



Amended Bidding Document

Plant Design, Supply & Installation Plus One (1) Year Operations & Maintenance (Without Prequalification)

For

Development Plus Operations & Maintenance of Solar Hybrid Mini Grids for Universities and A Teaching Hospital Open Competitive Bidding - International (AfDB -NEP)

Employer: Rural Electrification Agency
Project: Nigeria Electrification Project
Contract title: Development Plus Operations & Maintenance of Solar Hybrid Mini Grids for Universities and A Teaching Hospital (EEP-III of AfDB- NEP)
Country: Nigeria
ADB Loan No.: 200200003401
AGTF Loan No.: 5050200000551
RFB No: AfDB-NEP/OCBI/IFB/EEP-III/DSI-01
Issued on: 16th May 2023

INVITATION FOR BIDS

Plant Design, Supply and Installation Plus Operations & Maintenance (Without Prequalification)

IFB NUMBER: REA-AFDB NEP-EEP-III/DSI-01
Employer: RURAL ELECTRIFICATION AGENCY
Project: NIGERIA ELECTRIFICATION PROJECT - NEP
Contract title: DEVELOPMENT PLUS OPERATIONS & MAINTENANCE OF SOLAR HYBRID MINI GRIDS FOR EIGHT (8) FEDERAL UNIVERSITIES AND ONE (1) TEACHING HOSPITAL
Country: NIGERIA
ADB Loan No.: 200200003401
AGTF Loan No.: 5050200000551
Procurement Method: Open Competitive Bidding (International)
IFB OCBI No: AfDB-NEP/OCBI/IFB/EEP-III/DSI-01
Issued on: 16th May 2023

1. The Federal Government of Nigeria has received financing from the African Development Bank hereinafter called the Bank toward the cost of the Nigeria Electrification Project, and intends to apply part of the proceeds toward payments under the Contracts for **Development Plus Operations & Maintenance of Solar Hybrid Power Plants for Eight (8) Federal Universities and One (1) Teaching Hospital**. "For this contract, the Borrower shall process the payments using the Direct Payment disbursement method, as defined in the Bank's Disbursement Guidelines and procedures for Investment Project Financing, except for those payments, which the contract provides to be made through letter of credit."
2. The **Rural Electrification Agency** now invites sealed Bids from eligible Bidders to **develop and provide one-year operations and maintenance services to Eight Federal Universities and One (1) Teaching Hospital as the Third Phase of the Energizing Education Program (EEP-III)**. The contract period is estimated to be **Twenty-Four (24) months from the commencement date**.

3. Bidding will be conducted through the Open Competitive Bidding (International), OCBI procedures as specified in the Bank's [Procurement Framework](#) for group funded operations, October 2015, IFB and is open to all eligible Bidders as defined in the Procurement Framework.
4. Interested eligible Bidders may obtain further information from the Rural Electrification Agency (REA) – Nigeria Electrification Project (NEP), Attention: Abba Aliyu, afdbnep.procure@rea.gov.ng, and inspect the bidding document during office hours i.e. 09.00am to 17.00pm at the address given below:
5. The bidding document in English *language* may be purchased by interested eligible Bidders upon the submission of a written application to the address below and upon payment of a nonrefundable fee of Two Hundred Thousand Naira (N200,000.00). The method of payment will be via www.remita.net by generating Remita Retrieval Reference (RRR) in favor of Rural Electrification Agency – Nigeria Electrification Project. The document can be collected by the bidder or sent by courier upon additional payment of Twenty Thousand Naira (N20,000.00) for places within Nigeria, Forty Thousand Naira (N40,000.00) for places in Europe and West Africa, and Sixty Thousand Naira (N60,000.00) for all other countries to cover the cost of delivery.
6. Bids must be delivered to the address below on or before 11.00 am (WAT), 22nd June 2023. Late Bids will be rejected. Bids will be publicly opened in the presence of the Bidders' designated representatives and anyone who chooses to attend at the address below on 25th May 2023 at 11.00am (WAT).
7. All Bids must be accompanied by a "Bid Security" of the amount specified in the Bid Data Sheet (BDS).
8. Attention is drawn to the Procurement Framework requiring the Borrower to disclose information on the successful bidder's beneficial ownership, as part of the Contract Award Notice, using the Beneficial Ownership Disclosure Form as included in the bidding document.
9. The address referred to above is:

Nigeria Electrification Project (NEP)
Attn: Abba Aliyu, Head, PMU - NEP
No. 16, Umaru Dikko Street,
Jabi, Abuja.
E-mail: afdbnep.procure@rea.gov.ng

Standard Bidding Document

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PART 1 – Bidding Procedures

Section I - Instructions to Bidders

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Section I - Instructions to Bidders

A- General

1. Scope of Bid

- 1.1 In connection with the Specific Procurement Notice - Invitation for Bids (IFB), specified in the Bid Data Sheet (BDS), the Employer, as specified **in the BDS**, issues this bidding document for the Design, Supply and Installation of Plant as specified in Section VII, Employer's Requirements. The name, identification and number of "Whole of the Plant and Installation" hereafter called 'Plant', lots, each lot containing one or more 'Plant' (s) or packages, each package containing one or more lots of this IFB are specified **in the BDS**.
- 1.2 Throughout this bidding document:
- (a) the term "in writing" means communicated in written form (e.g. by mail, e-mail, fax, including if specified **in the BDS**, distributed or received through the electronic-procurement system used by the Employer) with proof of receipt;
 - (b) if the context so requires, "singular" means "plural" and vice versa;
 - (c) "**Day**" means calendar day, unless otherwise specified as "**Business Day**." A Business Day is any day that is an official working day of the Borrower. It excludes the Borrower's official public holidays;
 - (d) "**ES**" means environmental and social (including Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH));
 - (e) "**Sexual Exploitation and Abuse**" ("**SEA**") means the following:
 - (f) **Sexual Exploitation** is defined as any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another.
 - (g) **Sexual Abuse** is defined as the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions;
 - (h) "**Sexual Harassment**" ("**SH**") is defined as unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature by the Contractor's Personnel with other Contractor's or Employer's Personnel;
 - (i) "**Contractor's Personnel**" is as defined in GCC Sub-Clause 1; and

(j) **“Employer’s Personnel”** is as defined in GCC Sub-Clause 1.

A non-exhaustive list of (i) behaviors which constitute SEA and (ii) behaviors which constitute SH is attached to the Code of Conduct form in Section IV.

2. Source of Funds

- 2.1 The Borrower or Recipient (hereinafter called “Borrower”) indicated **in the BDS** has applied for or received financing (hereinafter called “funds”) from the Specific Financing Institution named in the BDS (hereinafter called “the Bank”) in an amount specified **in BDS**, toward the project named **in BDS**. The Borrower intends to apply a portion of the funds to eligible payments under the contract(s) for which this bidding document is issued.
- 2.2 Payment by the Bank will be made only at the request of the Borrower and upon approval by the Bank in accordance with the terms and conditions of the Loan (or other financing) Agreement. The Loan (or other financing) Agreement prohibits a withdrawal from the loan account for the purpose of any payment to persons or entities, or for any import of goods, equipment, plant, or materials, if such payment or import is prohibited by a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations. No party other than the Borrower shall derive any rights from the Loan (or other financing) Agreement or have any claim to the proceeds of the Loan (or other financing).

3. Fraud and Corruption

- 3.1 The Bank requires compliance with the Bank’s Integrity Framework comprising the African Development Bank Group’s Sanctions Procedures, the Bank’s Whistleblowing and Complaints Policy, the Bank’s Procurement Policy under the Procurement Framework and any other applicable Policies and Procedures including their updates in regard to corrupt and fraudulent practices, as set forth in Section VI.
- 3.2 In further pursuance of this policy, bidders shall permit and shall cause their agents (where declared or not), subcontractors, subconsultants, service providers, suppliers, and their personnel, to permit the Bank to inspect all accounts, records and other documents relating to any prequalification process, bid submission, and contract performance (in the case of award), and to have them audited by auditors appointed by the Bank.

4. Eligible Bidders

- 4.1 A Bidder may be a firm that is a private entity, a state-owned enterprise or institution subject to ITB 4.6, or any combination of such entities in the form of a joint venture,

consortium, or association hereinafter called JV, under an existing agreement or with the intent to enter into such an agreement supported by a letter of intent. In the case of a joint venture, consortium, or association (JV): a) Unless otherwise **specified in the BDS**, all members shall be jointly and severally liable for the execution of the entire Contract in accordance with the Contract terms; b) The JV shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the members of the JV during the Bidding process and, in the event the JV is awarded the Contract, during contract execution; c) The maximum number of members proposed in a JV shall not exceed the number **specified in the BDS**, or the number derived from the percentage specified under ITB 4.1 (d), whichever is smaller unless both are equal, in which case anyone shall apply; and d) Participation by value of the contract as share of each of the JV partner (member) shall not be less than the percentage **specified in the BDS**. In case of any inconsistency between ITB 4.1 (c) and ITB 4.1 (d) that both cannot be applied simultaneously, the latter shall prevail.

- 4.2 A Bidder shall not have a conflict of interest. Any Bidder found to have a conflict of interest shall be disqualified. A Bidder may be considered to have a conflict of interest for the purpose of this Bidding process, if the Bidder:
- (a) directly or indirectly controls, is controlled by or is under common control with another Bidder; or
 - (b) receives or has received any direct or indirect subsidy from another Bidder; or
 - (c) has the same legal representative as another Bidder; or
 - (d) has a relationship with another Bidder, directly or through common third parties, that puts it in a position to influence the Bid of another Bidder, or influence the decisions of the Employer regarding this Bidding process; or
 - (e) or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the Plant and Installation Services that are the subject of the Bid; or
 - (f) or any of its affiliates has been hired (or is proposed to be hired) by the Employer or Borrower as Project Manager for the Contract implementation; or
 - (g) would be providing goods, works, or non-consulting services resulting from or directly related to consulting services for the preparation or implementation of the project specified in the BDS ITB 2.1 that it provided or were provided by any affiliate that directly or indirectly controls, is controlled by, or is under common control with that firm; or

(h) has a close business or family relationship with a professional staff of the Borrower (or of the project implementing agency, or of a recipient of a part of the loan) who: (i) are directly or indirectly involved in the preparation of the bidding document or specifications of the Contract, and/or the Bid evaluation process of such Contract; or (ii) would be involved in the implementation or supervision of such contract unless the conflict stemming from such relationship has been resolved in a manner acceptable to the Bank throughout the Bidding process and execution of the Contract.

- 4.3 A firm that is a Bidder (either individually or as a JV member) shall not participate as a Bidder or as JV member in more than one Bid except for permitted alternative Bids. Such participation shall result in the disqualification of all Bids in which the firm is involved. However, this does not limit the participation of a Bidder as subcontractor in another Bid or of a firm as a subcontractor in more than one Bid.
- 4.4 A Bidder and all parties constituting the Bidder including subcontractors, suppliers and affiliates shall have the nationality of an eligible country of the Bank in accordance with the Bank's Procurement Policy for Bank Group Funded Operations described under the Bank's Procurement Framework, and as listed in Section V, Eligible Countries. Subject to the restrictions pursuant to ITB 4.8. A Bidder shall be deemed to have the nationality of a country if the Bidder is constituted, incorporated or registered in and operates in conformity with the provisions of the laws of that country, as evidenced by its articles of incorporation (or equivalent documents of constitution or association) and its registration documents, as the case may be. This criterion also shall apply to the determination of the nationality of proposed subcontractors or subconsultants for any part of the Contract including related Services.
- 4.5 A Bidder that has been sanctioned by the Bank, pursuant to the Bank's Integrity Framework in accordance with its prevailing sanctions policies and procedures as set forth in the Bank's Integrity Framework as described in Section VI paragraph 2.2 (d), shall be ineligible to be prequalified for, bid for, or be awarded a Bank-financed contract or benefit from a Bank-financed contract, financially or otherwise, during such period of time as the Bank shall have determined. The list of debarred firms and individuals is available at the electronic address specified in the BDS.
- 4.6 Bidders that are state-owned enterprises or institutions in the Employer's Country may be eligible to compete and be awarded a Contract(s) only if they can establish, in a manner acceptable to the Bank, that they (i) are legally and financially autonomous (ii) operate under commercial law, and (iii) are not under supervision of the Employer.

- 4.7 A Bidder shall not be under suspension from Bidding by the Employer as the result of the operation of a Bid-Securing Declaration.
- 4.8 Firms and individuals may be ineligible if so indicated in Section V and: (a) as a matter of law or official regulations, the Borrower's country prohibits commercial relations with that country, provided that the Bank is satisfied that such exclusion does not preclude effective competition for the supply of goods or the contracting of works or services required; or (b) by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's country prohibits any import of goods or contracting of works or services from that country, or any payments to any country, person, or entity in that country. Where the procurement is implemented across jurisdictional boundaries (and more than one country is a Borrower, and is involved in the procurement), then exclusion of a firm or individual on the basis of ITB 4.8 (a) above by any country may be applied to that procurement across other countries involved, if the Bank and the Borrowers involved in the procurement agree.
- 4.9 A Bidder shall provide such documentary evidence of eligibility satisfactory to the Employer, as the Employer shall reasonably request.
- 4.10 A firm that is under a sanction of debarment by the Borrower from being awarded a contract is eligible to participate in this procurement, unless the Bank, at the Borrower's request, is satisfied that the debarment; (a) relates to fraud or corruption, and (b) followed a judicial or administrative proceeding that afforded the firm adequate due process.

5. Eligible Plant and Equipment, Installation and Other Services

- 5.1 For the purpose of this bidding document, the words "facilities", "Plant and Equipment", Services such as "Installation Services", "Design Services", etc. shall be construed in accordance with the respective definitions and/or descriptions given to them in the General Conditions of Contract, Specifications and other parts of the Bidding Documents. All plant and equipment to be supplied and installation and other services carried out under the Contract and financed by the Bank shall have their origin in an eligible country of the Bank in accordance with the Bank's Procurement Policy for Bank Group Funded Operations described under the Bank's Procurement Framework, and as listed in Section V, Eligible Countries subject to the restrictions specified therein and all expenditures made under the contract shall be limited to such plant, equipment, and services.
- 5.2 For purposes of ITB 5.1 above, "origin" means the place where the plant, or component parts thereof are mined, grown, produced or manufactured, and from

which the services are provided. Plant components are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that is substantially different in its basic characteristics or in purpose or utility from its components.

- 5.3 The nationality of the firm that produces, assembles, distributes, or sells the materials and equipment shall not determine their origin.

B- Contents of Bidding Document

6. Sections of Bidding Document

- 6.1 The bidding document consists of Parts 1, 2, and 3, which include all the sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB 8.

PART 1. Bidding Procedures

- Section I - Instructions to Bidders (ITB)
- Section II - Bid Data Sheet (BDS)
- Section III - Evaluation and Qualification Criteria
- Section IV - Bidding Forms
- Section V - Eligible Countries
- Section VI - Fraud and Corruption

PART 2. Employer's Requirements

- Section VII -Employer's Requirements

PART 3. Conditions of Contract and Contract Forms

- Section VIII - General Conditions of Contract (GCC)
- Section IX -Particular Conditions of Contract (PCC)
- Section X -Contract Forms

- 6.2 The Specific Procurement Notice-Invitation for Bids (IFB) issued by the Employer is not part of the bidding document.
- 6.3 Unless obtained directly from the Employer, the Employer is not responsible for the completeness of the document, responses to requests for clarification, the Minutes of the pre-Bid meeting (if any), or Addenda to the bidding document in accordance

with ITB 8. In case of any contradiction, documents obtained directly from the Employer shall prevail.

- 6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the bidding document and to furnish with its Bid all information or documentation as is required by the bidding document.

7. Clarification of Bidding Document, Site Visit, Pre-Bid Meeting

- 7.1 A Bidder requiring any clarification of the bidding document shall contact the Employer in writing at the Employer's address indicated **in the BDS** or raise his enquiries during the pre-Bid meeting if provided for in accordance with ITB 7.4. The Employer will respond in writing to any request for clarification, provided that such request is received prior to the deadline for submission of Bids within a period specified **in the BDS**. The Employer shall forward copies of its response to all Bidders who have acquired the bidding document in accordance with ITB 6.3, including a description of the inquiry but without identifying its source. If so specified **in the BDS**, the Employer shall also promptly publish its response at the web page identified **in the BDS**. Should the clarification result in changes to the essential elements of the bidding document, the Employer shall amend the bidding document following the procedure under ITB 8 and ITB 23.2.
- 7.2 The Bidder is advised to visit and examine the site where the plant is to be installed and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Bid and entering into a Contract for the provision of Plant and Installation Services. The costs of visiting the site shall be at the Bidder's own expense.
- 7.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.
- 7.4 If so specified **in the BDS**, the Bidder's designated representative is invited to attend a pre-Bid meeting and/or a site visit. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
- 7.5 The Bidder is requested to submit any questions in writing, to reach the Employer not later than one week before the meeting.

7.6 Minutes of the pre-Bid meeting, including the text of the questions raised without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the bidding document in accordance with ITB 6.3. If so specified **in the BDS**, the Employer shall also promptly publish the Minutes of the pre-Bid meeting at the web page identified **in the BDS**. Any modification to the bidding document that may become necessary as a result of the pre-Bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to ITB 8 and not through the minutes of the pre-Bid meeting. Nonattendance of the pre-Bid meeting will not be a cause for disqualification of a Bidder.

8. Amendment of Bidding Document

- 8.1 At any time prior to the deadline for submission of Bids, the Employer may amend the bidding document by issuing addenda.
- 8.2 Any addendum issued shall be part of the bidding document and shall be communicated in writing to all who have obtained the bidding document from the Employer in accordance with ITB 6.3. The Employer shall also promptly publish the addendum on the Employer's web page in accordance with ITB 7.1.
- 8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Employer may, at its discretion, extend the deadline for the submission of bids, pursuant to ITB 23.2.

C- Preparation of Bids

9. Cost of Bidding

- 9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Employer shall not be responsible or liable for those costs, regardless of the conduct or outcome of the Bidding process.

10. Language of Bid

- 10.1 The Bid, as well as all correspondence and documents relating to the Bid exchanged by the Bidder and the Employer, shall be written in the language specified **in the BDS**. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language specified **in the BDS**, in which case, for purposes of interpretation of the Bid, such translation shall govern.

11. Documents Comprising the Bid

11.1 The Bid shall comprise the following:

- (a) **Letter of Bid** prepared in accordance with ITB12.1;
- (b) **Price Schedules** completed in accordance with ITB 12 and ITB 17;
- (c) **Bid Security or Bid Securing Declaration**, in accordance with ITB 20;
- (d) **Technical Bid of Base Bid**;
- (e) **Commercial Terms and Conditions**;
- (f) **Alternative Technical Bid**, if permissible, in accordance with ITB 13;
- (g) **Authorization**: written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 21.3;
- (h) **Eligibility of Plant and Installation Services**: documentary evidence established in accordance with ITB 14.1 that the Plant and Installation Services offered by the Bidder in its Bid or in any alternative Bid, if permitted, are eligible;
- (i) **Bidder's Eligibility and Qualifications**: documentary evidence in accordance with ITB 15.1 establishing the Bidder's eligibility and qualifications to perform the Contract if its Bid is accepted;
- (j) **Conformity**: documentary evidence in accordance to ITB 16, ITB 30 and ITB 31, and in support of above sub-paragraphs (d) and (e) of ITB 11.1, as necessary, to establish that the Plant and Installation Services, and Terms and Conditions of the bid offered by the Bidder conform to the requirements and provisions of the bidding document;
- (k) **Subcontractors**: list of subcontractors in accordance with ITB 16.2; and
- (l) **any other document required in the BDS.**

11.2 In addition to the requirements under ITB 11.1, Bids submitted by a JV shall include a copy of the Joint Venture Agreement entered into by all members. Alternatively, a letter of intent to execute a Joint Venture Agreement in the event of a successful Bid shall be signed by all members and submitted with the Bid, together with a copy of the proposed Agreement.

11.3 The Bidder shall furnish in the Letter of Bid information on commissions and gratuities, if any, paid or to be paid to agents or any other party relating to this Bid.

12. Letter of Bid and Price Schedules

12.1 The Letter of Bid and Price Schedules shall be prepared, using the relevant forms furnished in Section IV, Bidding Forms. The forms must be completed as instructed in each form without any alterations to the text, and no substitutes shall be accepted except as provided under ITB 21.3. All blank spaces shall be filled in with the information requested.

13. Alternative Bids

13.1 Unless otherwise specified **in the BDS**, alternative Bids shall not be considered. If Alternative Bids are permitted, the BDS shall specify which of the following ITB (s) namely, ITB 13.2, ITB 13.3 or ITB 13.4 shall be considered.

13.2 When alternatives to the Time Schedule are explicitly invited, a statement to that effect will be included **in the BDS**, and the method of evaluating different time schedules will be described in Section III, Evaluation and Qualification Criteria.

13.3 Except as provided under ITB 13.4 below, and if permitted under BDS, Bidders wishing to offer technical alternatives to the Employer's requirements as described in the bidding document must also provide: (i) a price at which they are prepared to offer a Plant meeting the Employer's requirements; and (ii) all information necessary for a complete evaluation of the alternatives by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed installation methodology and other relevant details. Only the technical alternatives, if any, of the Bidder with the Lowest Evaluated Bid conforming to the basic technical requirements shall be considered by the Employer.

