45.9
					Min	5			Temperature (°C)	32.4	CO_2(ppm)	400	Min	41.0
					TWA	21			Rel. Humidity (%)	66.3	NO_2(ppm)	0.0		
									Wind Direction	SE	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.1		
											O_2 (%)	20.9		
	AQ 2- Garri Processing Plant	7.076289	4.818549	232.3	Max	53.1	23.5	9.4	Wind Speed (m/s)	0.4/1.3	CO (ppm)	0.0	Max	78.7
					Min	13.0			Temperature (°C)	31.1	CO_2(ppm)	500	Min	60.5
					TWA	39.1			Rel. Humidity (%)	68.3	NO_2(ppm)	0.0		
									Wind Direction	SW	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	0.9		
											O_2 (%)	20.9		
	AQ3 – Proposed Project Location	7.076108	4.816049	236.2	Max	65.0	23.8	10.3	Wind Speed (m/s)	1.3/2.0	CO (ppm)	0.0	Max	46.5
					Min	7.0			Temperature (°C)	30.8	CO_2(ppm)	500	Min	61.7
					TWA	43.0			Rel. Humidity(%)	74.9	NO_2(ppm)	0.0		

									Wind Direction	SW	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.0		
											O_2 (%)	20.9		
	AQ4 - Proposed Project Location	7.076142	4.815575	233.7	Max	57.0	23.4	9.4	Wind Speed (m/s)	0.9/1.2	CO (ppm)	0.0	Max	55.0
					Min	10.0			Temperature (°C)	30.9	CO_2(ppm)	500	Min	44.0
					TWA	39.0			Rel. Humidity(%)	73.2	NO_2(ppm)	0.0		
									Wind Direction	SE	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	0.8		
											O_2 (%)	20.9		
	AQ5 - Proposed Project Location	7.075705	4.815189	235.2	Max	34.0	8.4	3.4	Wind Speed (m/s)	0.7/1.2	CO (ppm)	0.0	Max	66.1
					Min	5.0			Temperature (°C)	30.4	CO_2(ppm)	500	Min	31.7
					TWA	14.0			Rel. Humidity(%)	78.3	NO_2(ppm)	0.0		
									Wind Direction	SW	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	0.8		
											O_2 (%)	20.9		
	AQ6 – Proposed	7.076763	4.815933	234.2	Max	115.0	45.6	18.2	Wind Speed (m/s)	0.6/1.8	CO (ppm)	0.0	Max	76.6

	Project Location (By Fence)				Min	35.0			Temperature (°C)	31.1	CO_2(ppm)	600	Min	72.3
					TWA	76.0			Rel. Humidity(%)	78.8	NO_2(ppm)	0.0		
									Wind Direction	SE	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.1		
											O_2 (%)	20.9		
	AQ7- Near Borehole Rotimi Close (Residential Quarters)	7.07924	4.819290	232.3	Max	53.1	23.5	9.4	Wind Speed (m/s)	0.4/1.3	CO (ppm)	0.0	Max	78.7
					Min	13.0			Temperature (°C)	31.1	CO_2(ppm)	500	Min	60.5
					TWA	39.1			Rel. Humidity(%)	68.3	NO_2(ppm)	0.0		
									Wind Direction	SW	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	0.9		
											O_2 (%)	20.9		
	AQ8- Proposed Project Location	7.076108	4.816049	236.2	Max	65.0	23.8	10.3	Wind Speed (m/s)	1.3/2.0	CO (ppm)	0.0	Max	66.5
					Min	7.0			Temperature (°C)	30.8	CO_2(ppm)	500	Min	61.7
					TWA	43.0			Rel. Humidity(%)	74.9	NO_2(ppm)	0.0		
									Wind Direction	SW	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.0		
											O_2 (%)	20.9		

	AQ9 – Proposed Project Location	7.076101	4.8160452	236.2	Max	65.0	23.8	10.3	Wind Speed (m/s)	1.3/2.0	CO (ppm)	0.0	Max	68.3
					Min	7.0			Temperature (°C)	30.8	CO_2(ppm)	500	Min	63.2
					TWA	43.0			Rel. Humidity(%)	74.9	NO_2(ppm)	0.0		
									Wind Direction	SW	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.0		
											O_2 (%)	20.9		
	AQ10 – Proposed Project Location	7.076112	4.816049	236.2	Max	65.0	23.8	10.3	Wind Speed (m/s)	1.3/2.0	CO (ppm)	0.0	Max	63.3
					Min	7.0			Temperature (°C)	30.8	CO_2(ppm)	500	Min	51.7
					TWA	43.0			Rel. Humidity(%)	74.9	NO_2(ppm)	0.0		
									Wind Direction	SW	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.0		
											O_2 (%)	20.9		
	AQ11 – Proposed Project Location	7.076261	4.818540	236.2	Max	65.0	23.8	10.3	Wind Speed(m/s)	1.3/2.0	CO (ppm)	0.0	Max	65.1
					Min	7.0			Temperature (°C)	30.8	CO_2(ppm)	500	Min	61.7
					TWA	43.0			Rel. Humidity(%)	74.9	NO_2(ppm)	0.0		
									Wind Direction	SW	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		