13.4 When Bidders are invited **in the BDS** to submit alternative technical solutions for specified parts of the facilities, such parts will be identified **in the BDS**, and described in Section VII, Employer's Requirements. The method for their evaluation will be stipulated in Section III, Evaluation and Qualification Criteria.

14. Documents Establishing the Eligibility of the Plant and Equipment, their Installation and Other Services

14.1 To establish the eligibility of the Plant and Equipment, their Installation and other Services performed under the contract, in accordance with ITB 5, Bidders shall complete the Letter of Bid, and country of origin declarations in the Price Schedule Forms, included in Section IV, Bidding Forms.

15. Documents Establishing the Eligibility and Qualifications of the Bidder including proposed subcontractors and manufacturers

15.1 To establish its eligibility and qualifications to perform the Contract in accordance with Section III, Evaluation and Qualification Criteria, the Bidder shall complete the Letter of Bid and provide all documentation and information with respect to the Bidder, its subcontractors, specialized subcontractors and/or manufacturers proposed in the bid including those as requested in the corresponding forms included in Section IV, Bidding Forms.

16. Documents Establishing the Conformity of the Plant and Installation Services

16.1 The Bidder shall furnish the information stipulated in Section IV, Bidding Forms in sufficient detail to demonstrate substantial responsiveness of the Bidders' proposal to the work requirements and the completion time. The Bidder shall furnish details of the technical specifications proposed in the Technical part of the Bid including all relevant technical information requested by the Employer, functional guarantees, standards, codes, etc. as applicable, and details of any deviations, reservations, omissions or exceptions in the Technical Bid form included in Section IV. The Bidder shall demonstrate substantial responsiveness with required technical specifications of the Plant and Installation and no change in substance will be permitted after bid opening regardless of any replacement of a subcontractor or manufacturer determined unacceptable as provided under ITB 39.

16.2 For major items of Plant and Installation Services as listed by the Employer in Section III, Evaluation and Qualification Criteria, which the Bidder intends to purchase or subcontract, the Bidder shall give details of the name and nationality of the proposed Subcontractors, including manufacturers, for each of those items at the option of the Bidder, one or more than one firm for each item. In addition, the Bidder shall include in its Bid information and supporting documentation establishing conformity and compliance with the technical requirements specified by the Employer for these items including the qualification information of the subcontractor, specialized subcontractors and manufacturers establishing that they meet the minimum qualification criteria for respective items. Quoted rates and prices will be deemed to apply to whichever Subcontractor is appointed, and no adjustment of the rates and prices will be permitted.

16.3 The Bidder shall be responsible for ensuring that any Subcontractor, specialized subcontractor and manufacturer proposed complies with the requirements of ITB 4, and that any plant, or services to be provided by the Subcontractor, specialized subcontractor and manufacturer comply with the requirements of ITB 5 and ITB 16.1.

17. Bid Prices and Discounts

- 17.1 Unless otherwise specified in the **BDS**, Bidders shall quote for the entire Plant and Installation Services on a "single responsibility" basis. The total Bid price shall include all the Contractor's obligations mentioned in or to be reasonably inferred from the bidding document in respect of the design, manufacture, including procurement and subcontracting (if any), delivery, construction, installation and completion of the Plant. This includes all requirements under the Contractor's responsibilities for testing, pre-commissioning and commissioning of the plant and, where so required by the bidding document, the acquisition of all permits, approvals and licenses, etc.; the operation, maintenance and training services and such other items and services as specified in the bidding document, all in accordance with the requirements of the General Conditions. Items against which no price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed to be covered by the prices for other items. An item not listed in the Price Schedule shall be assumed not to be included in the Bid, and provided that the Bid is determined substantially responsive notwithstanding this omission, the average price or the highest price of the item as **specified in the BDS** quoted by substantially responsive Bidders will be added to the Bid price and the equivalent total cost of the Bid so determined will be used for price comparison.
- 17.2 Bidders are required to quote the price for the commercial, contractual and technical obligations outlined in the bidding document.
- 17.3 Bidders shall give a breakdown of the prices in the manner and detail called for in the Price Schedules included in Section IV, Bidding Forms.
- 17.4 Depending on the scope of the Contract, the Price Schedules may comprise up to the six (6) schedules listed below. Separate numbered Schedules included in Section IV, Bidding Forms, from those numbered 1 to 4 below, shall be used for each of the elements of the Plant and Installation Services. The total amount from each Schedule corresponding to an element of the Plant and Installation Services shall be summarized in the schedule titled Grand Summary, (Schedule 5), giving the total Bid price(s) to be entered in the Letter of Bid. Bidders shall note that the plant and equipment included in Schedule Nos. 1 and 2 below exclude materials used for civil, building and other construction works. All such materials shall be included and priced under Schedule No. 4, Installation Services. The Schedules comprise:

Schedule No. 1: Plant (including Mandatory Spare Parts) Supplied from Abroad

Schedule No. 2: Plant (including Mandatory Spare Parts) Supplied from within the Employer's Country

Schedule No. 3: Design Services

Schedule No. 4: Installation Services

Schedule No. 5: Grand Summary (Schedule Nos. 1 to 4)

Schedule No. 6: Recommended Spare Parts

17.5. In the Schedules, Bidders shall give the required details and a breakdown of their prices as follows:

(a) Plant to be supplied from abroad (Schedule No. 1):

The price of the Plant shall be quoted on CIP-named place of destination basis as specified **in the BDS**.

(b) Plant manufactured within the Employer's Country (Schedule No. 2):

(i) The price of the plant shall be quoted on an EXW Incoterm basis (such as "ex-works," "ex-factory," "ex-warehouse" or "off-the-shelf," as applicable);

(ii) Sales tax and all other taxes payable in the Employer's Country on the plant if the contract is awarded to the Bidder;

(c) Design Services (Schedule No. 3) and shall include all taxes, levies, charges, etc. payable, if any, on such services as of twenty-eight (28) days prior to the deadline for submission of Bids;

(d) Installation Services shall be quoted separately (Schedule No. 4) and subject to provision under ITB 17.5 (d), (i) shall include rates or prices for local transportation to named place of final destination as specified **in the BDS**, insurance and other services incidental to delivery of the plant, all labor, contractor's equipment, temporary works, materials, consumables and all matters and things of whatsoever nature, including operations and maintenance services, the provision of operations and maintenance manuals, training, etc., where identified in the bidding document, as necessary for the proper execution of the installation and other services, including all taxes, duties, levies and charges payable in the Employer's Country as of twenty-eight (28) days prior to the deadline for submission of Bids; and (ii) subject to provisions under ITB 17.5 (d) (i), and except when the place of destination and final destination is the same, the prices quoted under Schedule 1 will be quoted on the basis of CIP place of final destination and such prices shall include the

cost of local transportation and Insurance, etc. up to the final destination place and therefore in such a case, Schedule 4 will not include costs of local transportation, Insurance, etc. related to items in Schedule 1 already included in prices under Schedule 1.

- (e) Recommended spare parts shall be quoted separately (Schedule 6) as specified in either subparagraph (a) or (b) above in accordance with the origin of the spare parts.

17.6 The terms EXW, CIP, and other similar terms shall be governed by the rules prescribed in the current edition of Incoterms, published by the International Chamber of Commerce, as specified **in the BDS**.

17.7 The prices shall be either fixed or adjustable as specified **in the BDS**.

17.8 In the case of **Fixed Price**, prices quoted by the Bidder shall be fixed during the Bidder's performance of the contract and not subject to variation on any account. A Bid submitted with an adjustable price quotation will be treated as non-responsive and rejected.

17.9 In the case of **Adjustable Price**, prices quoted by the Bidder shall be subject to adjustment during performance of the contract to reflect changes in the cost elements such as labor, material, transport and contractor's equipment in accordance with the procedures specified in the corresponding Appendix to the Contract Agreement. A Bid submitted with a fixed price will not be rejected, but the price adjustment will be treated as zero unless otherwise stated in the BDS in which case the Bid with a fixed price shall be rejected. Bidders are required to indicate the source of labor and material indices in the corresponding Form in Section IV, Bidding Forms.

17.10 Unless otherwise specified in the BDS, Bid are being invited for 'Plant' as a single contract (or as one lot). If so indicated in ITB 1.1, and the Employer requires several "Plants" and all such Plants are grouped into lots and/or packages. In such case, Bids are being invited for individual lots (contracts) or for any combination of lots (packages) as specified in the BDS. Bidders wishing to offer any price reduction (discount) for the award of more than one Contract shall specify in their Letter of Bid the price reductions applicable to each contract, lot, and package as the case may be. Bidders shall fully explain the methodology and calculations for applying the discounts, showing how the reductions were derived and what are the net amounts of each contract after application of the discounts including how discounts will be applied to individual items to determine the net prices of the items included in the

Contract. Discounts should be submitted with due regard to the consequences of unclear or ambiguous discounts as per ITB 17.12. Discounts for combination of lots or packages can be considered only when they are opened at the same time.

17.11 Bidders wishing to offer any unconditional discount (unrelated to combination of contracts or without any conditions) shall specify in their Letter of Bid the offered discounts and the manner in which price discounts will apply along the lines of ITB 17.10 and ITB 17.12.

17.12 Discounts offered shall be clear and without any ambiguity to avoid rejection of bid as no clarification shall be requested or permitted on this account after bid submission. The Employer's decision on a bid's discount will be based on the contents of the bid itself, without recourse to any extrinsic evidence. If in the Employer's opinion, which shall be final, a discount offered in the bid: i) is unclear, ambiguous or vaguely presented to the extent that it cannot be either interpreted or applied with reasonable accuracy, the Bid shall be rejected; ii) relates to any item of cost where the Employer has indicated its estimated cost in the bidding document, the bid will be evaluated without the discount applicable to such an item; and iii) has a minor discrepancy or unclarity which could be interpreted reasonably, the Employer in this case may decide to apply the discount as it deems reasonable and appropriate resulting in the lowest evaluated cost to the Employer. If the Bidder does not accept the Employer's decision based on any of the above, the Bid shall be rejected.

18. Currencies of Bid and Payment

18.1 The currency(ies) of the Bid and the currency(ies) of payments shall be the same. The Bidder shall quote in the currency of the Employer's country the portion of the Bid price that corresponds to expenditures incurred in the currency of the Employer's Country, unless otherwise specified **in the BDS**.

18.2 The Bidder may express the Bid price in any currency. If the Bidder wishes to be paid in a combination of amounts in different currencies, it may quote its price accordingly but shall use no more than three foreign currencies in addition to the currency of the Employer's Country.

19. Period of Validity of Bids

19.1 Bids shall remain valid for the Bid Validity period specified **in the BDS**. The Bid Validity period starts from the Bid submission deadline (as prescribed by the Employer in accordance with ITB 23.1). A Bid valid for a shorter period shall be rejected by the Employer as nonresponsive.

19.2 In exceptional circumstances, prior to the expiration of the Bid validity period, the Employer may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a Bid Security is requested in accordance with ITB 20, the Bidder granting the request shall also extend the Bid Security for twenty-eight (28) days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its Bid Security. A Bidder granting the request shall not be required or permitted to modify its Bid, except as provided in ITB 19.3.

19.3 If the award is delayed by a period exceeding fifty-six (56) days beyond the expiry of the initial Bid validity period, the Contract price shall be determined as follows:

- (a) in the case of **fixed price** contracts, the Contract price shall be the Bid price adjusted by the factor or factors specified **in the BDS** to reflect any increase in the cost of inputs over the period of extension, which for the purpose of this adjustment, shall be the period elapsed between the date arrived immediately after expiry of fifty-six (56) days beyond the initial Bid validity period and the date of notification of award;
- (b) in the case of **adjustable price** contracts, no adjustment shall be made; or
- (c) in any case, Bid evaluation shall be based on the Bid price without taking into consideration the applicable correction from those indicated above.

20. Bid Security

20.1 The Bidder shall furnish as part of its Bid, either a Bid-Securing Declaration or a Bid Security amount as specified **in the BDS**, in original form and, in the case of a Bid Security amount, in the amount and currency specified **in the BDS**.

20.2 A Bid-Securing Declaration shall use the form included in Section IV Bidding Forms.

20.3 If a Bid Security amount is specified pursuant to ITB 20.1, the Bid security shall be a demand guarantee in any of the following forms at the Bidder's option:

- (a) an unconditional guarantee issued by a bank or non-bank financial institution (such as an insurance, bonding or surety company);
- (b) an irrevocable letter of credit;
- (c) a cashier's or certified check; or
- (d) another security indicated **in the BDS**,

from a reputable source from an eligible country. If an unconditional guarantee is issued by a non-bank financial institution located outside the Employer's Country the issuing non-bank financial institution shall have a correspondent financial institution located in the Employer's Country to make it enforceable unless the Employer has agreed in writing, prior to Bid submission, that a correspondent financial institution is not required. In the case of a bank guarantee, the Bid Security shall be submitted either using the Bid Security Form included in Section IV, Bidding Forms, or in another substantially similar format approved by the Employer prior to Bid submission. The Bid Security shall be valid for twenty-eight (28) days beyond the original validity period of the Bid, or beyond any period of extension if requested under ITB 19.2.

- 20.4 If a Bid Security in amount or a Bid-Securing Declaration is specified pursuant to ITB 20.1, any Bid not accompanied by a substantially responsive Bid Security in amount or Bid-Securing Declaration shall be rejected by the Employer as nonresponsive.
- 20.5 If a Bid Security is specified pursuant to ITB 20.1, the Bid Security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder's signing the Contract and furnishing of the Performance Security pursuant to ITB 48.
- 20.6 The Bid Security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required Performance Security.
- 20.7 The Bid Security amount may be forfeited:
- (a) if a Bidder withdraws its Bid during the period of Bid validity specified by the Bidder on the Letter of Bid, or any extension thereto provided by the Bidder; or
 - (b) if the successful Bidder fails to:
 - (i) sign the Contract in accordance with ITB 47; or
 - (ii) furnish a Performance Security in accordance with ITB 48.
- 20.8 The Bid Security or the Bid-Securing Declaration of a JV shall be in the name of the JV that submits the Bid. If the JV has not been legally constituted into a legally enforceable JV at the time of bidding, the Bid Security or the Bid Securing Declaration shall be in the names of all future members as named in the letter of intent referred to in ITB 4.1 and ITB 11.2.
- 20.9 If a Bid Securing Declaration is required **in the BDS**, pursuant to ITB 20.1, and:

- (a) if a Bidder withdraws its Bid during the period of Bid validity specified by the Bidder on the Letter of Bid or any extension thereto provided by the Bidder; or
- (b) if the successful Bidder fails to:
 - (i) sign the Contract in accordance with ITB 47; or
 - (ii) furnish a Performance Security in accordance with ITB 48;

the Borrower may execute the Bid Securing Declaration, as provided for **in the BDS**, declare the Bidder ineligible to be awarded a contract by the Employer for a period of time as stated **in the BDS**.

21. Format and Signing of Bid

- 21.1 The Bidder shall prepare one original of the documents comprising the bid as described in ITB 11 and clearly mark it "Original." Alternative Bids, if permitted in accordance with ITB 13, shall be clearly marked "Alternative". In addition, the Bidder shall submit copies of the Bid, in the number specified **in the BDS** and clearly mark them "Copy." In the event of any discrepancy between the original and the copies, the original shall prevail.
- 21.2 Bidders shall mark as "CONFIDENTIAL" information in their Bids which is confidential to their business. This may include proprietary information, trade secrets or commercial or financially sensitive information.
- 21.3 The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified **in the BDS** and shall be attached to the Bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Bid where entries or amendments have been made shall be signed or initialed by the person signing the Bid.
- 21.4 In the case that the Bidder is a JV, the Bid shall be signed by an authorized representative of the JV on behalf of the JV, and so as to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives.
- 21.5 Any interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Bid.

D- Submission and Opening of Bids

22. Submission, Sealing and Marking of Bids

22.1 The Bidder shall deliver the Bid in a single, sealed envelope (one (1) envelope process). Within the single envelope the Bidder shall place the following separate, sealed envelopes:

- (a) in an envelope marked "ORIGINAL", all documents comprising the Bid, as described in ITB 11; and
- (b) in an envelope marked "COPIES", all required copies of the Bid; and
- (c) if alternative Bids are permitted in accordance with ITB 13, and if relevant:
 - (i) in an envelope marked "ORIGINAL-ALTERNATIVE BID" the alternative Bid; and
 - (ii) in the envelope marked "COPIES – ALTERNATIVE BID" all required copies of the alternative Bid.

22.2 The inner and outer envelopes shall:

- (a) bear the name and address of the Bidder;
- (b) be addressed to the Employer in accordance with ITB 23.1;
- (c) bear the specific identification of this Bidding process indicated in accordance with ITB 1.1; and
- (d) bear a warning not to open before the time and date for Bid opening.

22.3 If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the Bid.

23. Deadline for Submission of Bids

23.1 Bids must be received by the Employer at the address and no later than the date and time indicated **in the BDS**. When so specified **in the BDS**, Bidders shall have the option of submitting their Bids electronically. Bidders submitting Bids electronically shall follow the electronic Bid submission procedures specified **in the BDS**.

23.2 The Employer may, at its discretion, extend the deadline for the submission of Bids by amending the bidding document in accordance with ITB 8, in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.

24. Late Bids

24.1 The Employer shall not consider any Bid that arrives after the deadline for submission of Bids, in accordance with ITB 23. Any Bid received by the Employer after the deadline for submission of Bids shall be declared late, rejected, and returned unopened to the Bidder.

25. Withdrawal, Substitution, and Modification of Bids

25.1 A Bidder may withdraw, substitute, or modify its bid after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITB 21.3, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the Bid must accompany the respective written notice. All notices must be:

- (a) prepared and submitted in accordance with ITB 21 and ITB 22 (except that withdrawal notices do not require copies), and in addition, the respective envelopes shall be clearly marked "Withdrawal," "Substitution," "Modification"; and
- (b) received by the Employer prior to the deadline prescribed for submission of Bids, in accordance with ITB 23.

25.2 Bids requested to be withdrawn in accordance with ITB 25.1 shall be returned unopened to the Bidders.

25.3 No Bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of Bids and the expiration of the period of Bid validity specified by the Bidder on the Letter of Bid or any extension thereof.

26. Bid Opening

26.1 Except as in the cases specified in ITB 24 and ITB 25.2, the Employer shall publicly open and read out in accordance with ITB 26.5 all Bids received by the deadline at the date, time and place specified **in the BDS** in the presence of Bidders' designated representatives and anyone who choose to attend. Any specific electronic Bid opening procedures required if electronic Bidding is permitted in accordance with ITB 23.1, shall be as specified **in the BDS**.

26.2 First, the written notice of withdrawal in the envelopes marked "Withdrawal" shall be opened and read out and the envelope with the corresponding Bid shall not be opened, but returned to the Bidder. No bid withdrawal shall be permitted unless

the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at Bid opening.

- 26.3 Next, envelopes marked "Substitution" shall be opened and read out and exchanged with the corresponding Bid being substituted, and the substituted Bid shall not be opened, but returned to the Bidder. No Bid substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at Bid opening.
- 26.4 Next, envelopes marked "Modification" shall be opened and read out with the corresponding Bid. No Bid modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at Bid opening.
- 26.5 Next, all remaining envelopes shall be opened one at a time, reading out: the name of the Bidder and the total Bid Price, Bid Price(s) per lot (contract), if applicable, including any discounts and alternative Bids, and indicating whether there is a modification; the presence or absence of a Bid Security or Bid-Securing Declaration, if required; and any other details as the Employer may consider appropriate.
- 26.6 Only Bids, alternative Bids and discounts that are opened and read out at Bid opening shall be considered further. The Letter of Bid and the Price Schedules are to be initialed by representatives of the Employer attending Bid opening in the manner specified **in the BDS**.
- 26.7 The Employer shall neither discuss the merits of any Bid nor reject any Bid (except for late Bids, in accordance with ITB 24.1).
- 26.8 The Employer shall prepare a record of the Bid opening that shall include, as a minimum:
- (a) the name of the Bidder and whether there is a withdrawal, substitution, or modification;
 - (b) the Bid Price, per lot if applicable, including any discounts;
 - (c) any alternative Bids; and
 - (d) the presence or absence of a Bid Security or a Bid-Securing Declaration.
- 26.9 The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.

E- Evaluation and Comparison of Bids

27. Confidentiality

- 27.1 Information relating to the evaluation of Bids and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with the Bidding process until information on Intention to Award the Contract is transmitted to all Bidders in accordance with ITB 43.1.
- 27.2 Any effort by a Bidder to influence the Employer in the evaluation of the bids or Contract award decisions may result in the rejection of its Bid.
- 27.3 Notwithstanding ITB 27.2, from the time of Bid opening to the time of Contract Award, if any Bidder wishes to contact the Employer on any matter related to the Bidding process, it should do so in writing.

28. Preliminary Examination & Clarification of Bids

- 28.1 Prior to the detailed evaluation, pursuant to ITB 35, the Employer will conduct preliminary examination of all bids that have been received by the deadline for bid submission and opened at the public bid opening as the first step towards determination of their substantial responsiveness to the bidding document. The Employer's determination of a bid's responsiveness shall be based on the contents of the bid itself, as defined in ITB 11 without recourse to extrinsic evidence. The Employer will verify and examine bids to determine whether they are complete, properly signed to bind the bidder, meet eligibility requirements of the bidders, plant, materials, equipment, and services, bidders have no conflict of interest and have provided the bid validity, bid security or bid securing declaration, as required and other essential documents to complete the evaluation, and whether the bids are generally in order. Subject to ITB 28.2 and ITB 28.3, Bids failing to meet the above requirements shall be rejected and not retained for further review.
- 28.2 To assist in the examination, evaluation, and comparison of the Bids, and qualification of the Bidders, the Employer may, at its discretion, ask any Bidder for a clarification of its Bid. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in the prices or substance of the Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Bids, in accordance with ITB 32.

28.3 If a Bidder does not provide clarifications of its Bid by the date and time set in the Employer's request for clarification, its Bid may be rejected.

29. Deviations, Reservations, and Omissions

29.1 During the evaluation of Bids, the following definitions apply:

- (a) "Deviation" is a departure from the requirements specified in the bidding document;
- (b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the bidding document; and
- (c) "Omission" is the failure to submit part or all of the information or documentation required in the bidding document.

30. Determination of Responsiveness

30.1 Following the rejection of Bids if any, pursuant to ITB 28, as the next step, the remaining Bids shall be further reviewed to determine their substantial responsiveness. The Employer's determination of a Bid's responsiveness is to be based on the contents of the Bid itself, as defined in ITB11.

30.2 A substantially responsive Bid is one that meets the requirements of the bidding document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that:

- (a) if accepted, would:
 - (i) affect in any substantial way the scope, quality, or performance of the Plant and Installation Services specified in the Contract; or
 - (ii) limit in any substantial way, inconsistent with the bidding document, the Employer's rights or the Bidder's obligations under the proposed Contract; or
- (b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive Bids.

30.3 Before carrying out detailed technical evaluation as per ITB 35.2, the Employer shall examine the technical aspects of the Bid in particular, to confirm that all requirements of Section VII, Employer's Requirements have been met without any material deviation, reservation, or omission. Any material deviation, reservation or omission from the scope of the Employer's requirements including Design, Plant, Equipment, Installation and other services, will be the cause for rejection regardless

whether the same has been identified in an item or service to be provided by the Bidder or by any other manufacturer or subcontractor from whom the Bidder intends to purchase or subcontract. Bidders shall ensure that all major items and services offered in the bid, whether provided by the Bidder himself or through other authorized manufactures and subcontractors substantially meet the technical specifications and requirements failing which the Bid shall be rejected. If more than one manufacturer or subcontractor have been proposed for any item, or service, unless at least one of them has proposed substantially compliant technical specifications, the Bid shall be rejected.

- 30.4 The Employer shall similarly examine the commercial aspects of the Bids for any deviations, other than technical specifications, to determine if they conform to the terms and conditions of the draft contract and other documents included in the bidding document without any material deviation, reservation or omission.
- 30.5 If a Bid is not substantially responsive to the requirements of the bidding document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission. All other Bids determined substantially responsive will be retained for further evaluation.

31. Nonmaterial Nonconformities

- 31.1 Provided that a Bid is substantially responsive, the Employer may waive any nonconformity in the Bid that does not constitute a material deviation, reservation or omission.
- 31.2 Provided that a Bid is substantially responsive, the Employer may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the price of the Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.
- 31.3 Provided that a Bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component and costs associated, if any, with non-material deviations, reservations and omissions to the requirements of the bidding documents in the manner specified **in the BDS**.

32. Correction of Arithmetical Errors

32.1 Provided that the Bid is substantially responsive, the Employer shall correct arithmetical errors on the following basis:

- (a) if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and the quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected;
- (b) where there are errors between the total of the amounts given under the column for the price breakdown and the amount given under the Total Price, the former shall prevail and the latter will be corrected accordingly;
- (c) where there are errors between the total of the amounts of Schedule Nos. 1 to 4 and the amount given in Schedule No. 5 (Grand Summary), the former shall prevail and the latter will be corrected accordingly; and
- (d) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.

32.2 Bidders shall be requested to accept correction of arithmetical errors. Failure to accept the correction in accordance with ITB 32.1, shall result in the rejection of the Bid.

33. Conversion to Single Currency

33.1 For evaluation and comparison purposes, the currency(ies) of the Bid shall be converted into a single currency as specified **in the BDS**.

34. Margin of Preference

34.1 Unless otherwise specified **in the BDS** no margin of domestic or regional preference shall apply. If a margin of preference applies, the application methodology shall be as specified in Section III, Evaluation and Qualification Criteria, and in accordance with the provisions stipulated in the Bank's Procurement Framework.

35. Evaluation of Bids

35.1 The Employer shall use the criteria and methodologies listed in this ITB and Section III, Evaluation and Qualification criteria. No other evaluation criteria or methodologies shall be permitted. By applying the criteria and methodologies the Employer shall determine the successful Bid or Bids in accordance with ITB 40.

35.2 **Technical Evaluation.** The Employer will carry out a detailed technical evaluation of the Bids not previously rejected to determine whether the technical aspects are in compliance with the bidding document. The Bid that does not meet minimum acceptable standards of completeness, consistency and detail, and the specified minimum (or maximum, as the case may be) requirements for specified functional guarantees, will be rejected for non-responsiveness. In order to reach its determination, the Employer will examine and compare the technical aspects of the Bids on the basis of the information supplied by the Bidders, taking into account the following:

- (a) overall completeness and compliance with the Employer's Requirements; conformity of the Plant and Installation Services offered with specified performance criteria, including conformity with the specified minimum (or maximum, as the case may be) requirement corresponding to each functional guarantee, as indicated in the Specification and in Section III, Evaluation and Qualification Criteria; suitability of the Plant and Installation Services offered in relation to the environmental and climatic conditions prevailing at the site; and quality, function and operation of any process control concept included in the Bid;
- (b) type, quantity and long-term availability of mandatory and recommended spare parts and maintenance services; and
- (c) other relevant factors, if any, listed in Section III, Evaluation and Qualification Criteria.

35.3 Where alternative technical solutions have been allowed in accordance with ITB 13, and offered by the Bidder, the Employer will make a similar evaluation of the alternatives. Where alternatives have not been allowed but have been offered, they shall be ignored.

35.4 **Economic Evaluation.** To evaluate a Bid, the Employer shall consider the following factors with respect to the Base Bid and Alternative Bid (s) (if the latter is permitted in the BDS of ITB 13.1), in accordance with evaluation and award criteria as applicable for 'Plant', lots or packages (combination of lots) and as specified under Section III-Evaluation and Qualification Criteria:

- (a) the Bid price, excluding provisional sums and the provision, if any, for contingencies in the Price Schedules;
- (b) price adjustment for correction of arithmetic errors in accordance with ITB 32.1;

- (c) price adjustment due to discounts offered in accordance with ITB 17.11;
- (d) price adjustment due to quantifiable nonmaterial nonconformities in accordance with ITB 31.3;
- (e) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 33;
- (f) the evaluation factors specified **in the BDS** and in Section III, Evaluation and Qualification Criteria; and
- (g) price adjustment due to application of Margin of Preference, if applicable, as per BDS of ITB 34.1, and Section III, Evaluation and Qualification Criteria.

35.5 If price adjustment is allowed in accordance with ITB 17.7, the estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Bid evaluation.

35.6 If this bidding document allows Bidders to quote separate prices for different lots (contracts), and the award to a single Bidder of multiple lots (contracts), the methodology to determine the lowest evaluated cost of the lot (contract) combinations, including any discounts offered in the Letter of Bid, is specified in Section III, Evaluation and Qualification Criteria.

36. Comparison of Bids

36.1 The Employer shall compare the evaluated costs of all substantially responsive Bids established in accordance with ITB 35.4 to determine the Bid that has the lowest evaluated cost.

37. Abnormally Low Bids

37.1 An Abnormally Low Bid is one where the Bid price, in combination with other elements of the Bid, appears so low that it raises material concerns as to the capability of the Bidder to perform the Contract for the offered Bid Price.

37.2 In the event of identification of a potentially Abnormally Low Bid, the Employer shall seek written clarifications from the Bidder, including detailed price analyses of its Bid price in correlation to the subject matter of the contract, scope, proposed methodology, schedule, allocation of risks and responsibilities and any other requirements of the bidding document.

37.3 After evaluation of the price analysis, in the event that the Employer determines that the Bidder has failed to demonstrate its capability to deliver the contract for the offered tender price, the Employer shall reject the Bid.

38. Unbalanced or Front-Loaded Bids

38.1 If the Bid that is evaluated as the lowest evaluated cost is, in the Employer's opinion, seriously unbalanced or front loaded the Employer may require the Bidder to provide written clarifications. Clarifications may include detailed price analyses to demonstrate the consistency of the Bid prices with the scope of works, proposed methodology, schedule and any other requirements of the bidding document.

38.2 After the evaluation of the information and detailed price analyses presented by the Bidder, the Employer may:

- (a) accept the Bid; or
- (b) if appropriate, require that the total amount of the Performance Security be increased, at the expense of the Bidder, to a level not exceeding twenty percent (20%) of the Contract Price; or
- (c) reject the Bid.

39. Eligibility and Qualification of the Bidder

39.1 The Employer shall determine to its satisfaction whether the Bidder or Bidders that is/are selected as having submitted the lowest evaluated cost and substantially responsive Bid (s) including all proposed subcontractors, specialized subcontractors or manufacturers as the case may be are eligible and meet the qualifying criteria specified in Section III, Evaluation and Qualification Criteria. To this end, the Employer will determine for Lots and Packages, and/or their combinations, as the case may be, for which the Bidder submitted a bid, that it meets the respective minimum combined qualification criteria.

39.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 15.1. The determination shall not take into consideration the qualifications of other firms such as the Bidder's subsidiaries, parent entities, affiliates, subcontractors (other than Specialized Subcontractors if permitted in the bidding document) or any other firm(s) different from the Bidder.

39.3 An affirmative determination shall be a prerequisite for award of the Contract to the Bidder. A negative determination shall result in disqualification of the Bid, in which

event the Employer shall proceed to the Bidder or Bidders who offered a substantially responsive Bid or Bids with the next lowest evaluated cost to make a similar determination of such Bidder's qualifications to perform satisfactorily.

39.4 The capabilities of all manufacturers, specialized subcontractors and subcontractors proposed in its Bid to be used by the successful Bidder(s) for identified major items of supply or services will also be evaluated for acceptability in accordance with Section III, Evaluation and Qualification Criteria. Their participation should be confirmed with a letter of intent between the parties, as needed. Should a manufacturer or subcontractor proposed for any item or service be determined to be unacceptable, the Bid will not be rejected, provided the Bidder himself or another subcontractor or manufacturer proposed in the bid is determined qualified and submitted conforming specifications for such item, but the Bidder may be required to substitute an acceptable manufacturer or subcontractor without any change to the Bid price or specifications. Prior to signing the Contract, the corresponding Appendix to the Contract Agreement shall be completed, listing the approved manufacturers or subcontractors for each item concerned.

40. Successful Bid or Bids

40.1 Having compared the evaluated costs of Bids, the Employer shall determine the successful Bid or combination of Bids as the case may be, in accordance with the additional Bid Evaluation Criteria as further described in Section III. Such Bid or Bids would be those which has/have been determined to:

- (a) be substantially responsive to the bidding document;
- (b) offer the lowest evaluated cost to the Employer for all Plants and Installation Services included in the scope of the Employer's Requirements under Section VII to be procured based on either a single Contract or all multiple Contracts combined, as the case may be, in accordance with the ITB 17.10 inviting bid prices and discounts, and provisions made in the Bidding Document for evaluation of bids and award of contract (s); and
- (c) be offered by a Bidder or Bidders that substantially meet the qualification criteria applicable for the Contract or combination of Contracts for which they are selected.

41. Employer's right to Accept Any Bid and to Reject Any or All Bids

41.1 The Employer reserves the right to accept or reject any Bid, and to annul the Bidding process and reject all Bids at any time prior to Contract Award, without thereby incurring any liability to Bidders. In case of annulment, all Bids submitted and specifically, Bid securities shall be promptly returned to the Bidders.

42. Standstill Period

42.1 The Contract shall not be awarded earlier than the expiry of the Standstill Period. The Standstill Period shall be ten (10) Business Days unless extended in accordance with ITB 46. The Standstill Period commences the day after the date the Employer has transmitted to each Bidder the Notification of Intention to Award the Contract. Where only one Bid is submitted, or if this contract is in response to an emergency situation recognized by the Bank, the Standstill Period shall not apply.

43. Notification of Intention to Award

43.1 The Employer shall send to each Bidder the Notification of Intention to Award the Contract to the successful Bidder. The Notification of Intention to Award shall contain, at a minimum, the following information:

- (a) the name and address of the Bidder submitting the successful Bid;
- (b) the Contract price of the successful Bid;
- (c) the names of all Bidders who submitted Bids, and their Bid prices as readout, and as evaluated;
- (d) a statement of the reason(s) the Bid (of the unsuccessful Bidder to whom the notification is addressed) was unsuccessful, unless the price information in (c) above already reveals the reason;
- (e) the expiry date of the Standstill Period; and
- (f) instructions on how to request a debriefing and/or submit a complaint during the standstill period.

F- Award of Contract

44. Award Criteria

44.1 Subject to ITB 41, the Employer shall award the Contract or Contracts to the successful Bidder or Bidders whose Bid or Bids has/have been determined successful in accordance with ITB 40.

45. Notification of Award

45.1 Prior to the expiration of the Bid Validity Period, and upon expiry of the Standstill Period, specified in ITB 42.1 or any extension thereof, and upon satisfactorily addressing any complaint that has been filed within the Standstill Period, the Employer shall notify the successful Bidder, in writing, that its Bid has been accepted. The notification of award (hereinafter and in the Contract Forms called the "Letter of Acceptance") shall specify the sum that the Employer will pay the Contractor in

consideration of the execution of the contract (hereinafter and in the Conditions of Contract and Contract Forms called "the Contract Price").

45.2 Within ten (10) Business Days after the date of transmission of the Letter of Acceptance, the Employer shall publish the Contract Award Notice which shall contain, at a minimum, the following information:

- (a) name and address of the Employer;
- (b) name and reference number of the contract being awarded, and the selection method used;
- (c) names of all Bidders that submitted Bids, and their Bid prices as read out at Bid opening, and as evaluated;
- (d) names of all Bidders whose Bids were rejected either as nonresponsive or as not meeting qualification criteria, or were not evaluated, with the reasons therefore;
- (e) the name of the successful Bidder, the final total contract price, the contract duration and a summary of its scope; and
- (f) successful Bidder's Beneficial Ownership Disclosure Form, if specified in BDS ITB 47.1.

45.3 The Contract Award Notice shall be published on the Employer's website with free access if available, or in at least one newspaper of national circulation in the Employer's Country, or in the official gazette. The Employer shall also publish the contract award notice in UNDB online.

45.4 Until a formal contract is prepared and executed, the Letter of Acceptance shall constitute a binding Contract

46. Debriefing by the Employer

46.1 On receipt of the Employer's Notification of Intention to Award referred to in ITB 43.1, an unsuccessful Bidder has three (3) Business Days to make a written request to the Employer for a debriefing. The Employer shall provide a debriefing to all unsuccessful Bidders whose request is received within this deadline.

46.2 Where a request for debriefing is received within the deadline, the Employer shall provide a debriefing within five (5) Business Days, unless the Employer decides, for justifiable reasons, to provide the debriefing outside this timeframe. In that case, the standstill period shall automatically be extended until five (5) Business Days after such debriefing is provided. If more than one debriefing is so delayed, the standstill period shall not end earlier than five (5) Business Days after the last debriefing takes

place. The Employer shall promptly inform, by the quickest means available, all Bidders of the extended standstill period.

- 46.3 Where a request for debriefing is received by the Employer later than the three (3)-Business Day deadline, the Employer should provide the debriefing as soon as practicable, and normally no later than fifteen (15) Business Days from the date of publication of Public Notice of Award of contract. Requests for debriefing received outside the three (3)-day deadline shall not lead to extension of the standstill period.
- 46.4 Debriefings of unsuccessful Bidders may be done in writing or verbally. The Bidder shall bear their own costs of attending such a debriefing meeting.

47. Signing of Contract

- 47.1 The Employer shall send to the successful Bidder the Letter of Acceptance including the Contract Agreement, and, if specified in the BDS, a request to submit the Beneficial Ownership Disclosure Form providing additional information on its beneficial ownership. The Beneficial Ownership Disclosure Form, if so requested, shall be submitted within eight (8) Business Days of receiving this request.
- 47.2 The successful Bidder shall sign, date and return to the Employer, the Contract Agreement within twenty-eight (28) days of its receipt.
- 47.3 Notwithstanding ITB 47.2 above, in case signing of the Contract Agreement is prevented by any export restrictions attributable to the Employer, to the country of the Employer, or to the use of the Plant and Installation Services to be supplied, where such export restrictions arise from trade regulations from a country supplying those Plant and Installation Services, the Bidder shall not be bound by its Bid, always provided, however, that the Bidder can demonstrate to the satisfaction of the Employer and of the Bank that signing of the Contract Agreement has not been prevented by any lack of diligence on the part of the Bidder in completing any formalities, including applying for permits, authorizations and licenses necessary for the export of the Plant and Installation Services under the terms of the Contract.

48. Performance Security

- 48.1 Within twenty-eight (28) days of the receipt of the Letter of Acceptance from the Employer, the successful Bidder shall furnish the Performance Security in accordance with the General Conditions GCC 13.3, subject to ITB 38, using for that purpose the Performance Security Form included in Section X, Contract Forms, or another form acceptable to the Employer. If the Performance Security furnished by the successful Bidder is in the form of a bond, it shall be issued by a bonding or insurance company that has been determined by the successful Bidder to be

acceptable to the Employer. A foreign institution providing a bond shall have a correspondent financial institution located in the Employer's Country, unless the Employer has agreed in writing that a correspondent financial institution is not required.

48.2 Failure of the successful Bidder to submit the above-mentioned Performance Security or sign the Contract shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security. In that event the Employer may award the Contract to the Bidder or Bidders offering the next Lowest Evaluated Cost to the Employer as per the bid evaluation and award criteria.

49. Procurement Related Complaint

49.1 The procedures for making a Procurement-related Complaint are as specified in the BDS.

Section II - Bid Data Sheet

The following specific data for the Facilities to be procured shall complement, supplement, or amend the provisions in the Instructions to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in ITB.