											LEL(%)	0.0		
											VOC(ppm)	1.0		
											O_2 (%)	20.9		
	AQ12 – Proposed Project Location	7.076142	4.815545	236.2	Max	65.0	23.8	10.3	Wind Speed (m/s)	1.3/2.0	CO (ppm)	0.0	Max	60.3
					Min	7.0			Temperature(°C)	30.8	CO_2 (ppm)	500	Min	61.2
					TWA	43.0			Rel. Humidity (%)	74.9	NO_2(ppm)	0.0		
									Wind Direction	SW	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.0		
											O_2 (%)	20.9		
	AQ13 – Proposed Project Location	7.076141	E4.815581	236.2	Max	65.0	23.8	10.3	Wind Speed (m/s)	1.3/2.0	CO (ppm)	0.0	Max	60.1
					Min	7.0			Temperature (°C)	30.8	CO_2(ppm)	500	Min	51.7
					TWA	43.0			Rel. Humidity(%)	74.9	NO_2(ppm)	0.0		
									Wind Direction	SW	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.0		
											O_2 (%)	20.9		
	AQ14 –	7.076140	4.815564	236.2	Max	65.0	23.8	10.3	Wind Speed (m/s)	1.3/2.0	CO (ppm)	0.0	Max	6.5
					Min	7.0			Temperature (°C)	30.8	CO_2(ppm)	500	Min	61.7
					TWA	43.0			Rel. Humidity(%)	74.9	NO_2(ppm)	0.0		
									Wind Direction	SW	SO_2(ppm)	0.0		

	Proposed Project Location										NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.0		
											O_2 (%)	20.9		
	AQ15 – Proposed Project Location	7.075702.	4.819291	236.2	Max	65.0	23.8	10.3	Wind Speed (m/s)	1.3/2.0	CO (ppm)	0.0	Max	75.7
					Min	7.0			Temperature (°C)	30.8	CO_2(ppm)	500	Min	61.7
					TWA	43.0			Rel. Humidity(%)	74.9	NO_2(ppm)	0.0		
									Wind Direction	SW	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.0		
											O_2 (%)	20.9		
	AQ16 Proposed Project Location	7.075791	4.819275	232.9	Max	33	12.6	5.0	Wind Speed (m/s)	0.8/1.1	CO (ppm)	0.0	Max	73.2
					Min	5			Temperature (°C)	32.4	CO_2(ppm)	400	Min	41.0
					TWA	21			Rel. Humidity (%)	66.3	NO_2(ppm)	0.0		
									Wind Direction	SE	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.1		
											O_2 (%)	20.9		
	AQ17	7.075702	4.819278	232.9	Max	33	12.6	5.0	Wind Speed (m/s)	0.8/1.1	CO (ppm)	0.0	Max	`75.9
					Min	5			Temperature (°C)	32.4	CO_2(ppm)	400	Min	54.4

	Proposed Project Location Proposed Project Location				TWA	21			Rel. Humidity (%)	66.3	NO_2(ppm)	0.0		
									Wind Direction	SE	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.1		
											O_2 (%)	20.9		
	AQ18 -	7.075702	E4.819294	232.9	Max	33	12.6	5.0	Wind Speed (m/s)	0.8/1.1	CO (ppm)	0.0	Max	72.1
					Min	5			Temperature (°C)	32.4	CO_2(ppm)	400	Min	51.8
					TWA	21			Rel. Humidity (%)	66.3	NO_2(ppm)	0.0		
									Wind Direction	SE	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.1		
											O_2 (%)	20.9		
	AQ19 – Opposite Mother and Child Hospital)	7.076142	4.815567	232.9	Max	33	12.6	5.0	Wind Speed (m/s)	0.8/1.1	CO (ppm)	0.0	Max	88.9
					Min	5			Temperature (°C)	32.4	CO_2(ppm)	400	Min	71.2
					TWA	21			Rel. Humidity (%)	66.3	NO_2(ppm)	0.0		
									Wind Direction	SE	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.1		
											O_2 (%)	20.9		
	AQ20	7.073812	4.815485	243.4	Max	112.0	28.2	11.3	Wind Speed (m/s)	0.3/0.6	CO (ppm)	0.0	Max	75.7

	_ Control Mother & Child Hospital (Laje-Ondo Road)				Min	45.0			Temperature (°C)	28.3	CO_2(ppm)	600	Min	64.8
					TWA	47.0			Rel. Humidity(%)	84.6	NO_2(ppm)	0.0		
									Wind Direction	NE	SO_2(ppm)	0.0		
											NH_3(ppm)	0.0		
											H_2S(ppm)	0.0		
											LEL(%)	0.0		
											VOC(ppm)	1.2		
											O_2 (%)	20.9		

Appendix 5: Air Quality & Noise Sampling Map

Appendix 6: Satellite Image of the Proposed Project Area