A. General

ITB 1.1	<p>The reference number of the Invitation for Bids (IFB) is: NEP/OCBI/IFB/EEP-III/DSI-01</p> <p>Employer is: Rural Electrification Agency (REA)</p> <p>The name of the IFB is: Development Plus Operations & Maintenance of Solar Hybrid Power Plants for Eight (8) Federal Universities and One (1) Teaching Hospital</p> <p>Name of the Plant and Installation: Solar Hybrid Power Plants</p> <p>The number and identification of lots (contracts) comprising this IFB is:</p> <table border="1"> <thead> <tr> <th>LOT</th> <th>LOT NUMBER</th> <th>Location</th> <th>Plant PV Array Power Capacity (DC) (kWp)</th> <th>Plant PV Rated Power Capacity (AC) (kWac)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>AfDB-NEP/EEP-3/SHMG – 01</td> <td>Modibbo Adama University of Technology, Yola, Adamawa State</td> <td>5,000</td> <td>4,100</td> </tr> <tr> <td>2</td> <td>AfDB-NEP/EEP-3/SHMG – 02</td> <td>Federal University of Dutsin-Ma, Katsina State</td> <td>1,934</td> <td>1,600</td> </tr> <tr> <td>3</td> <td>AfDB-NEP/EEP-3/SHMG – 03</td> <td>Federal University of Lafia, Nasarawa State</td> <td>1,600</td> <td>1,300</td> </tr> <tr> <td>4</td> <td>AfDB-NEP/EEP-3/SHMG – 04</td> <td>Federal University of Lokoja, Kogi State</td> <td>1,716</td> <td>1400</td> </tr> <tr> <td>5</td> <td>AfDB-NEP/EEP-3/SHMG – 05</td> <td>Federal University of Technology Owerri, Imo State</td> <td>8,518</td> <td>7,000</td> </tr> <tr> <td>6</td> <td>AfDB-NEP/EEP-3/SHMG – 06</td> <td>University of Port Harcourt and the Teaching Hospital, Rivers State</td> <td>10,754</td> <td>9,000</td> </tr> <tr> <td>7</td> <td>AfDB-NEP/EEP-3/SHMG – 07</td> <td>Federal University of Uyo, Akwa Ibom State</td> <td>2,926</td> <td>2,400</td> </tr> <tr> <td>8</td> <td>AfDB-NEP/EEP-3/SHMG – 08</td> <td>Federal University of Technology Akure, Ondo State</td> <td>4,506</td> <td>3,700</td> </tr> </tbody> </table> <p>Note: Bidder may bid for one or more or even all lots</p>	LOT	LOT NUMBER	Location	Plant PV Array Power Capacity (DC) (kWp)	Plant PV Rated Power Capacity (AC) (kWac)	1	AfDB-NEP/EEP-3/SHMG – 01	Modibbo Adama University of Technology, Yola, Adamawa State	5,000	4,100	2	AfDB-NEP/EEP-3/SHMG – 02	Federal University of Dutsin-Ma, Katsina State	1,934	1,600	3	AfDB-NEP/EEP-3/SHMG – 03	Federal University of Lafia, Nasarawa State	1,600	1,300	4	AfDB-NEP/EEP-3/SHMG – 04	Federal University of Lokoja, Kogi State	1,716	1400	5	AfDB-NEP/EEP-3/SHMG – 05	Federal University of Technology Owerri, Imo State	8,518	7,000	6	AfDB-NEP/EEP-3/SHMG – 06	University of Port Harcourt and the Teaching Hospital, Rivers State	10,754	9,000	7	AfDB-NEP/EEP-3/SHMG – 07	Federal University of Uyo, Akwa Ibom State	2,926	2,400	8	AfDB-NEP/EEP-3/SHMG – 08	Federal University of Technology Akure, Ondo State	4,506	3,700
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ITB 1.2 (a)	Electronic –Procurement System (Not Applicable)																																													

ITB 2.1	<p>The Borrower is: Federal Government of Nigeria</p> <p>The amount of the financing is: USD 200 Million</p> <p>The Specific Bank financing institution is:</p> <p>ADB: USD 150 Million;</p> <p>AGTF: USD 50 Million</p> <p>The name of the Project is: Nigeria Electrification Project (NEP)</p>
ITB 4.1 (a)	i) The firms in a Joint Venture, Consortium or Association (JV) “shall be” jointly and severally liable.
ITB 4.1 (c)	Maximum number of members in the Joint Venture, Consortium or Association (JV) shall be: Three (3) .
ITB 4.1 (d)	Minimum share of a member of Joint Venture, Consortium or Association (JV) in the contract shall not be less than 25 % percent of the total value of the contract. In case of any contradiction between ITB 4.1 (c) and ITB 4.1 (d) the latter provision shall prevail.
ITB 4.5	<p>A list of debarred firms and individuals is available on the Bank’s external website:</p> <p>https://www.afdb.org/en/projects-operations/debarment-and-sanctions-procedures</p>
B. Bidding Document	
ITB 7.1	<p>For Clarification of Bid purposes only, the Employer’s address is:</p> <p>Attention: Taiwo Olowyin</p> <p>Senior Procurement Specialist</p> <p>Address: Nigeria Electrification Project (NEP)</p> <p>No. 16, Umaru Dikko Street,</p> <p>Jabi, Abuja</p> <p>Country: Nigeria</p> <p>Tel: +234 803 388 0180</p> <p>E-mail: afdbnep.procure@rea.gov.ng</p> <p>Requests for clarification should be received by the Employer no later than 21 calendar days before the deadline for submission</p> <p>Web page: Not Applicable</p>

ITB 7.4	<p>A Pre-Bid meeting shall take place at the following date, time and place:</p> <p>Date: 6th April 2023</p> <p>Time: 10.00 am</p> <p>Place: Sheraton Hotel, Abuja and via Virtual Call</p> <p>A site visit conducted by the Employer shall be organized.</p> <p>The Employer shall organize a joint site visit to selected sites across the Eight (8) Lots to enable the Bidders, who shall bear the cost of their individual visits, have an idea of the level of accuracy of the data provided on the REA-NEP. The sites, with their respective GPS coordinates are as provided in Part 2 "Employer's requirement". However, the Bidders shall have no restrictions to carry-out individual site visits to their preferred sites. The Employer shall issue, on request, an appropriate letter of introduction to the Bidders in order to facilitate the separate visits.</p> <p>Kindly see below the proposed Project Site Visit Schedule:</p> <table border="1"> <thead> <tr> <th>S/ N</th> <th>Institution</th> <th>State</th> <th>Date</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Federal University of Lokoja</td> <td>Kogi</td> <td>10th – 11th April 2023</td> </tr> <tr> <td>2.</td> <td>Federal University of Lafia</td> <td>Nasarawa</td> <td>12th – 13th April 2023</td> </tr> <tr> <td>3.</td> <td>Federal University of Technology Akure</td> <td>Ondo</td> <td>17th – 19th April 2023</td> </tr> <tr> <td>4.</td> <td>Federal University of Uyo</td> <td>Akwa Ibom</td> <td>20th – 21st April 2023</td> </tr> <tr> <td>5.</td> <td>Federal University of Technology Owerri</td> <td>Imo</td> <td>24th – 25th April 2023</td> </tr> <tr> <td>6.</td> <td>University of Port Harcourt and University of Port Harcourt Teaching Hospital</td> <td>Rivers</td> <td>26th – 27th April 2023</td> </tr> <tr> <td>7.</td> <td>Federal University of Dutsin-Ma</td> <td>Katsina</td> <td>2nd – 3rd May 2023</td> </tr> <tr> <td>8.</td> <td>Modibbo Adama University of Technology, Yola</td> <td>Adamawa</td> <td>4th – 5th May 2023</td> </tr> </tbody> </table>	S/ N	Institution	State	Date	1.	Federal University of Lokoja	Kogi	10 th – 11 th April 2023	2.	Federal University of Lafia	Nasarawa	12 th – 13 th April 2023	3.	Federal University of Technology Akure	Ondo	17 th – 19 th April 2023	4.	Federal University of Uyo	Akwa Ibom	20 th – 21 st April 2023	5.	Federal University of Technology Owerri	Imo	24 th – 25 th April 2023	6.	University of Port Harcourt and University of Port Harcourt Teaching Hospital	Rivers	26 th – 27 th April 2023	7.	Federal University of Dutsin-Ma	Katsina	2 nd – 3 rd May 2023	8.	Modibbo Adama University of Technology, Yola	Adamawa	4 th – 5 th May 2023
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ITB 7.6	Web page: www.nep.rea.gov.ng																																				

C. Preparation of Bids	
ITB 10.1	<p>The language of the Bid is: “English”.</p> <p>All correspondence exchange shall be in English language.</p> <p>Language for translation of supporting documents and printed literature is English.</p>
ITB 11.1 (I)	<p>The Bidder shall submit the following additional documents in its Bid:</p> <p><i>Full literature, brochures and technical documents of all items offered and quoted in the Bid.</i></p> <p><i>Others include:</i></p> <ul style="list-style-type: none"> ● Health, Safety and Security concept ● Implementation concept for the Environmental and Social Impact Management plan ● Quality of testing and commissioning concept for the Plant ● Implementation plan and work program ● Demand side management and Metering concept ● Technical Plant monitoring concept ● Operation and Maintenance concept for one (1) year and then for subsequent 14 years thereafter. ● Communication Strategy <p>Code of Conduct for Contractor’s Personnel (ES)</p> <p>The Bidder shall submit its Code of Conduct that will apply to the Contractor’s Personnel (as defined in GCC Sub- Clause 1) employed for the execution of Installation Services (defined in GCC Sub- Clause 1) at the Site (or other places in the country where the Site is located), to ensure compliance with the Contractor’s Environmental and Social (ES) obligations under the Contract. The Bidder shall use for this purpose the Code of Conduct form provided in Section IV. No substantial modifications shall be made to this form, except that the Bidder may introduce additional requirements, including as necessary to take into account specific Contract issues/risks.</p> <p>Management Strategies and Implementation Plans (MSIP) to manage the (ES) risks</p> <p>The Bidder shall submit Management Strategies and Implementation Plans (MSIPs) to manage the following key Environmental and Social (ES) risks:</p>

	<p>environmental pollution, climate change, labour conditions, grievances, occupational health and safety, gender-based violence, and sexual exploitation & abuse.</p> <p>The MSIPs shall include detailed corporate environmental and social management policies, e-waste management plan, plans to mitigate climate change disaster such as erosion, flooding, and drought; stakeholders engagement plan; grievance redress management plan; emergency preparedness plan; occupational health and safety policies; Sexual Exploitation and Abuse (SEA) prevention and response plans.</p>
ITB 13.1	Alternative Bids <i>“shall not be considered”</i> .
ITB 13.2	Alternatives to the Time Schedule <i>“shall not be”</i> permitted.
ITB 13.3	Technical Alternative as per ITB 13.3 <i>“shall not be”</i> permitted.
ITB 13.4	Alternative technical solutions <i>‘shall not be’</i> permitted.
ITB 17.1	<p>Bidders shall quote for the following components or services on a single responsibility basis: Not Applicable</p> <p>and</p> <p>The following components or services will be provided under the responsibility of the Employer: Not Applicable</p>
ITB 17.1	The adjustment shall be based on the <i>“average”</i> price of the item as quoted in other substantially responsive Bids.
ITB 17.5 (a) and (d) (i)	<p>Place of destination: Apapa Sea Port, Lagos, Nigeria</p> <p>Final destination (Project Site): As stated in Part 2, Employer’s Requirements</p> <p><i>Incoterm used shall be CIP for goods supplied from Abroad and Ex-Works for goods supplied within the country.</i></p> <p><i>This also includes unloading and appropriate safe storage of goods at site.</i></p> <p>Operations and Maintenance Services for One (1) year.</p>
ITB 17.6	The Incoterms edition is: Incoterms 2020.

ITB 17.7 & ITB 17.9	The prices quoted by the Bidder “shall not” be subject to adjustment during the performance of the Contract.																								
ITB 17.10	Bids are invited for individual lots each lot containing one or more ‘Plant’ (s). Bidders have the option to bid for any one or more lots. Section III describes the criteria for evaluation and award of One and Multiple Contracts.																								
ITB 18.1	The Bidder “is” required to quote in the currency of the Employer’s Country the portion of the Bid price that corresponds to expenditures incurred in that currency.																								
ITB 19.1	The Bid validity period shall be One Hundred and Fifty-Four (154) days.																								
ITB 19.3 (a)	The Bid price shall be adjusted by the following factor(s): The local currency portion of the Contract price shall be adjusted by a factor reflecting local inflation during the period of extension, and the foreign currency portion of the Contract price shall be adjusted by a factor reflecting the international inflation (in the country of the foreign currency) during the period of extension which for the purpose of this adjustment, shall be the period elapsed between the date arrived immediately after the expiry of fifty-six (56) days beyond the initial Bid validity period and the date of notification of award.																								
ITB 20.1	<p>A Bid Security amount “shall be” required.</p> <p>The amount and currency of the Bid Security shall be as follows:</p> <table border="1"> <thead> <tr> <th rowspan="2">LOT</th> <th rowspan="2">DESCRIPTION</th> <th colspan="2">BID SECURITY AMOUNT</th> </tr> <tr> <th>USD</th> <th>NAIRA EQUIVALENT</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Modibbo Adama University of Technology, Yola, Adamawa State</td> <td>315,166.26</td> <td>126,066,504.00</td> </tr> <tr> <td>2</td> <td>Federal University of Dutsin-Ma, Katsina State</td> <td>150,967.60</td> <td>60,387,040.00</td> </tr> <tr> <td>3</td> <td>Federal University of Lafia, Nasarawa State</td> <td>157,315.92</td> <td>62,926,368.00</td> </tr> <tr> <td>4</td> <td>Federal University of Lokoja, Kogi State</td> <td>150,528.54</td> <td>60,211,426.00</td> </tr> </tbody> </table>			LOT	DESCRIPTION	BID SECURITY AMOUNT		USD	NAIRA EQUIVALENT	1	Modibbo Adama University of Technology, Yola, Adamawa State	315,166.26	126,066,504.00	2	Federal University of Dutsin-Ma, Katsina State	150,967.60	60,387,040.00	3	Federal University of Lafia, Nasarawa State	157,315.92	62,926,368.00	4	Federal University of Lokoja, Kogi State	150,528.54	60,211,426.00
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4	Federal University of Lokoja, Kogi State	150,528.54	60,211,426.00																						

	5	Federal University of Technology Owerri, Imo State	506,215.06	202,486,024.00
	6	University of Port Harcourt and the Teaching Hospital, Rivers State	608,248.06	243,299,224.00
	7	Federal University of Uyo, Akwa Ibom State	196,497.76	78,599,104.00
	8	Federal University of Technology Akure, Ondo State	240,062.46	96,024,984.00
<p>Note: Bid Security is required for each lot as per amounts indicated against each lot. Bidders have the option of submitting one Bid Security for all lots (for the combined total amount of all lots) for which Bids have been submitted, however if the amount of Bid Security is less than the total required amount, the Employer will determine for which lot or lots the Bid Security amount shall be applied.</p>				
ITB 20.3 (a)	Only Bid Security issued by a reputable commercial bank will be acceptable			
ITB 20.3 (b)	An irrevocable letter of credit – Not acceptable			
ITB 20.3 (c)	A cashier's or certified check – Not acceptable			
ITB 20.3 (d)	Other types of acceptable securities: "None"			
ITB 20.9	Not Applicable			
ITB 21.1	<p>The Bidder shall submit in both hard and soft copy (soft copy in flash drive). If there are any discrepancies between the two formats, the hard copy shall prevail over the electronic copy.</p> <p>In addition to the original of the Bid, the number of copies is: Three (3) hard copies.</p>			
ITB 21.3	The written confirmation of authorization to sign on behalf of the Bidder shall consist of: Power of Attorney.			
D. Submission and Opening of Bids				
ITB 23.1	For <u>Bid submission purposes</u> only, the Employer's address is: Nigeria Electrification Project			

	<p>Attention: Abba Aliyu Street Address: No. 16, Umaru Dikko Street, Jabi Floor/ Room number: Third Floor, Conference Room City: Federal Capital Territory, Abuja Postal Code: 900108 Country: Nigeria</p> <p>The deadline for Bid submission is: Date: 22nd June 2023 Time: 11.00am Bidders "shall not" have the option of submitting their Bids electronically. The electronic Bidding submission procedures shall be: Not Applicable</p>
ITB 26.1	<p>The Bid opening shall take place at: Street Address: No. 16, Umaru Dikko Street, Jabi Floor/ Room number: Third Floor, Conference Room City: Federal Capital Territory, Abuja Postal Code: 900108 Country: Nigeria Date: 22nd June 2023 Time: 11.00am</p> <p>The Bid opening shall be also be carried out via zoom conference call for bidders' designated representatives who chose to join online</p>
ITB 26.6	<p>The Letter of Bid and Price Schedules shall be initialed by Three (3) representatives of the Employer conducting Bid opening. Each Bid shall be initialed by all representatives and shall be numbered, any modification to the unit or total price shall be initialed by the Representative of the Employer.</p>
E. Evaluation, and Comparison of Bids	
ITB 31.3	<p>The adjustment with respect to a missing or non-conforming item or component, and costs associated, if any, with non-material deviations, reservations or</p>

	omissions to the requirements of the bidding document shall be based on the "average" price of the item or component and associated cost, if any, derived from other substantially responsive Bids unless any other specific evaluation criteria has been provided elsewhere in the bidding document for such adjustments in which case the latter shall be applied. If the price or cost of any of the above cannot be derived from the price of other substantially responsive Bids, the Employer shall use its best estimate based on its own judgment, past experience or market search, as considered appropriate and as agreed with the Bank.
ITB 33.1	The currency that shall be used for Bid evaluation and comparison purposes to convert (at the selling exchange rate) all Bid prices expressed in various currencies into a single currency is: Nigerian Naira The source of exchange rate shall be: Central Bank of Nigeria (CBN) The date for the exchange rate shall be: Date of Bid Submission Deadline
ITB 34.1	A margin of domestic preference "shall" apply. A margin of regional preference "shall not" apply.
ITB 35.4 (f)	The adjustments shall be determined using the following criteria, from amongst those set out in Section III, Evaluation and Qualification Criteria: (a) Deviation in Time for Completion: No,; (b) Life cycle costs: No,; (c) Functional Guarantees of the Facilities: No,; (d) Work, services, facilities, etc., to be provided by the Employer: No,
F- Award of Contract	
ITB 47.1	The successful Bidder shall submit the Beneficial Ownership Disclosure Form.
ITB 49.1	The procedures for making a Procurement-related Complaint are detailed in the Part B of the Operations Procurement Manual under the Procurement Framework of the African Development Bank. If a Bidder wishes to make a Procurement-related Complaint, the Bidder shall submit its complaint following these procedures to the employer, in writing (by the quickest means available, such as by email in accordance with the following:

	<p>For the attention: Abba Aliyu</p> <p>Title/position: Head – Project Management Unit (Nigeria Electrification Project)</p> <p>Employer: Rural Electrification Agency (REA)</p> <p>Email address: afdbnep.procure@rea.gov.ng</p> <p>In summary, a Procurement-related Complaint may challenge any of the following:</p> <ol style="list-style-type: none">1. the terms of the Bidding Documents;2. the purchaser's decision to exclude a bidder from the procurement process prior to the award of contract; and3. the Employer's decision to award the contract. <p>The Bank's Procurement Framework stipulates that bidders may send copies of their communications with the Borrowers to the Bank or write to the Bank directly when, Borrowers do not respond promptly, any questions on any issues regarding the implementation of Bank funded projects, or when the communication is a complaint against the Borrower. In this regard, if a bidder wishes to protest against a decision made by a Borrower or the Bank with regards to the procurement process or wishes to inform the Bank that the Bank's procurement rules and/or provisions of the bidding documents have not been complied with, an email can be sent to the following address:</p> <p>Email: procurementcomplaints@afdb.org</p>
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Section III - Evaluation and Qualification Criteria

This Section contains all the criteria that the Employer shall use to evaluate Bids and qualify Bidders. No other factors, methods or criteria shall be used other than those specified in this bidding document.

The Bidder shall provide all the information requested in the forms included in Section IV, Bidding Forms.

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The Employer shall use the criteria and methodologies listed in this Section to evaluate Bids. By applying the criteria and methodologies, the Employer shall determine the Successful Bid or Bids as defined under ITB 40.

1. Margin of Preference

1.1 Domestic Preference:

As a general rule, in the case of single responsibility (other than Turnkey) contracts for large industrial plants and facilities, the margin of domestic preference shall be applied as described below. It will not be applied to the whole contract for Plant and Installation services but only to the locally manufactured equipment. As described under ITB 17.5, equipment offered from abroad shall be quoted CIP and equipment manufactured and offered locally shall be quoted EXW under Schedules 1 and 2 respectively. All other items and components under the Contract such as design, construction, materials, local transportation, and insurance to the place of destination, assembly, installation, and supervision, as applicable, shall be quoted separately as per ITB 17.5. For the purpose of bid evaluation and comparison of bids, only the CIP price of each bid of the equipment offered from outside the Borrower's country as quoted under Schedule 1 shall be increased by 15% (fifteen percent). No preference shall be applied for any other items under the Contract including associated or non-consulting services or works included in the package. The bid determined to be the lowest evaluated in accordance with the bid evaluation criteria including domestic preference, if applicable, and applied as above, shall be selected for award.

2. Evaluation

2.1 Technical Evaluation

In addition to the criteria listed in ITB 35.2, 35.3 and BDS, the following criteria shall apply:

- i) Assessment of adequacy of Technical Proposal with Requirements (Reference ITB 16 and ITB 30.3): The Employer shall determine whether the Bids are substantially responsive to the Technical Requirements.

Evaluation of the Bidder's Technical Proposal shall include an assessment of the Bidder's technical capacity to mobilize key equipment and personnel for the contract consistent with its proposal regarding method statement, scheduling, plant, material and equipment sourcing in sufficient detail and fully in accordance with the requirements stipulated in Section VII, Employer's Requirements.

Environmental and Social Adequacy

The bidder shall submit:

- a corporate environmental and social management system (ESMS) (see attached template);
- evidence of having developed and/ or familiar with the use of site specific ESMP/ ESIA/ RAP for similar project (ESMP/ESIA certificates or approval for at least 2 completed assignments).
- evidence of experience in stakeholders / community engagement

Also, the bidder shall provide in his team

- an Environmental Health and Safety (EHS) Officer with a minimum of Bachelor's degree or its equivalent in Environmental science, Engineering, Physical/ Natural Sciences (or related field). The officer must have certification with related HSE professional bodies. He/ She must demonstrate a minimum of 5 years post qualification experience with at least 3 years in power sector, with the capacity to conduct and/ or guide the process of preparation of ESMP/ ESIA.
- A Social Safeguard Officer with a minimum of Bachelor's Degree in Social Sciences or gender studies. Experience in Gender Based violence is compulsory. Four (4) years post qualification experience in stakeholders' engagement and management, grievance redress mechanism, involuntary resettlement planning and knowledge of gender issues in development particularly GBV, SEA/SH with at least two (2) years' experiences in GBV (especially in areas of sexual exploitation and abuse, and sexual harassment).

- ii) Assessment of adequacy of Commercial Terms and Conditions of the Bid (Reference ITB 30.4): The Employer will determine whether the Bids are substantially responsive to the Commercial and Contractual Terms and Conditions.

No additional requirement

2.2 Economic Evaluation

The following factors and methods will apply in addition to Margin of Preference stated under paragraph 1.0 of Section III, if applicable:

(a) Time Schedule: Not Applicable

Time to complete the Plant and Installation Services from the effective date specified in Article 3 of the Contract Agreement for determining time for completion of pre-commissioning activities is: Not Applicable. No credit will be

given for earlier completion. Bids offering a completion date beyond the maximum designated period shall be rejected.

(b) Life Cycle Costs - (Not Applicable)

(c) Functional Guarantees of the Facilities - (Pass or Fail)

The minimum (or maximum) requirements stated in the Specification for functional guarantees required in the Specification are:

University	Guaranteed Expected Output of the plant during Daylight Hours [MWh/month]	Maximum SAIDI per quarter during Daylight Hours (hr)	Minimum Solar-Battery Energy Fraction) during Daylight Hours [%]
MAU YOLA	544	33	75%
FUDMA	228	33	75%
FU LAFIA	156	33	75%
FU LOKOJA	156	33	75%
FUTA	358	33	75%
FU UYO	218	33	75%
FUTO	692	33	75%
UNIPORT & UPTH	881	33	75%

(d) Work, services, facilities, etc., to be provided by the Employer – (Not Applicable)

(e) Sustainable procurement - (Not Applicable)

(f) Alternative technical solutions for specified parts - (Not Applicable)

(g) Specific additional criteria - (Not Applicable)

2.3 Single and Multiple Contracts (ITB 35.6)

Pursuant to ITB 17.10, and ITB 35.4 and in accordance with how bids are invited either for 'Plant' as a single contract (or as one lot) or more than one lot (contract) each lot consisting of one 'Plant' or packages (one or more lots in a package) and bids are invited for one or multiple lots, the evaluation and award will be as follows:

Evaluation and Award Criteria for Single and Multiple Contracts [ITB 35.4]:

i) For 'Plant' (Single Contract):

The bids will be evaluated for 'Plant' and the contract will be awarded to the Bidder offering the lowest evaluated cost to the Employer for 'Plant', subject to the selected Bidder substantially meeting the required qualification criteria for the contract, and determination of substantial responsiveness of the Bid.

ii) For Multiple Contracts [ITB 35.4]:

Lots

Bidders have the option to Bid for any one or more lots. Bids will be evaluated lot-wise, taking into account discounts offered, if any, after considering all possible combinations of lots, the contract(s) will be awarded to the Bidder or Bidders offering the lowest evaluated cost to the Employer for combined lots (contracts), subject to the selected Bidder(s) substantially meeting the required qualification criteria for lot or combination of lots for which they are selected as the case may be.

In determining the lowest evaluated cost for combined lots or combined packages as aforesaid, the Employer will decide which contract or contracts will be awarded to a Bidder based on its overall technical and financial capacity limitation including such limitations of JV members and/or specialized contractors, as the case may be, for combined contracts determined pursuant to ITB 15 and ITB 39, notwithstanding that the Bidder submitted the lowest evaluated cost for a number of contracts but the aggregate qualification requirements of such contracts exceed Bidder's overall technical and financial capacity.

3. Qualification Criteria for Multiple Contracts

The criteria for qualification is the aggregate minimum requirement for respective lots as specified under sub items 3.1, 3.2, 4.1, 4.2(a) & (b) of Paragraph 3.1: Qualification, of Section III. However, with respect to the **specific experience** under item 4.2 (a) of Paragraph 3.1: Qualification, of Section III, the Employer will select any one or more of the options as identified below:

N is the minimum number of contracts

V is the minimum value of a single contract

(a) For one Contract:

Option 1: (Not Applicable)

(i) N contracts, each of minimum value V;

Or

Option 2: (Applicable)

(i) N contracts, each of minimum value V; or

(ii) Less than or equal to N contracts, each of minimum value V, but with total value of all contracts equal or more than $N \times V$.

(b) For multiple Contracts

Option 1: - (Not Applicable)

(i) Minimum requirements for combined contract(s) shall be the aggregate requirements for each contract for which the Bidder has submitted Bids as follows, and N1, N2, N3, etc. shall be different contracts:

Lot 1: N1 contracts, each of minimum value V1;

Lot 2: N2 contracts, each of minimum value V2;

Lot 3: N3 contracts, each of minimum value V3;

----etc.

Or

Option 2: - (Not Applicable)

(i) Minimum requirements for combined contract(s) shall be the aggregate requirements for each contract for which the Bidder has submitted Bids as follows, and N1, N2, N3, etc. shall be different contracts:

Lot 1: N1 contracts, each of minimum value V1;

Lot 2: N2 contracts, each of minimum value V2;

Lot 3: N3 contracts, each of minimum value V3;

----etc., **or**

(ii) Lot 1: N1 contracts, each of minimum value V1; or number of contracts less than or equal to N1, each of minimum value V1, but with total value of all contracts equal or more than $N1 \times V1$.

(iii) Lot 2: N2 contracts, each of minimum value V2; or number of contracts less than or equal to N2, each of minimum value V2, but with total value of all contracts equal or more than $N2 \times V2$.

(iv) Lot 3: N3 contracts, each of minimum value V3; or number of contracts less than or equal to N3, each of minimum value V3, but with total value of all contracts equal or more than $N3 \times V3$.

----etc.

Or

Option 3: - (Applicable)

(i) Minimum requirements for combined contract(s) shall be the aggregate requirements for each contract for which the Bidder has bid for as follows, and N1, N2, N3, etc. shall be different contracts:

Lot 1: N1 contracts, each of minimum value V1;

Lot 2: N2 contracts, each of minimum value V2;

Lot 3: N3 contracts, each of minimum value V3;

----etc., **or**

(ii) Lot 1: N_1 contracts, each of minimum value V_1 ; or number of contracts less than or equal to N_1 , each of minimum value V_1 , but with total value of all contracts equal or more than $N_1 \times V_1$.

Lot 2: N_2 contracts, each of minimum value V_2 ; or number of contracts less than or equal to N_2 , each of minimum value V_2 , but with total value of all contracts equal or more than $N_2 \times V_2$.

Lot 3: N_3 contracts, each of minimum value V_3 ; or number of contracts less than or equal to N_3 , each of minimum value V_3 , but with total value of all contracts equal or more than $N_3 \times V_3$.

----etc., **or**

(iii) Subject to compliance as per (ii) above with respect to minimum value of single contract for each lot, total number of contracts is equal or less than $N_1 + N_2 + N_3$ ---but the total value of all such contracts is equal or more than $N_1 \times V_1 + N_2 \times V_2 + N_3 \times V_3$ ----.

Other criteria – (None)

3.1 Qualification

Factor	1. Eligibility					
Sub-Factor	Requirement	Criteria				Documentation Required
		Single Entity	Bidder			
			Joint Venture (existing or intended)			
			All members combined	Each Partner	At least one Partner	
1.1 Nationality	Nationality in accordance with ITB 4.4.	Must meet requirement	must meet requirement	Must meet requirement	N / A	Form ELI –1.1 and 1.2, with attachments
1.1.2 Eligibility of Materials, Equipment, Plant and Services	Country of Origin in accordance with ITB 5	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Letter of Bid & Form ELI-1.3
1.2 Conflict of Interest	No- conflicts of interests as described in ITB 4.2	Must meet requirement	must meet requirement	Must meet requirement	N / A	Letter of Bid
1.3 Bank Ineligibility	Not having been declared ineligible by the Bank as described in 4.5.	Must meet requirement	must meet requirement	Must meet requirement	N / A	Letter of Bid

1.4 State Owned Enterprise or Institution of the Borrower country	Compliance with conditions of ITB 4.6	Must meet requirement	Must meet requirement	Must meet requirement	N / A	Form ELI –1.1 and 1.2, with attachments
1.5 Ineligibility based on a United Nations resolution or Borrower’s country law	Not having been excluded as a result of the Borrower’s country laws or official regulations, or by an act of compliance with UN Security Council resolution, in accordance with ITB 4.8 and Section V.	Must meet requirement	must meet requirement	Must meet requirement	N / A	Letter of Bid

Factor	2. Historical Contract Non-Performance					
Sub-Factor	Requirement	Criteria				Documentation Required
		Single Entity	Bidder			
			Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
2.1 History of non-performing contracts	Non-performance ¹ of a contract did not occur as a result of contractor default since 1 st January 2018.	Must meet requirement by itself or as member to past or existing JV	N / A	Must meet requirement ²	N / A	Form CON - 2

¹ Nonperformance, as decided by the Employer, shall include all contracts where (a) nonperformance was not challenged by the contractor, including through referral to the dispute resolution mechanism under the respective contract, and (b) contracts that were so challenged but fully settled against the contractor. Nonperformance shall not include contracts where Employers decision was overruled by the dispute resolution mechanism. Nonperformance must be based on all information on fully settled disputes or litigation, i.e. dispute or litigation that has been resolved in accordance with the dispute resolution mechanism under the respective contract and where all appeal instances available to the Bidder have been exhausted.

² This requirement also applies to contracts executed by the Bidder as JV member.

Factor	2. Historical Contract Non-Performance					
Sub-Factor	Requirement	Criteria				Documentation Required
		Single Entity	Bidder			
			Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
2.2 Suspension	Suspension Based on Execution of Bid Securing Declaration by the Employer or withdrawal of the Bid within Bid validity period or other failures pursuant to ITB 4.7 and ITB 20.9 or any such conditions	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Letter of Bid
2.3 Pending Litigation	Bid's financial position and prospective long-term profitability still sound according to criteria established in 3.1 below and assuming that all pending litigation will be resolved against the Bidder	Must meet requirement	N / A	Must meet requirement	N / A	Form CON – 2

Factor	2. Historical Contract Non-Performance					
Sub-Factor	Requirement	Criteria				Documentation Required
		Single Entity	Bidder			
			Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
2.4 Litigation History	No consistent history of court/arbitral award decisions against the Bidder ³ since 1 st January 2018	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Form CON – 2

³ The Bidder shall provide accurate information on the related Letter of Bid about any litigation or arbitration resulting from contracts completed or ongoing under its execution over the last five years. A consistent history of awards against the Bidder or any member of a joint venture may result in failure of the Bid.

Factor	2. Historical Contract Non-Performance					
Sub-Factor	Requirement	Criteria				Documentation Required
		Single Entity	Bidder			
			Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
2.5 Declaration: Environmental and Social (ES) past performance	Declare any contract that has been suspended or terminated and/or performance security called by an employer for reasons of breach of environmental, or social (including Sexual Exploitation, and Abuse) contractual obligations in the past five years. ⁴	Must make the declaration. Where there are Specialized Subcontract or/s, the Specialized Subcontract or/s must also make the declaration.	N/A	Each must make the declaration. Where there are Specialized Subcontractor/s, the Specialized Subcontractor/s must also make the declaration.	N/A	Form CON-3 ES Performance Declaration

⁴ The Employer may use this information to seek further information or clarifications in carrying out its due diligence.

Factor	3. Financial Situation					
Sub-Factor	Requirement	Criteria				Documentation Required
		Single Entity	Bidder			
			Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
3.1 Financial Capabilities	Submission of audited balance sheets or if not required by the law of the Bidder's Country, other financial statements acceptable to the Employer, for the last five [5] years to demonstrate the current soundness of the Bidders financial position and its prospective long-term profitability.	Must meet requirement	N / A	Must meet requirement	N / A	Form FIN – 3.1 with attachments
3.2 Average Annual Turnover	Minimum average annual turnover in Construction of PV plants for: Lot-1: N10,085,320,320 or \$25,213,300.00, Lot 2: N4,830,963,200.00, or \$12,077,408.00, Lot-3: N5,034,109,440.00 or \$12,585,273.00, Lot 4: N4,816,913,280.00, or \$12,042,283.00, Lot-5: N16,248,602,400.00, or \$40,497,204.00, Lot 6: N19,463,937,920.00, or \$48,659,844.00, Lot 7: N6,287,928,320.00, or \$15,719,820.00,	Must meet requirement	Must meet requirement	Must meet Twenty-Five percent (25%) of the requirement	Must meet Fifty percent (50%) of the requirement	Form FIN – 3.2

Factor	3. Financial Situation					
Sub-Factor	Requirement	Criteria				Documentation Required
		Single Entity	Bidder			
			Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
	Lot 8: N7,681,998,720.00, or \$19,204,996.00. calculated as total certified payments received for contracts in progress or completed, within the last five (5) years					
3.3 Financial Resources	<p>The Bidder must demonstrate access to, or availability of, financial resources such as liquid assets, unencumbered real assets, lines of credit, and other financial means, other than any contractual advance payments to meet:</p> <p>(i) the following cash-flow requirement: Lot-1: N2,101,108,400.00 or \$5,252,771.00, Lot 2: N1,006,450,668.00, or \$2,516,126.67, Lot-3: N1,048,772,800.00, or \$2,621,932.00, Lot 4: N1,003,523,600.00, or \$2,508,809.00, Lot-5: N3,374,767,068.00, or \$8,436,917.67, Lot 6: N4,054,987,068.00, or \$10,137,467.67, Lot 7: N1,309,985,068.00 or \$3,274,962.67, Lot 8: N1,600,416,400.00 or \$4,001,041.00</p>	Must meet requirement	Must meet requirement	Must meet Twenty-Five percent (25%) of the requirement	Must meet Fifty percent (50%) of the requirement	Form FIN – 3.3

Factor	3. Financial Situation					
Sub-Factor	Criteria					Document ation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
All members combined	Each member		At least one member			
	and (ii) the overall cash flow requirements for this contract and its current commitments.					

Factor	4. Experience					
Sub-Factor	Criteria	Bidder				Document ation Required
	Requirement	Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
4.1 General Experience	Experience in Engineering, Procurement and Construction of Solar Hybrid Power Plants under contracts in the role of <i>contractor</i> , subcontractor, or management contractor for at least the last five years starting 1 st January 2018.	Must meet requirement	N / A	Must meet requirement	N / A	Form EXP-4.1

4.2(a) Specific Experience	<p>(a) Participation as contractor, joint venture member⁵, management contractor, or subcontractor, in at least Two (2) contracts within the last Five (5) years, each with a value of at least:</p> <p>Lot-1: N5,042,660,160.00, or \$12,606,650.40, Lot 2: N2,415,481,600.00, or \$6,038,704.00, Lot-3: N2,517,054,720.00, or \$6,292,636.80, Lot 4: N2,408,456,640.00, or \$6,021,141.60, Lot-5: N8,099,440,960.00, or \$20,248,602.40, Lot 6: N9,731,968,960.00, or \$24,329,922.40, Lot 7: N3,143,964,160.00, or \$7,859,910.40 Lot 8: N3,840,999,360.00, or \$9,602,498.40, that have been successfully and substantially⁶completed and that are similar to the proposed Plant and Installation Services.</p> <p>The similarity of the contracts shall be based on the following: NA</p>	Must meet requirement	Must meet requirements ⁷	N / A	N/A	Form EXP 4.2(a)
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⁵ For contracts under which the Bidder participated as a joint venture member or sub-contractor, only the Bidder's share, by value, shall be considered to meet this requirement

⁶ Substantial completion shall be based on 80% or more plant and installation completed under the contract.

⁷ In the case of JV, the value of contracts completed by its members shall not be aggregated to determine whether the requirement of the minimum value of a single contract has been met. Instead, each contract performed by each member shall satisfy the minimum value of a single contract as required for single entity. In determining whether the JV meets the requirement of total number of contracts, only the number of contracts completed by all members each of value equal or more than the minimum value required shall be aggregated.

<p>4.2(b) Specific Experience</p>	<p>(b) For the above or other contracts executed during the period stipulated in 4.2(a) above, a minimum experience in the following key activities:</p> <p>1. Experience in Engineering, Procurement and Construction of Solar Hybrid Power Plants: The Bidder has Constructed at least (irrespective of lot capacity) 3 x Hybrid Project, (PV+Battery minimum) experience with at least 1 project of:</p> <ul style="list-style-type: none"> - 500 kWh Li-Ion storage minimum for Lots with less than 5 MWh storage - 2000 kWh Li-Ion storage minimum for Lots more than 5 MWh storage (Yola, Futo, Uniport) <p>Depending on Lot PV capacity –</p> <ul style="list-style-type: none"> - 1 MWp PV capacity minimum for Lots of smaller than 5 MWp and - 3 MWp PV capacity minimum for Lots of 5MWp or larger (Yola, Futo, Uniport) <p>With the minimum for any the 3 project references to be 100 kWh Li Ion storage and 100 kWp PV.</p> <p>since January 2018, and these Power Plant is still in operation* at the time of issuance of this bidding document, as evidenced by:</p>	<p>Must meet requirements</p>	<p>Must meet requirements⁸</p>	<p>Each member should have experience in the design, supply, installation, and operation of solar hybrid power plants (at least 2 projects). Specifically, each project must have at least 100kWp PV and 100kWh Energy Storage system.</p>	<p>Must meet requirement.</p>	<p>Form EXP-4.2(b)</p>
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⁸ In the case of JV, the value of contracts completed by its members shall not be aggregated to determine whether the requirement of the minimum value of a single contract has been met. Instead, each contract performed by each member shall satisfy the minimum value of a single contract as required for single entity. In determining whether the JV meets

the requirement of total number of contracts, only the number of contracts completed by all members each of value equal or more than the minimum value required shall be aggregated.

	<ul style="list-style-type: none"> ▪ A description of the mini grid systems (size, generation technology, location, year of operations date etc.) ▪ References (names, contacts). <p>2. Experience in Operations and Maintenance of Solar Hybrid Power Plant: The Bidder has operated and maintained at least three (3) Solar Hybrid Power Plants of the minimum PV and energy storage capacities as listed above, since January 2018, and this power plant is still in operation at the time of issuance of this, as evidenced by:</p> <ul style="list-style-type: none"> ▪ A description of the Power Plant (size, generation technology, location, year of COD, etc.) ▪ References (names, contacts). <p><i>Indicate, if any, of these key requirements may also be met through a specialized subcontractor. NA</i></p>					
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4.2 (c) Experience in Managing ES Risks & Impact	<p>For the contracts in 4.2 (a) above and/or any other contracts [substantially completed and under implementation] as prime contractor, joint venture member, or Subcontractor between 1st January 2018 and Bid submission deadline, experience in managing ES risks and impacts in the following aspects: <i>[Based on the ES assessment, specify, as appropriate, specific experience requirements to manage ES aspects.]</i></p> <ul style="list-style-type: none"> • Development and familiarity with the use of site specific ESMP/ ESIA/ RAP for similar projects (ESMP/ESIA certificates or approval for at least 2 completed assignments • experience in stakeholders / community engagement 	<p>Must meet requirements</p>	<p>Must meet requirements</p>	<p>Must meet the following requirements : "N/A"</p>	<p>Must meet the following requirements: "N/A"</p>	<p>Form EXP – 4.2 (c)</p>
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Note: *[For Multiple lots (contracts) specify financial and experience criteria for each lot under Sub-Factors 3.1, 3.2, 4.2(a), 4.2(b) and 4.2 (c)]*

3.2 Contractor's Representative and other Key Personnel

The Bidder must demonstrate that it will have a suitably qualified Contractor's Representative and other suitably qualified (and in adequate numbers) key personnel, as required for each lot and as described in the Specification (refer to Part 2 – Employers Requirements).

The Bidder shall provide details of the Contractor's Representative and other key personnel and such other key personnel that the Bidder considers appropriate to perform the Contract, together with their academic qualifications and work experience. The Bidder shall complete the relevant Forms in Section IV, Bidding Forms.

3.3 Equipment

The Bidder must demonstrate that it will have access to the key Contractor's equipment listed hereafter:

No.	Equipment Type, Characteristics and Specifications	Minimum Number required per lot
1	Lifting Cranes 80-100 Tons Depending on Generator Weight & Location.	1
2	Pallet Trucks and Towing Devices of various capacities	2
3	Forklift as appropriate Self-loader truck for Site Installation works able to lift 8 tons or suitable capacity.	4
4	A vehicle truck AAA-88XU (Hiab Truck)	2
5	Assorted types of rollers for generator positioning works	8
6	Chain Blocks and hall- yards	6
7	Assorted Welding Machines	6
8	Angle Grinders and various kinds of cutters for Mild Steel and Stainless Steel	10
9	Brush trolley for cleaning PV panels	20
10	Vermeer PD10 Solar Pile Drivers or equivalent	4

The Bidder shall provide further details of proposed items of equipment using the relevant Form in Section IV.

3.4 Subcontractors/Manufacturers

Subcontractors/manufacturers for the following major items of supply or services ('Specialized Subcontractors') must meet the following minimum criteria, herein listed for that item:

Item No.	Description of Item	Years of Experience/ Manufacturing Equipment related to the Project
1	PV modules	5
2	PV inverters	5
3	PCS	5
4	Batteries	5
5	Mounting structure	5
6	Subcontractor for Civil Works	10
7	Subcontractor for Mechanical Works	10

All Manufacturers must be certified according to ISO9001 and ISO14001

Failure to comply with this requirement will result in rejection of the subcontractor.

In the case of a Bidder who offers to supply and install major items of supply under the contract that the Bidder did not manufacture or otherwise produce, the Bidder shall provide the manufacturer's authorization, using the form provided in Section IV, showing that the Bidder has been duly authorized by the manufacturer or producer of the related plant and equipment or component to supply and install that item in the Employer's Country. The Bidder is responsible for ensuring that the manufacturer or producer complies with the requirements of ITB 4 and 5 and meets the minimum criteria listed above for that item.

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Letter of Bid

INSTRUCTIONS TO BIDDERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE DOCUMENT

The Bidder must prepare this Letter of Bid on stationery with its letterhead clearly showing the Bidder's complete name and business address.

Note: All italicized text is to help Bidders in preparing this form.

Date of this Bid submission: *[insert date (as day, month and year) of Bid submission]*

OCBI No.: *[insert number of bidding process as per procurement plan]*

Invitation for Bid No.: *[insert same IFB No. as advertised]*

Alternative No.: *[insert identification No if this is a Bid for an alternative]*

To: *[insert complete name of Employer]*

- (a) **No reservations:** We have examined and have no reservations to the bidding document, including Addenda issued in accordance with ITB 8;
- (b) **Eligibility of Bidders:** We, including any subcontractors or suppliers for any part of the Contract, have nationalities from eligible countries and meet the eligibility requirements and have no conflict of interest in accordance with ITB 4;
- (c) **Eligibility of Plant and Equipment, Installation and Other Services:** We meet the eligibility requirements for Plant and Equipment, Installation and Other Services in accordance with ITB 5;
- (d) **Bid-Securing Declaration:** We have not been suspended nor declared ineligible by the Employer based on execution of a Bid Securing Declaration in the Employer's Country in accordance with ITB 4.7;
- (e) **Conformity:** We offer to provide design, supply and installation services in conformity with the bidding document of the following: *[insert a brief description of the Plant, Design, Supply and Installation Services];*

- (f) **Bid Price:** The total price of our Bid, excluding any discounts offered in item (g) below is: *[Insert one of the options below as appropriate in accordance with ITB 17.10]*

[Option 1, in case of one lot (contract) i.e. 'Plant' as a Single Contract:] Total price is: [insert the total price of the Bid in words and figures, indicating the various amounts and the respective currencies];

Or

[Option 2, in case of multiple lots i.e. 'Plant'(s) are divided into lots (contracts)]

For Option 2 : (a) Total price of each lot *[insert the total price of each lot in words and figures, indicating the various amounts and the respective currencies; and* (b) Total price of all lots (sum of all lots) *[insert the total price of all lots in words and figures, indicating the various amounts and the respective currencies];*

- (g) **Discounts:** The discounts offered and the methodology for their application are:

(i) The discounts offered are: *[Specify in detail each discount offered.]*

(ii) The exact method of calculations to determine the net price of each item, and in case of multiple lots, net price of each item and each lot, as applicable, after application of discounts is shown below: *[Specify in detail the method that shall be used to apply the discounts and ensure clarity, unambiguity, etc. in accordance with ITB 17.12];*

- (h) **Bid Validity Period:** Our Bid shall be valid for the period specified in BDS 19.1 (or as amended if applicable) from the date fixed for the Bid submission deadline specified in BDS 23.1 (as amended if applicable), and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
- (i) **Performance Security:** If our Bid is accepted, we commit to obtain a Performance Security in accordance with the bidding document;
- (j) **One Bid Per Bidder:** We are not submitting any other Bid(s) as an individual Bidder, and we are not participating in any other Bid(s) as a Joint Venture member, and meet the requirements of ITB 4.3, other than alternative Bids submitted in accordance with ITB 13;
- (k) **Suspension and Debarment:** We, along with any of our subcontractors, suppliers, consultants, manufacturers, or service providers for any part of the contract, are not subject to, and not controlled by any entity or individual that is subject to, a

temporary suspension or a debarment imposed by the Bank or a debarment imposed by the Bank in accordance with the Agreement for Mutual Enforcement of Debarment Decisions between the Bank and other development banks. Further, we are not ineligible under the Employer's Country laws or official regulations or pursuant to a decision of the United Nations Security Council;

- (l) **State-owned enterprise or institution:** *[select the appropriate option and delete the other] [We are not a state-owned enterprise or institution] / [We are a state-owned enterprise or institution but meet the requirements of ITB 4.6];*
- (m) **Commissions, gratuities and fees:** We have paid, or will pay the following commissions, gratuities, or fees with respect to the Bidding process or execution of the Contract: *[insert complete name of each Recipient, its full address, the reason for which each commission or gratuity was paid and the amount and currency of each such commission or gratuity]*

Name of Recipient	Address	Reason	Amount

(If none has been paid or is to be paid, indicate "none.")

- (n) **Binding Contract:** We understand that this Bid, together with your written acceptance thereof included in your Letter of Acceptance, shall constitute a binding contract between us, until a formal contract is prepared and executed;
- (o) **Not Bound to Accept:** We understand that you are not bound to accept the lowest evaluated cost Bid, or any other Bid that you may receive; and
- (p) **Fraud and Corruption:** We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf engages in any type of Fraud and Corruption.

Name of the Bidder: **[insert complete name of person signing the Bid]*

Name of the person duly authorized to sign the Bid on behalf of the Bidder: ***[insert complete name of person duly authorized to sign the Bid]*

Title of the person signing the Bid: *[insert complete title of the person signing the Bid]*

Signature of the person named above: *[insert signature of person whose name and capacity are shown above]*

Date signed *[insert date of signing]* **day of** *[insert month]*, *[insert year]*

Schedule of Rates and Prices (Price Schedules)

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad

Item	Description	Code ¹		Qty.	Unit Price ²		Total Price
						<i>CIP³</i>	
				<i>(1)</i>	<i>(2)</i>	<i>(3)</i>	<i>(1) x (3)</i>
TOTAL (to Schedule No. 5. Grand Summary)							
				Name of Bidder _____ Signature of Bidder _____			

¹ Bidders shall enter a code representing the country of origin of all imported plant and equipment.

² Specify currency. Create and use as many columns for Unit Price and Total Price as there are currencies.

³ Specify final destination if destination and final destination is the same. In that case refer to ITB 17.5 (d) with respect to local transportation, insurance, etc.

Country of Origin Declaration Form

Item	Description	Code	Country

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Within the Employer's Country

Item	Description	Qty.	EXW Unit Price ¹	Sales and other taxes payable per line item if Contract is awarded (in accordance with ITB 17.5 (b) (ii))	EXW Total Price
		<i>(1)</i>	<i>(2)</i>	<i>(3)</i>	<i>(1) x (2)</i>
TOTAL (to Schedule No. 5. Grand Summary)					
Name of Bidder _____ Signature of Bidder _____					

¹ Specify currency in accordance with specifications in Bid Data Sheet under ITB 18.1

Schedule No. 3. Design Services

Item	Description	Qty. <i>(1)</i>	Unit Price ²		Total Price <i>(1) x (2)</i>
			Local Currency Portion <i>(2)</i>	Foreign Currency Portion <i>(optional)</i>	
TOTAL (to Schedule No. 5. Grand Summary)					

Name of Bidder _____

Signature of Bidder _____

² Unit and Total price for design services shall include all taxes, levies, charges, etc. payable, if any, on such services as of twenty-eight (28) days prior to the deadline for submission of Bids in accordance with ITB 17.5 (c).

**Schedule No. 4. Installation and Other Services (Including
Operations and Maintenance/Training)**

Item	Description	Qty. <i>(1)</i>	Unit Price		Total Price ³	
			Foreign Currency Portion	Local Currency Portion	Foreign	Local
			<i>(2)</i>	<i>(3)</i>	<i>(1) x (2)</i>	<i>(1) x (3)</i>
TOTAL (to Schedule No. 5. Grand Summary)						
		Signature of Bidder _____				

³ Specify currency in accordance with ITB 18. Also, when destination and final destination is the same and Schedule 1 requires CIP final destination prices, then Schedule 4 will not include costs of local transportation, Insurance, etc. related to items in Schedule 1 already included in prices under Schedule 1

Schedule No. 5. Grand Summary

Item	Description	Total Price ⁴	
		Foreign	Local
	Total Schedule No. 1. Plant, and Mandatory Spare Parts Supplied from Abroad		
	Total Schedule No. 2. Plant, and Mandatory Spare Parts Supplied from Within the Employer's Country		
	Total Schedule No. 3. Design Services		
	Total Schedule No. 4. Installation and Other Services		
TOTAL (to Letter of Bid)			
		Name of Bidder _____ Signature of Bidder _____	

⁴ Specify currency in accordance with ITB 18. Create and use as many columns for Foreign Currency requirement as there are foreign currencies

Schedule No. 6. Recommended Spare Parts

Item	Description	Qty. <i>(1)</i>	Unit Price		Total Price <i>(1) x (2) or (3)</i>
			CIF or CIP (foreign parts) <i>(2)</i>	EXW (local parts) <i>(3)</i>	
<p>Name of Bidder _____</p> <p>Signature of Bidder _____</p>					

Price Adjustment - (Not Applicable)

Where the Contract Period (excluding the Defects Liability Period) exceeds eighteen (18) months, it is normal procedure that prices payable to the Contractor shall be subject to adjustment during the performance of the Contract to reflect changes occurring in the cost of labor and material components. In such cases the bidding document shall include in this form a formula of the following general type, pursuant to PCC Sub-Clause 11.2.

Where Contracts are of a shorter duration than eighteen (18) months or in cases where there is to be no Price Adjustment, the following provision shall not be included. Instead, it shall be indicated under this form that the prices are to remain firm and fixed for the duration of the Contract.

Sample Price Adjustment Formula

If in accordance with GCC 11.2, prices shall be adjustable, the following method shall be used to calculate the price adjustment:

Prices payable to the Contractor, in accordance with the Contract, shall be subject to adjustment during performance of the Contract to reflect changes in the cost of labor and material components, in accordance with the following formula:

$$P_1 = P_0 \left(a + b \frac{L_1}{L_0} + c \frac{M_1}{M_0} \right) - P_0$$

in which:

P_1 = adjustment amount payable to the Contractor

P_0 = Contract price (base price)

a = percentage of fixed element in Contract price ($a = \%$)

b = percentage of labor component in Contract price ($b = \%$)

c = percentage of material and equipment component in Contract price (c = %)

L_0, L_1 = labor indices applicable to the appropriate industry in the country of origin on the base date and the date for adjustment, respectively

M_0, M_1 = material and equipment indices in the country of origin on the base date and the date for adjustment, respectively

N.B. $a+b+c= 100\%$.

Conditions Applicable To Price Adjustment

The Bidder shall indicate the source of labor, source of exchange rate and materials indices and the base date indices in its bid.

<u>Item</u>	<u>Source of Indices Used</u>	<u>Base Date Indices</u>
-------------	-------------------------------	--------------------------

The base date shall be the date thirty (30) days prior to the Bid closing date.

The date of adjustment shall be the mid-point of the period of manufacture or installation of component or Plant.

The following conditions shall apply:

- (a) No price increase will be allowed beyond the original delivery date unless covered by an extension of time awarded by the Employer under the terms of the Contract. No price increase will be allowed for periods of delay for which the Contractor is responsible. The Employer will, however, be entitled to any price decrease occurring during such periods of delay.
- (b) If the currency in which the Contract price, P_0 , is expressed is different from the currency of the country of origin of the labor and/or materials indices, a correction factor will be applied to avoid incorrect adjustments of the Contract price. The correction factor shall be: Z_0 / Z_1 , where,

Z_0 = the number of units of currency of the origin of the indices which equal to one unit of the currency of the Contract Price P_0 on the Base date, and

Z_1 = the number of units of currency of the origin of the indices which equal to one unit of the currency of the Contract Price P_0 on the Date of Adjustment.

- (c) No price adjustment shall be payable on the portion of the Contract price paid to the Contractor as an advance payment.

Technical Bid

- Technical Bid-Base Bid
- Site Organization
- Method Statement
- Mobilization Schedule
- Construction Schedule
- Plant including Major Equipment Requirement Forms
- Contractor's Equipment
- Personnel
- Proposed Subcontractors for Major Items of Plant and Installation Services
- Others

Technical Bid-Base Bid

[Note for information of Bidder: Bidder shall demonstrate compliance with the Employer's requirements and Technical Specifications as described in Section VII of the Bidding Documents. Any departures or deviations from the required Technical Specifications shall be highlighted and if there are none, full compliance shall be confirmed.

In support of the above confirmation of compliance, the Bidder shall provide complete information and documentation of technical standards, codes, designs and specifications, of the Plant and Installation Services offered along with performance characteristics, Model number or any other details including identification number of the manufacturer wherever applicable and in accordance with all requirements mentioned in ITB 16. Bidding document may stipulate a Table, Form, or Template to present Technical designs, specification, characteristics, functional or other guaranteed parameters, the Bidder shall invariably use the same without any changes and ensure that all requested details and supporting documents are provided. Lack or omission or non-confirmation of substantial details, information, and documentation for major or essential technical requirements/features may result in rejection of the Bid.

If the details of specifications for the offered Plant and equipment in the written text of the Bid differ from the details provided in the supporting literature, drawings or other parts of the document, all such discrepancies shall be explained to the satisfaction of the Employer failing which the Employer, may reject the Bid, or if deemed appropriate, may consider the information in the written text of the Bid to be valid ignoring details in other parts of the Bid. Failure of the Bidder to confirm this will result in rejection of the Bid.

In establishing conformity with the Employer's Specifications and requirements as specified in the Bidding Document along with all supporting documents mentioned in ITB 16, the documentary evidence may be in the form of literature, drawings or data, and shall consist of a detailed item by item description of the essential technical and performance characteristics of the Plant, Equipment and Installation Services, demonstrating their substantial responsiveness to the technical specification, and if applicable, a statement of deviations and exceptions to the provisions of the Section VII, Schedule of Requirements.

Any deviations in the technical standards, codes, designs or specifications or other requirements from those stated in the Bidding Documents shall be explained indicating their impact on the performance requirements, characteristics or

parameters of the Plant and Installation Services required. To this end, for any such deviations to be acceptable, Bid shall establish substantial responsiveness to the required technical specifications by explaining and documenting for the offered Plant and Installation Services equivalency with or improvement to the required technical standards, codes, designs and Specifications.

All required information on Functional Guarantees and those required for determination of life-cycle-cost or cost of operation or maintenance, for the purpose of evaluation and/or award of contract as requested by the Bidding document should be furnished complete in all respect and without any inconsistencies or ambiguities failing which the Bid may not be considered for evaluation and rejected without seeking clarifications especially if such details are major or may lead to change in the substance or price of the bid.

Any Major deviation from the Employer's requirements shall be the cause for rejection of the Bid. Any deviation which in the Bidder's opinion is considered minor, the Bidder shall provide evidence to this effect including evidence of any monetary implications caused by such deviation. The Employer's evaluation shall be independent of Bidder's opinion on such matters and shall be final]

Site Organization

Method Statement

Mobilization Schedule

Construction Schedule

ES Management Strategies and Implementation Plans (ES-MSIP)

The Bidder shall submit comprehensive and concise Environmental and Social Management Strategies and Implementation Plans (ES-MSIP) as required by ITB 11.1 (l) of the Bid Data Sheet. These strategies and plans shall describe in detail the actions, materials, equipment, management processes etc. that will be implemented by the Contractor, and its subcontractors.

In developing these strategies and plans, the Bidder shall have regard to the ES provisions of the contract including those as may be more fully described in the Employer's Requirements in Section VII.

Code of Conduct for Contractor's Personnel (ES) Form

Note to the Employer:

The following minimum requirements shall not be modified. The Employer may add additional requirements to address identified issues, informed by relevant environmental and social assessment.

The types of issues identified could include risks associated with: labour influx, spread of communicable diseases, and Sexual Exploitation and Abuse (SEA), Sexual Harassment (SH) etc.

Delete this Box prior to issuance of the bidding documents.

Note to the Bidder:

The minimum content of the Code of Conduct form as set out by the Employer shall not be substantially modified. However, the Bidder may add requirements as appropriate, including to take into account Contract-specific issues/risks.

The Bidder shall initial and submit the Code of Conduct form as part of its bid.

CODE OF CONDUCT FOR CONTRACTOR'S AND SUBCONTRACTOR'S PERSONNEL

We are the Contractor, [enter name of Contractor]. We have signed a contract with [enter name of Employer] for [enter description of the Facilities]. The Plant for the Facilities will be installed at [enter the Site]. Our contract requires us to implement measures to address environmental and social risks, related to the Installation Services i.e. services ancillary to the supply of the Plant for the Facilities, such as inland transportation, site preparation works/ associated civil works, installation, testing, precommissioning, commissioning, operations and maintenance etc. as the case may require.

This Code of Conduct is part of our measures to deal with environmental and social risks related to the Installation Services.

All personnel that we utilize in the execution of the Contract, including staff, labor and other employees of us and of each Subcontractor, and any other personnel assisting us in the execution of the Contract, are referred to as Contractor's personnel.

This Code of Conduct identifies the behavior that we require from the Contractor's Personnel employed for the execution of Installation Services at the Site (or other places in the country where the Site is located).

Our workplace is an environment where unsafe, offensive, abusive or violent behavior will not be tolerated and where all persons should feel comfortable raising issues or concerns without fear of retaliation.

REQUIRED CONDUCT

Contractor's Personnel employed for the execution of Installation Services at the Site (or other places in the country where the Site is located) shall:

1. carry out his/her duties competently and diligently;
2. comply with this Code of Conduct and all applicable laws, regulations and other requirements, including requirements to protect the health, safety and well-being of other Contractor's and Subcontractor's personnel and any other person;
3. maintain a safe working environment including by:
 - a. ensuring that workplaces, machinery, equipment and processes under each person's control are safe and without risk to health;
 - b. wearing required personal protective equipment;
 - c. using appropriate measures relating to chemical, physical and biological substances and agents; and
 - d. following applicable emergency operating procedures.
4. report work situations that he/she believes are not safe or healthy and remove himself/herself from a work situation which he/she reasonably believes presents an imminent and serious danger to his/her life or health;
5. treat other people with respect, and not discriminate against specific groups such as women, people with disabilities, migrant workers or children;
6. not engage in any form of sexual harassment including unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature with other Contractor's or Employer's Personnel;
7. not engage in Sexual Exploitation, which means any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another;

8. not engage in in Sexual Abuse, which means the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions;
9. not engage in any form of sexual activity with individuals under the age of 18, except in case of pre-existing marriage;
10. complete relevant training courses that will be provided related to the environmental and social aspects of the Contract, including on health and safety matters, and Sexual Exploitation and Abuse, and Sexual Harassment (SH);
11. report violations of this Code of Conduct; and
12. not retaliate against any person who reports violations of this Code of Conduct, whether to us or the Employer, or who makes use of the grievance mechanism for Contractor's Personnel or the project's Grievance Redress Mechanism.

RAISING CONCERNS

If any person observes behavior that he/she believes may represent a violation of this Code of Conduct, or that otherwise concerns him/her, he/she should raise the issue promptly. This can be done in either of the following ways:

1. Contact [*enter name of the Contractor's Social Expert with relevant experience in handling sexual exploitation, sexual abuse and sexual harassment cases, or if such person is not required under the Contract, another individual designated by the Contractor to handle these matters*] in writing at this address [] or by telephone at [] or in person at []; or
2. Call [] to reach the Contractor's hotline (*if any*) and leave a message.

The person's identity will be kept confidential, unless reporting of allegations is mandated by the country law. Anonymous complaints or allegations may also be submitted and will be given all due and appropriate consideration. We take seriously all reports of possible misconduct and will investigate and take appropriate action. We will provide warm referrals to service providers that may help support the person who experienced the alleged incident, as appropriate.

There will be no retaliation against any person who raises a concern in good faith about any behavior prohibited by this Code of Conduct. Such retaliation would be a violation of this Code of Conduct.

CONSEQUENCES OF VIOLATING THE CODE OF CONDUCT

Any violation of this Code of Conduct by the Contractor's Personnel may result in serious consequences, up to and including termination and possible referral to legal authorities.

FOR CONTRACTOR'S PERSONNEL:

I have received a copy of this Code of Conduct written in a language that I comprehend. I understand that if I have any questions about this Code of Conduct, I can contact *[enter name of Contractor's contact person(s) with relevant experience]* requesting an explanation.

Name of Contractor's Personnel: [insert name]

Signature:

Date: (day month year): _____

Countersignature of authorized representative of the Contractor:

Signature: _____

Date: (day month year): _____

ATTACHMENT 1: Behaviors constituting SEA and behaviors constituting SH

ATTACHMENT 1 TO THE CODE OF CONDUCT FORM

BEHAVIORS CONSTITUTING SEXUAL EXPLOITATION AND ABUSE (SEA) AND BEHAVIORS CONSTITUTING SEXUAL HARASSMENT (SH)

The following non-exhaustive list is intended to illustrate types of prohibited behaviors.

(1) Examples of sexual exploitation and abuse include, but are not limited to:

- A Contractor's Personnel tells a member of the community that he/she can get them jobs related to the work site (e.g. cooking and cleaning) in exchange for sex.
- A Contractor's Personnel that is connecting electricity input to households says that he can connect women headed households to the grid in exchange for sex.

- A Contractor's Personnel rapes, or otherwise sexually assaults a member of the community.
- A Contractor's Personnel denies a person access to the Site unless he/she performs a sexual favor.
- A Contractor's Personnel tells a person applying for employment under the Contract that he/she will only hire him/her if he/she has sex with him/her.

(2) Examples of sexual harassment in a work context

- A Contractor's Personnel comment on the appearance of another Installation Services Personnel (either positive or negative) and sexual desirability.
- When a Contractor's Personnel complains about comments made by another Contractor's Personnel on his/her appearance, the other Contractor's Personnel comment that he/she is "asking for it" because of how he/she dresses.
- Unwelcome touching of a Contractor's Personnel or Employer's Personnel by another Contractor's Personnel.
- A Contractor's Personnel tells another Contractor's Personnel that he/she will get him/her a salary raise, or promotion if he/she sends him/her naked photographs of himself/herself.

Plant including Major Equipment Requirement Forms

Major Equipment Requirement Forms

Technical documentation (datasheets, manuals etc.) as well as evidence of warranty/manufacture references etc. to be provided for each of the parameters listed below.

1 PV Modules

N°	Parameter	Requirement	Proposed
1	Technical Characteristics		(Value or Yes/No) Evidence to be submitted
	Module Brand and Model Number	To be Specified along with datasheet	
1.1	PV Module technology	c-Si	
1.2	Number of cells per modules	72 or higher	
1.3	Module rated power at STC	≥ 660Wp for FUTO and UNIPORT; and 400 Wp for other Universities	
1.4	Module Efficiency at STC	≥ 20%	
1.5	Temperature coefficient on power at STC (negative on sign)	Not less than -0.45%/°C	
1.6	Nominal Power Tolerances from	0% ≤ Pnom ≤ +3%; or 0 Wp ≤ Pnom ≤ +5 Wp	

	Manufacturer (used for acceptance to the module)		
1.7	Module Maximum System Voltage	1,000 V DC	
1.8	Module operating temperature range	-10°C to +75°C or wider	
1.9	Junction Box (rear side of the module)	IP 67 rated with at least 3 by-pass diodes	
1.10	Frame	Material: Anodized Aluminium	
1.11	Connectors	≥ IP65 Type MC4 or equivalent	
1.12	Permanent labelling	Serial number (or bar code) Model type and reference Technical data at STC (Peak power, Voc, Isc, Imp, Vmp)	
2	Warranty		
2.1	Performance warranty (year 1): power output guaranteed during the first year of operation	Minimum 97.5%	
2.2	Performance warranty (year 2 to 25) : linear	Maximum of -0.6%/year	

	degradation coefficient on power output		
2.5	Product warranty against manufacturing defects	Minimum 12 years	
3	Manufacturer		
	Bankability Rating	Tier 1	
	Number of Years experience in manufacturing PV Modules	Minimum 5 years	
	Annual manufacturing capacity	Minimum 1500 MWp/yr	
	Specific Module operational reference	At least 12 months in a commercially financed non-recourse project with size of at least 20 MWp	
	Manufacturing facilities standards	ISO9001 and ISO14001	
3	Certification		
3.1	IEC 61215 - Terrestrial photovoltaic (PV) modules - Design qualification and type approval		
3.2	IEC 61730 - Photovoltaic (PV) module safety qualification		

3.3	IEC 61701 - Salt mist corrosion testing of photovoltaic (PV) modules	
3.4	IEC 62716 - PV modules Ammonia corrosion testing	
3.5	PID free certificate issued by a reputable third-party laboratory according to IEC TS 62804 - Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation - Part 1: Crystalline silicon	
3.6	PV module manufacturing facility certified according to ISO9001 et ISO14001	
3.7	EU declaration of conformity	

2 Mounting Structure

N°	Parameter	Requirement	Proposed
1	Technical Characteristics		
	Mounting Structure brand and type	Fixed – module layout to be specified To be specified along with datasheet	
	Type of foundation	Rammed/Pile/Cast etc...Technical details to be provided	
1.1	Near shading incl. inter-row losses	< 1.5%	
1.2	Minimum height of lowest part of the PV modules	0.75 m (from ground level)	
1.3	Maximum height of the highest part of the PV modules	2.5 m (from ground level)	
1.4	Row to row distance	3.5 m recommended 2 m as a minimum value, subject to shading losses	
1.5	Tilt angle and azimuth	To be tendered for 10° towards perfect South, subject to final optimization	
1.6	Material	Anodized aluminium or	

		Hot-dip galvanized steel with protection level for local site conditions defined as per ISO 9223	
1.7	Screws, bolts and nuts	Stainless steel SS304 Antitheft type	
1.8	Maximum wind speed	175 km/h as per local civil codes With panels installed, shall be designed, and certified by a suitably qualified engineer, to withstand category 2 hurricane winds and equivalent wind gusts (in accordance with ISO 2394).	
1.9	Clamping type	Accepted by the PV module manufacturer – to be specified	
2	Warranty and Manufacturer		
2.1	Product warranty against manufacturing defects	Minimum 10 years	
	Manufacturing Experience	Minimum 5 years	

	Project references	Mounting structure manufacturer has supplied mounting structures to at least 20 MWp of projects with a minimum project size of 500kWp and a minimum project operational duration of 2 years (as of 2023)	
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3 PV Inverters

N°	Parameter	Requirement	Proposed
1	Technical Characteristics		
	Brand and Model	To be specified and datasheet included	
1.1	Minimum AC rated power (25°C)	60 kW	
1.2	Nominal AC output voltage	0.4 kV, Three phase + Neutral	
1.3	Rated frequency	50 Hz	
1.4	Maximum DC/AC ratio (ratio between the total DC PV capacity in Wp and the total AC rated power at 25°C of the inverters)	1.2 Technical compatibility between PV modules string configuration and PV inverters shall be confirmed in written along with loss and MPPT range calculations (to be provided with the bid)	
1.5	Degree of protection (according to IEC 60529)	IP65	
1.6	Maximum Power Point (MPP) operating voltage range	Maximum value: at least 10% higher than the string voltage at the lowest expected module temperature of 10°C	

		Minimum value: at least 10% lower than the string voltage at the highest expected module temperature of 75°C	
1.7	Maximum input DC voltage	1,000 V or 1,500 V as required based on inverter size The string voltage at the lowest expected module temperature of 10°C shall be below 1,000 VDC or 1,500 VDC based on inverter size	
1.8	Integrated protection functions on DC input	Surge Protection Device Lockable on-load switch disconnecter to isolate PV sub-arrays DC reverse polarity protection	
1.9	Communication protocol and capability	Standard protocol (Modbus TCP/IP or IEC 61850 based) compliant with Plant PLC	
1.10	Display function	To be included Instantaneous AC active and reactive powers Cumulative energy production Frequency and voltage output DC voltage and current	
1.11	Islanding protection	Required with the possibility to adjust on site minimum and	

		maximum disconnection values for voltage and frequency	
1.12	Maximum Efficiency	Minimum 98%	
1.13	Euro-efficiency	Minimum 97.5%	
1.14	Maximal Total Harmonic Distortion (THD)	3%	
1.15	Maximum standby consumption (at night)	3 W	
1.16	Ambient operating range without AC power derating	10°C - 45°C or wider	
1.17	Maximum permissible value for relative humidity	100%	
1.18	Power factor range	Adjustable (e.g. 0.8 leading to 0.8 lagging) Set-point can be provided via the PLC Dynamic regulation of the reactive power to be provided	
1.19	Cooling system	Active or Passive Cooling system description shall be included in the bid	

1.20	Permanent labelling	Serial number (or bar code) Model type and reference Technical data at STC (Rated power, Maximum input current and voltage, input voltage range)	
2	Warranty and Manufacturer		
2.1	Product warranty against manufacturing defects	Minimum 10 years The Bidder shall indicate if a warranty extension beyond the minimum value is possible	
	Number of Years experience in manufacturing PV Inverters	5 years for string type inverters	
	Annual manufacturing capacity	More than 1000 MW capacity (in the year before tender publication)	
	Manufacturing facilities standards	ISO9001 and ISO14001	
	Specific Inverter operational reference	At least 24 months in a commercially financed non-recourse project with size of at least 10 MWp	
3	Certification Required		Specify (Y/N)

3.1	IEC 62109 - Safety of power converters for use in photovoltaic power systems	
3.2	IEC 62116 - Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures	
3.3	IEC 61000 - Electromagnetic compatibility (EMC)	
3.4	IEC 61727 - Photovoltaic (PV) systems - Characteristics of the utility interface	
3.5	Written confirmation from the inverter manufacturer with regard to the PV module/inverter compatibility at site conditions for each PV block. This written confirmation shall state the absence of overload losses	
3.6	PV inverter manufacturing facility certified according to ISO9001 et ISO14001	
3.7	EU declaration of conformity	
3.8	Other relevant standards (to be specified by Bidder)	

4 ESS System - Batteries

N°	Parameter	Minimum Requirement	Proposed
1	Calendar lifetime (@25°C)	20 years	
2	DC/DC efficiency(@25°C)	95%	
3	Number of cycles to failure (EoL 80%, 1C/1C) Cycles v/s SOH curve from manufacturer for 1C/1C and also 0.5C/0.5C to be included	>4500 cycles Or equivalent corresponding number at 0.5C/0.5C	
4	Percentage of available capacity (25°C) @ 0.5C @ 1C	101% 100%	
5	Minimum Discharge Rate	0.5C	
	Minimum Charge Rate	0.5C	
	Fire Protection Type	Active Suppression Fire protection and Thermal Runaway prevention concept to be submitted additionally	
2	Warranty and Manufacturer (Evidences for each qualification criteria shall be provided in the bid)		
	Product warranty of Li-ion battery system	5 years	

N°	Parameter	Minimum Requirement	Proposed
	Capacity performance warranty of Li-ion batteries	10 years or 4500 cycles at 80% DoD and 1C (years and cycles to be specified by bidder) (or) (Or) equivalent at 0.5C (years and cycles to be specified by bidder)	
	Manufacturer experience in battery manufacturing	Minimum 5 years	
	Annual manufacturing capacity or manufacturer (year before the tender publication)	> 2 GWh	
	Manufacturing facilities standards	ISO9001 and ISO14001	
	Specific Battery References	The batteries must have been used in: at least: 3 different projects of : 2000 kWh or more in the past: 3 years, which have received non-recourse debt financing by: 3 different banks AND:	

N°	Parameter	Minimum Requirement	Proposed
		The proposed battery model shall have been deployed and in successful operation (ideally in similar environmental conditions) in one of the 3 projects for at least 24 months.	
3	Certification Required		
	IEC 62619 or UL 1973 - safety Requirements for Secondary Lithium Cells and Batteries or Standard for Stationary Batteries	Required	
	IEC 62897: Stationary Energy Storage Systems with Lithium Batteries – Safety Requirements	Required	
	IEC 62897: Stationary Energy Storage Systems with Lithium Batteries – Safety Requirements	Required	
	IEC 63056: Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries for use in electrical energy storage systems	Required	
	IEC 62109 or UL 1741: Safety of power converters for use in photovoltaic power systems or	Required	

N°	Parameter	Minimum Requirement	Proposed
	Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources		
	IEC 62485-2: Safety requirements for secondary batteries and battery installations – Part 2: Stationary batteries	Required	
	IEC 62485-5: Safety requirements for secondary batteries and battery installations - Part 5: Safe operation of stationary lithium ion batteries	Required	
	IEC 61427-1: Secondary cells and batteries for renewable energy storage – General requirements and methods of test – Part 1: Photovoltaic off-grid applications	Required	
	Safety compliance with: NFPA 855: Standard for the Installation of Stationary Energy Storage Systems And UL9540: Energy Storage Systems and Equipment	Required	
	Other relevant standards	To be specified	

5 Power Conversion System

N°	Parameter	Minimum Requirement	Proposed
1	Technical Requirements		
1.1	AC Voltage	400 V	
1.2	Maximum continuous AC Voltage	1.1 p.u.	
1.3	Maximum continuous current	1.1 p.u.	
1.4	10 sec maximum overcurrent	1.25 p.u.	
1.5	Voltage THD	<3%	
2	Warranty and Manufacturer (Evidences for each qualification criteria shall be provided in the bid)		
2.1	Product Warranty	5 years	
	Manufacturer Experience	More than 5 years in manufacturing PCS for similar applications	
	Manufacturing facilities standards	ISO9001 and ISO14001	
	Specific PCS References	The proposed PCS shall have been deployed and in successful operation (ideally in similar environmental conditions) for at least: 24 months in	

N°	Parameter	Minimum Requirement	Proposed
		3 different projects of: 2000 kWh or more in the past: 3 years	
3	Certification Required		
	IEC62109 or UL 1741: Standard for Inverters, Converters, Controllers, and Interconnection System Equipment for Use with Distributed Energy Resources.	Required	
	IEC 62477-1: Safety requirements for power electronic converter systems	Required	
	Other relevant standards	To be specified	

DIESEL GENERATORS

N°	Parameter	Minimum Requirement	Proposed
1.1	Genset Model number:		
1.2	Engine Make		
1.3	Installation Conditions	Outdoors @ 0-40 deg C 95% humidity	
1.4	Protection Degree	Within Canopy	

N°	Parameter	Minimum Requirement	Proposed
1.5	AC Output Power range (kVA)	300-625 (Prime Rated Power)	
1.6	Nominal AC Output Voltage range (V)	415 ± 5%	
1.7	Number of Phases	3+N	
1.8	Insulation class	H	
1.9	Genest Type	Canopy type @ 75dB (A)	
1.10	Noise Level	Canopy/Soundproof engine shall have noise level of 75dB (A) at 1meter distance	
1.11	Nominal Frequency (Hz)	50 ± 5%	
1.12	Rated Speed (Rpm)	1500	
1.13	Aspiration	Turbocharged & Charge air cooled	
1.14	Governing type	Electronic	
1.15	Cooling method	Water	
1.16	Excitation	Brushless, Self-excited	
1.17	Rated Power factor	0.8	
1.18	Protection class	IP23	
1.19	Fuel Filter Type	Replaceable Element	
1.20	Cycle	4 STROKE, Direct injection	
1.21	No. of Cylinders	6	
1.22	Steady State Voltage Regulation	±1% AVR	
1.23	Steady State Frequency Regulation	±0,5%	
1.24	Total harmonic Distortion withstands	At least 3%	
1.25	Communication Protocol	Modbus TCP/IP	

N°	Parameter	Minimum Requirement	Proposed
1.26	Controller Protections	46unbalance, 50/51phase overcurrent	
1.27	Generator Control System	Controller protection 46 unbalance 50/51 phase overcurrent	
1.28	Starting/charging system	24 volt starting motor(s)	
1.29	Cooling System	Radiator with guard sized for 50°C	
1.30	Nominal Voltage		415V at alternator terminals
1.31	Nominal Frequency		50Hz
1.32	Power Factor		Maximum 0.8 lagging with Overload greater than 2.0 p.u. for 10 seconds, with less than 30% voltage dip
2	Warranty and Manufacturer (Evidences for each qualification criteria shall be provided in the bid)		
2.1	Product warranty of gen set system		10 years
3	Certification Required		
3.1	GB/T2820	Required	
3.2	GB1105	Required	
3.3	YD/T502	Required	
3.4	ISO3046	Required	
3.5	ISO8525	Required	
3.6	ISO8525-3-5-6	Required	

N°	Parameter	Minimum Requirement	Proposed
3.7	ISO8528-3 for the Alternator at continuous peak rated at 27°C	Required	
3.8	IS 456: 2000: For Generator Plinths	Required	
3.9	Other relevant standards		IEC 60034-1: Rotating electrical machines ratings and performance standards DIN 6271, ISO 3046 and BS 5514-1: Power tolerance and Diesel consumption

ADVANCED METERING INFRASTRUCTURE

N°	Parameter	Minimum Requirement	Proposed
1	Technical Requirements		
1.1	Electrical phase	3 phase and 4 wires; 1 phase and 2 wires	
1.2	Accuracy Class	kWh: Class 1.0 kVarh: Class 2.0	
1.3	Reference Voltage	3 x 220 – 240/380 – 415V AC, L-N	
1.4	Operating Voltage	70% – 120% Un	

N°	Parameter	Minimum Requirement	Proposed
1.5	Basic Current Ib	5A	
1.6	Maximum Current I _{max}	100A	
1.7	Starting Current I _{st}	0.4%/0.2% I _b	
1.8	Reference Frequency	50Hz +/- 5%	
1.9	Power Consumption	Voltage Circuit < 1W, <2.5VA Current circuit < 0.25VA	
1.10	Temperature	Operation: - 40° to +55° C Storage: -40° to +80° C	
1.11	Local Communication	Optical, RS485	
1.12	Remote Communication	PLC, RF, GPRS, 3G, 4G, NB - IoT	
1.13	Enclosure	IP54 IEC 60529:1989	
1.14	Time of Use (TOU) Register	8	
1.15	Maximum Demand (MD)	4	
1.16	Switching Times	48	
1.17	Seasons	4	
1.18	Change of Season Days	12	
1.19	Exclusion Days	32	
1.20	End of Billing Dates	12	
1.21	Daylight Saving	30	
1.22			
2	Warranty and Manufacturer (Evidences for each qualification criteria shall be provided in the bid)		

N°	Parameter	Minimum Requirement	Proposed
2.1	Product Warranty		5 years
3	Certification Required		
3.1	IEC 60256 Electricity Metering Data Exchange	Required	
3.2	IEC 62052 – 11:2003 Electricity Metering Equipment (AC)	Required	
3.3	IEC 62053 – 21: 2003 Electricity Metering Equipment (AC) requirements Part 21: for Static Meters for Active Energy Classes 1 and 2	Required	
3.4	IEC 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use – General requirements	Required	
3.5	EN 50665:2017 Generic standard for the assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0Hz - 300GHz)	Required	
3.6	IEC 61326-1:2012 Electrical equipment for measurement, control & laboratory use – EMC requirements	Required	
3.7	ETSI EN 301-489-1, -3 EMC standard for radio equipment and services. Part 1 Common technical requirements	Required	

N°	Parameter	Minimum Requirement	Proposed
	<p>Part 3 Specific conditions for short range devices operating in the range 9kHz to 40GHz</p> <p>Part 17 Specific conditions for broadband data transmission systems</p> <p>Related tests include:</p> <p>EN 61000-4-11 (IEC 61000-4-11) Voltage Dips - AC Mains</p> <p>EN 61000-4-6 (IEC 61000-4-6) Conducted RF Immunity - AC Mains</p> <p>EN 61000-4-5 (IEC 61000-4-5) Voltage Surges - AC Mains</p> <p>EN 61000-4-4 (IEC 61000-4-4) Fast transient bursts - AC Mains</p> <p>EN 61000-4-3 (IEC 61000-4-3) Radiated RF Immunity - Enclosure port</p> <p>EN 61000-4-2 (IEC 61000-4-2) Electrostatic Discharge - Enclosure port</p> <p>EN 61000-3-3 (IEC 61000-3-3) Limitation of voltage changes and voltage fluctuations and flicker</p>		

N°	Parameter	Minimum Requirement	Proposed
	impressed onto public low voltage supply system EN 61000-3-2 (IEC 61000-3-2) Limits for harmonic current emissions injected into the public supply system (AC power port)		
3.8	ETSI EN 300 220-2 V3.1.1 (2017-02) RF testing of the LoRa device. Frequency range 865 to 869.5MHz, single channel operation	Required	
3.9	IEC 62059-41:2006 Electricity metering equipment - Dependability - part 41: Reliability prediction	Required	
3.10	Other requirements	IEC 62053 – 24, IEC 62056 – 21, IEC 62056 – 46, 62056 – 53, 62056 – 61, 62056 – 62, 62055 – 31, EN 50470	

STREET LIGHTS

N°	Parameter	Minimum Requirement	Proposed
1	Technical Requirements		
1.1	Steel pole work	BS Grade S355 Steel 100 microns coating thickness (gavanised)	
1.2	Steel brackets	BS Grade S275 Steel	
1.3	Light Source (LED)	3000K to 5000K	
1.4	Luminous efficacy	> 120 lumens/watt	
1.5	Wireless communication complying with IEEE 802.15.4a System interface/software to be password encrypted	Required	
1.6	Operating temperature	0°C to +50 °C	
1.7	The poles shall be capable of withstanding a basic wind speed of 35 m/s or 125 km/hr (3 second gust)	Required	
1.8	All poles shall be designed in accordance with the requirements of the latest edition of American Association of State Highway and Transportation Officials (AASHTO) or equivalent European or International standard.	Required	
1.9	Storage (non-operating)	0°C to +60 °	
2	Warranty and Manufacturer (Evidences for each qualification criteria shall be provided in the bid)		
2.1	Product Warranty		5 years
3	Certification Required		

N°	Parameter	Minimum Requirement	Proposed
3.1	BS ISO 15686-5: Standardized Method of Life Cycle Costing for Construction Procurement	Required	
3.2	IEC 60529: Ingress Protection	Required	
3.3	IEC 62262: IK code for Mechanical Strength	Required	
3.4	ASTM B 117-07a Standard Practice for Operating Salt Spray (Fog) Apparatus, 2007	Required	
3.5	ASTM D1654 - 08 Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments	Required	
3.6	ISO 9227 Corrosion tests in artificial atmospheres—Salt spray tests, 2006	Required	
3.7	ISO8289A: Low voltage test for detecting and locating defects	Required	
3.8	ISO 4892-1: Plastics -- Methods of exposure to laboratory light sources		
3.9	Electrical Safety - General and for Road Lighting Luminaires: EN 60598-parts 1, 2-1 & 2-3		
3.10	EN 61547, EN 61000-3-2, EN 61000-3-3 & EN 55015 (CISPR-15): for (Immunity Requirements, Harmonics Requirements, Flicker Requirements & Radiated and Conducted Emissions, respectively)		

N°	Parameter	Minimum Requirement	Proposed
3.11	ANSI C82.77-2002: Harmonic Emission Limits & IEEE Std 519 1992		
3.12	FCC 47 CFR Part 15 Radio Frequency Devices		
3.13	RoHS Directive 2002/95/EC, on the restriction of the use of certain hazardous substances in electrical and electronic equipment		
3.14	IESNA RP-8-00 (Roadway Lighting)		
3.15	CIE 115 - 2010(Lighting of Roads for Motor and Pedestrian Traffic)		
3.16	BS 5489-1(Code of Practice for Design of Road Lighting), BS EN 13201- 2 (Road Lighting – Performance Requirements),13201 - Road Lighting ME/ MEW Classes		
3.17	IESNA RP-8-00 (Roadway Lighting, Conflict Area) and DG-19-08 (Design o Guide for Roundabout Lighting)		
3.18	CIE 115 (Lighting of Roads for Motor and Pedestrian Traffic) – Zones of Conflict		
3.19	EN 13201 – Road Lighting CE Classes		
3.20	BS 5489-1(Code of Practice for Design of Road Lighting), BS EN 13201- 2 (Road Lighting – Performance Requirements		

N°	Parameter	Minimum Requirement	Proposed
3.21	IESNA DG-4-03 Design Guide for Roadway Lighting Maintenance		
3.22	CIE 154:2003 The Maintenance of outdoor lighting systems		

DISTRIBUTION NETWORK, SWITCHGEARS

N°	Parameter	Minimum Requirement	Proposed
1	Technical Requirements		
1.1	Switchgear Ratings Rated voltage	11kV	
1.2	System highest voltage	12kV	
1.3	Rated impulse withstand voltage (kV)	125	
1.4	Nominal rated current of busbars (A)	1250 – 1600	
1.5	Fault rating (kA)	25kA for 3 seconds	
1.6	Number of phases in system	Three (3)	
1.7	Frequency: (Hz)	50	
1.8	Circuit breaker type	Vacuum	

N°	Parameter	Minimum Requirement	Proposed
1.9	Circuit breaker duty rating	O – 0.3s – CO -15s - CO	
1.10	Supply Voltage for circuit breaker motor	110 VDC	
1.11	Supply voltage for control and protection circuits	110VDC	
1.12	Construction type	Metal-clad	
1.13	Rated internal fault current (kA)	25 kA for 0.5 seconds	
1.14	Enclosure degree of protection	IP42	
1.15	All electrical equipment, electrical components and electrical panels marking	CE Marking	
1.16	Enclosures protection class	IP4X (closed for dust and insects)	
1.17	Partitions between compartments of the same cubicle	IP2XC	
1.18	Switchboard dimensions	Not more than height: 2200mm and depth: 1400-1500mm	
1.19	Current transformer ratio	900-600/5-5-0.577 Amp For transformer control (with 1250 Amp VCB) 1200-600/5-5-0.577 Amp For transformer control (with 1600 Amp VCB) 300-150/5-5 Amp For feeder control	

N°	Parameter	Minimum Requirement	Proposed
1.20	Rated burden of the Current Transformer	Core 1: 15 VA, Core 2: 10 V, Core 3: -	
1.21	Class of Accuracy	Core 1: 0.5, Core 2: 5P, Core 3: PS	
1.22	Class of Accuracy for CT Meter	0.5	
1.23	Protection CTs accuracy class	5P20	
1.24	VT accuracy class	0.2	
1.25	Circuit breaker fully withdrawable	Required	
1.26	Circuit breaker trolley	Required	
1.27	Circuit breaker rating	630 – 1250A	
1.28	Protection relays	Microprocessor based	
1.29	Protection relays communications protocol	Modbus TCP	
1.30	Rated instrument security accuracy	Core 1: 10 (ISF), Core 2: 20 (ALF), Core 3: -	
1.31	Purpose	Core 1: metering, Core 2: Protection, Core 3: Differential Protection	
1.32	Potential Transformers (VTs) rated burden	100VA	
1.33	Type and Connections	One unit - 3 phase, 11 KV/110 Volt, Class (0.5) accuracy PTs	
1.34	Static Meter Accuracy	0.5	
1.35	IP rating of RMU	IP54	

N°	Parameter	Minimum Requirement	Proposed
1.36	Busbars	630A	
1.37	Nominal current rating of the breakers	200/630A	
1.38	Rated Voltage	12kV @16kA/3secs with BiL – 75kV	
2	Warranty and Manufacturer (Evidences for each qualification criteria shall be provided in the bid)		
2.1	Product Warranty		5 years
3	Certification Required		
3.1	IEC 60529 Degrees of protection provided by enclosures (IP code)	Required	
3.2	IEC 62271 High voltage switchgear and control gear	Required	
3.3	IEC 61869 Instrument transformers		
3.4	IEC 56, IEC 60265, and BS EN 60265: RMU Switchgear		
3.5	IEC 62271-200: Switchgear internal arc classification	Required	
	Other relevant standards	To be specified	

SCADA

N°	Parameter	Minimum Requirement	Proposed
1	Technical Requirements		
1.1	Network Type	Asynchronous Transmission mode (ATM)	ATM

N°	Parameter	Minimum Requirement	Proposed
1.2	Communication Protocols	TCP/IP & DNP 3	
1.3	Network bandwidth	SDH of STM1 capacity (155Mbps)	SDH of STM1 capacity (155Mbps)
1.4	Protocol compatibility for nodes, master stations and peripherals	Required	
2	Warranty and Manufacturer (Evidences for each qualification criteria shall be provided in the bid)		
3	Certification Required		
3.1	IEC 60870-6	Required	
3.2	IEC 61850 & IEC 60870-5-101/104: protocols and compatibility with features of IoT & RIoT, monitoring, control and management	Required	
3.3	IEC61850	Required	

TRANSFORMERS

N°	Parameter	Minimum Requirement	Proposed
1	Technical Requirements		
1.1	Rated power	1600 kVA /1250 kVA /1000KVA/ 800kVA /630kVA /500KVA/250KVA/ 160KVA/100KVA/50KVA	
1.2	Frequency	50 Hz	
1.3	Rated voltage primary	11 kV	
1.4	Rated voltage secondary	0.4 kV	

N°	Parameter	Minimum Requirement	Proposed
1.5	Impedance	6% For 800, 1250, 1600KVA, 4% for 50,100,160,250,400,630KVA	
1.6	Tap-changer positions	Plus 1x 2.5% Minus 3x 2.5%	
1.7	Insulation level	Impulse withstand voltage (Peak 1.2/50 μ s (kV)): 125 - Power Frequency withstand Voltage (r.m.s 1 minute (kV)): 50	
1.8	Grey colour	RAL 7023 or 7033	
1.9	minimum standard rating for all distribution transformers		400KVA, oil- immersed, three- phase type
1.10	Standard protection for distribution transformer		D-Type fuse at the transformer Primary and HRC fuse at the secondary. The insulation for the D-Type fuse shall be silicon type.
1.11	Transformer earthing		70mm ² Bare copper shall be used for transformer substation earthing; 50mm ² Bare copper conductor shall be used for line earthing
2	Warranty and Manufacturer (Evidences for each qualification criteria shall be provided in the bid)		

N°	Parameter	Minimum Requirement	Proposed
2.1	Product Warranty	2 years	
3	Certification Required		
3.1	IEC 60076 - Power Transformers		
3.2	DIN42500 - Three-phase oil-immersed distribution transformers Um up to 24 kV latest edition of the standards	Required	
3.3	IEC60296 – for transformer oil		
	Other relevant standards	To be specified	

Contractor's Equipment

Form EQU

The Bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key Contractor's equipment listed in Section III, Evaluation and Qualification Criteria. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder.

Item of equipment		
Equipment information	Name of manufacturer	Model and power rating
	Capacity	Year of manufacture
Current status	Current location	
	Details of current commitments	
Source	Indicate source of the equipment <input type="checkbox"/> Owned <input type="checkbox"/> Rented <input type="checkbox"/> Leased <input type="checkbox"/> Specially manufactured	

Omit the following information for equipment owned by the Bidder.

Owner	Name of owner	
	Address of owner	
	Telephone	Contact name and title
	Fax	Telex
Agreements	Details of rental / lease / manufacture agreements specific to the project	

Functional Guarantees

Form FUNC

The Bidder shall copy in the left column of the table below, the identification of each functional guarantee required in the Specification and stated by the Employer in para. 1.2 (c) of Section III, Evaluation and Qualification Criteria, and in the right column, provide the corresponding value for each functional guarantee of the proposed plant and equipment.

Required Functional Guarantee	Value of Functional Guarantee of the Proposed Plant and Equipment
1.	
2.	
3.	
...	

Personnel

Form PER -1

Contractor's Representative and other Key Personnel

Schedule

Bidders should provide the names of suitably qualified personnel to meet the specified requirements stated in Section VII. The data on their experience should be supplied using the Form below for each candidate.

Contractor' Representative and Key Personnel

1.	Title of position: Contractor's Representative	
	Name of candidate:	
	Duration of appointment:	<i>[insert the whole period (start and end dates) for which this position will be engaged]</i>
	Time commitment for this position:	<i>[insert the number of days/week/months/ that has been scheduled for this position]</i>
	Expected time schedule for this position:	<i>[insert the expected time schedule for this position (e.g. attach high level Gantt chart)]</i>
2.	Title of position: [Environmental Specialist]	
	Name of candidate:	
	Duration of appointment:	<i>[insert the whole period (start and end dates) for which this position will be engaged]</i>
	Time commitment for this position:	<i>[insert the number of days/week/months/ that has been scheduled for this position]</i>
	Expected time schedule for this position:	<i>[insert the expected time schedule for this position (e.g. attach high level Gantt chart)]</i>

3.	Title of position: [Health and Safety Specialist]	
	Name of candidate:	
	Duration of appointment:	<i>[insert the whole period (start and end dates) for which this position will be engaged]</i>
	Time commitment for this position:	<i>[insert the number of days/week/months/ that has been scheduled for this position]</i>
	Expected time schedule for this position:	<i>[insert the expected time schedule for this position (e.g. attach high level Gantt chart)]</i>
4.	Title of position: [Social Specialist]	
	Name of candidate:	
	Duration of appointment:	<i>[insert the whole period (start and end dates) for which this position will be engaged]</i>
	Time commitment for this position:	<i>[insert the number of days/week/months/ that has been scheduled for this position]</i>
	Expected time schedule for this position:	<i>[insert the expected time schedule for this position (e.g. attach high level Gantt chart)]</i>
5.	Title of position: Sexual Exploitation, Abuse and Harassment Expert <i>[Where a Project SEA risks are assessed to be substantial or high, key personnel shall include an expert/s with relevant experience in addressing sexual exploitation, sexual abuse and sexual harassment cases]</i>	
	Name of candidate	
	Duration of appointment:	<i>[insert the whole period (start and end dates) for which this position will be engaged]</i>
	Time commitment for this position:	<i>[insert the number of days/week/months/ that has been scheduled for this position]</i>
	Expected time schedule for this position:	<i>[insert the expected time schedule for this position (e.g. attach high level Gantt chart)]</i>

6.	Title of position: [insert title]	
	Name of candidate	
	Duration of appointment:	<i>[insert the whole period (start and end dates) for which this position will be engaged]</i>
	Time commitment for this position:	<i>[insert the number of days/week/months/ that has been scheduled for this position]</i>
	Expected time schedule for this position:	<i>[insert the expected time schedule for this position (e.g. attach high level Gantt chart)]</i>
7.	Title of position: [insert title]	

Form PER-2
Resume of Proposed Personnel

Name of Bidder

Position					
Personnel information	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 35%; padding: 5px;">Name</td> <td style="width: 30%; padding: 5px;">Date of birth</td> </tr> <tr> <td colspan="2" style="padding: 5px;">Professional qualifications</td> </tr> </table>	Name	Date of birth	Professional qualifications	
	Name	Date of birth			
Professional qualifications					
Present employment	Name of employer				
	Address of employer				
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 45%; padding: 5px;">Telephone</td> <td style="padding: 5px;">Contact (manager / personnel officer)</td> </tr> </table>	Telephone	Contact (manager / personnel officer)		
	Telephone	Contact (manager / personnel officer)			
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 45%; padding: 5px;">Fax</td> <td style="padding: 5px;">E-mail</td> </tr> </table>	Fax	E-mail		
Fax	E-mail				
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 45%; padding: 5px;">Job title</td> <td style="padding: 5px;">Years with present employer</td> </tr> </table>	Job title	Years with present employer			
Job title	Years with present employer				

Summarize professional experience over the last 20 years, in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

From	To	Company / Project / Position / Relevant technical and management experience

Proposed Subcontractors and Manufacturers for Major Items of Plant and Installation Services

A list of major items of Plant and Installation Services is provided below.

The following Subcontractors and/or manufacturers are proposed for carrying out the item of the facilities indicated. Bidders are free to propose more than one for each item

Major Items of Plant and Installation Services	Proposed Subcontractors/Manufacturers	Nationality	Years of Experience/ Manufacturing Equipment related to the Project

Others - Time Schedule

(to be used by Bidder when alternative Time for **Completion is invited in ITB 13.2**)

Commercial Terms and Conditions

[Bidder shall specify any deviations to the provisions of the Bidding Document (other than Technical Specifications) in particular those specified in Part 3 of the Bidding document including General and Particular Conditions of Contract. If "None" it shall be confirmed accordingly]

Alternative Technical Bid --If permitted in accordance with ITB 13

[Bidder to provide all relevant details/Forms as listed above for the Technical Base Bid]

Bidders Qualification without prequalification

To establish its qualifications to perform the contract in accordance with Section III, Evaluation and Qualification Criteria the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.

Note: These Forms are sample forms and should be adjusted if needed according to Section III.

Form ELI 1.1
Bidder Information Sheet

Date: _____

IFB No.: _____

Page _____ of _____ pages

1. Bidder's Legal Name
2. In case of JV, legal name of each party:
3. Bidder's actual or intended Country of Registration:
4. Bidder's Year of Registration:
5. Bidder's Legal Address in Country of Registration:
6. Bidder's Authorized Representative Information Name: Address: Telephone/Fax numbers: Email Address:

7. Attached are copies of original documents of

- Articles of Incorporation (or equivalent documents of constitution or association), and/or documents of registration of the legal entity named above, in accordance with ITB 4.4
- In case of JV, letter of intent to form JV or JV agreement, in accordance with ITB 4.1
- In case of state-owned enterprise or institution, in accordance with ITB 4.6, documents establishing:
 - Legal and financial autonomy
 - Operation under commercial law
 - Establishing that the Bidder is not under the supervision of the Employer

8. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership. *[If required under BDS ITB 47.1, the successful Bidder shall provide additional information on beneficial ownership, using the Beneficial Ownership Disclosure Form.]*

Form ELI 1.2
Party to JV Information Sheet

Date: _____

IFB No.: _____

Page _____ of _____ pages

1. Bidder's Legal Name:
2. JV's Party legal name:
3. JV's Party Country of Registration:
4. JV's Party Year of Registration:
5. JV's Party Legal Address in Country of Registration:
6. JV's Party Authorized Representative Information Name: Address: Telephone/Fax numbers: Email Address:
7. Attached are copies of original documents of <input type="checkbox"/> Articles of Incorporation (or equivalent documents of constitution or association), and/or registration documents of the legal entity named above, in accordance with ITB 4.4. <input type="checkbox"/> In case of a state-owned enterprise or institution, documents establishing legal and financial autonomy, operation in accordance with commercial law, and that they are not under the supervision of the Employer, in accordance with ITB 4.6. 8. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership. <i>[If required under BDS ITB 47.1, the successful Bidder shall provide additional information on beneficial ownership for each JV member using the Beneficial Ownership Disclosure Form.]</i>

Form ELI -1.3

Eligible Materials, Plant, Equipment, Installation and Other Services Form (to be completed by the Bidder)

Date: _____
 OCBI No. and title: _____
 Page _____ of _____ pages

Eligible Materials, Plant, Equipment, installation and Other Services: In compliance with ITB 5, provide the following information for all Materials, Plant, Equipment, Installation and Other Services included under the Contract. Instead of listing each and every item, broad categories are listed below. Include all items in these categories unless any item to be supplied is not covered by any one of them in which case list them separately.

1 S. No.	2 Description of Broad Category of Materials/Plant, Equipment Installation and Other Services	3 Estimated Quantity - <i>[Indicate: "All quantity as required" or quantity by subcategory of items]</i>	Estimated Aggregate Value (US Dollar Equivalent)	5 Countries of Origin
1	All Construction, Installation and Testing Materials including raw materials, Cement, Steel, Timber, Lime, Sand, Aggregates, Plastics, Bitumen, Oils, Lubricants, etc. as per specification			

2	All types of Plants, Equipment including Laboratory and Testing Equipment, All types of Vehicles, Furniture, Fittings and Fixtures, Pipes, Tools, Steel and Other Structures, Utensils, Computers and Other IT Equipment, etc. as per specification			
3	All Types of Services including Construction, Installation, Assembly, Inspection, Supervision, Care of Sites, Labor (Skilled and Unskilled), Drilling, Mapping, Transportation and Insurance, etc. as per specification			
4				
5				

Form CON – 2

Historical Contract Non-Performance

Bidder's Legal Name: _____ Date: _____

JV Member Legal Name: _____

IFB No.: _____

Page _____ of _____ pages

Non-Performed Contracts in accordance with Section III, Evaluation and Qualification Criteria			
<input type="checkbox"/> Contract non-performance did not occur since 1 st January <i>[insert year]</i> specified in Section III, Evaluation and Qualification Criteria, Sub-Factor 2.1. <input type="checkbox"/> Contract(s) not performed since 1 st January <i>[insert year]</i> specified in Section III, Evaluation and Qualification Criteria, requirement 2.1			
Year	Non-performed portion of contract	Contract Identification	Total Contract Amount (current value, currency, exchange rate and US\$ equivalent)
<i>[insert year]</i>	<i>[insert amount and percentage]</i>	Contract Identification: <i>[indicate complete contract name/ number, and any other identification]</i> Name of Employer: <i>[insert full name]</i> Address of Employer: <i>[insert street/city/country]</i> Reason(s) for nonperformance: <i>[indicate main reason(s)]</i>	<i>[insert amount]</i>
Pending Litigation, in accordance with Section III, Evaluation and Qualification Criteria			
<input type="checkbox"/> No pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3. <input type="checkbox"/> Pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3 as indicated below.			

Year of dispute	Amount in dispute (currency)	Contract Identification	Total Contract Amount (currency), USD Equivalent (exchange rate)
		Contract Identification: _____ Name of Employer: _____ Address of Employer: _____ Matter in dispute: _____ Party who initiated the dispute: _____ Status of dispute: _____	
		Contract Identification: Name of Employer: Address of Employer: Matter in dispute: Party who initiated the dispute: Status of dispute:	
Litigation History in accordance with Section III, Evaluation and Qualification Criteria			
<input type="checkbox"/> No Litigation History in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4. <input type="checkbox"/> Litigation History in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4 as indicated below.			

Year of award	Outcome as percentage of Net Worth	Contract Identification	Total Contract Amount (currency), USD Equivalent (exchange rate)
<i>[insert year]</i>	<i>[insert percentage]</i>	Contract Identification: <i>[indicate complete contract name, number, and any other identification]</i> Name of Employer: <i>[insert full name]</i> Address of Employer: <i>[insert street/city/country]</i> Matter in dispute: <i>[indicate main issues in dispute]</i> Party who initiated the dispute: <i>[indicate "Employer" or "Contractor"]</i> Reason(s) for Litigation and award decision <i>[indicate main reason(s)]</i>	<i>[insert amount]</i>

Form CON – 3

Environmental and Social Performance Declaration

[The following table shall be filled in for the Bidder, each member of a Joint Venture and each Specialized Subcontractor]

Bidder's Name: *[insert full name]*

Date: *[insert day, month, year]*

Joint Venture Member's or Specialized Subcontractor's Name: *[insert full name]*

IFB No. and title: *[insert IFB number and title]*

Page *[insert page number]* of *[insert total number]* pages

Environmental and Social Performance Declaration			
in accordance with Section III, Qualification Criteria, and Requirements			
<input type="checkbox"/> No suspension or termination of contract: An employer has not suspended or terminated a contract and/or called the performance security for a contract for reasons related to Environmental or Social (ES) performance since the date specified in Section III, Qualification Criteria, and Requirements, Sub-Factor 2.5.			
<input type="checkbox"/> Declaration of suspension or termination of contract: The following contract(s) has/have been suspended or terminated and/or Performance Security called by an employer(s) for reasons related to Environmental or Social (ES) performance since the date specified in Section III, Qualification Criteria, and Requirements, Sub-Factor 2.5. Details are described below:			
Year	Suspended or terminated portion of contract	Contract Identification	Total Contract Amount (current value, currency, exchange rate and US\$ equivalent)
<i>[insert year]</i>	<i>[insert amount and percentage]</i>	Contract Identification: <i>[indicate complete contract name/ number, and any other identification]</i> Name of Employer: <i>[insert full name]</i> Address of Employer: <i>[insert street/city/country]</i> Reason(s) for suspension or termination: <i>[indicate main reason(s) e.g. gender-based violence; sexual exploitation or sexual abuse breaches]</i>	<i>[insert amount]</i>

<i>[insert year]</i>	<i>[insert amount and percentage]</i>	Contract Identification: <i>[indicate complete contract name/ number, and any other identification]</i> Name of Employer: <i>[insert full name]</i> Address of Employer: <i>[insert street/city/country]</i> Reason(s) for suspension or termination: <i>[indicate main reason(s)]</i>	<i>[insert amount]</i>
...	...	<i>[list all applicable contracts]</i>	...

Performance Security called by an employer(s) for reasons related to ES performance

Year	Contract Identification	Total Contract Amount (current value, currency, exchange rate and US\$ equivalent)
<i>[insert year]</i>	Contract Identification: <i>[indicate complete contract name, number, and any other identification]</i> Name of Employer: <i>[insert full name]</i> Address of Employer: <i>[insert street/city/country]</i> Reason(s) for calling of performance security: <i>[indicate main reason(s) e.g. for gender-based violence; sexual exploitation, or sexual abuse breaches]</i>	<i>[insert amount]</i>

Form CCC

Current Contract Commitments / Works in Progress

Bidders and each member to a JV should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

Name of contract	Employer, contact address/tel /fax	Value of outstanding work (current US\$ equivalent)	Estimated completion date	Average monthly invoicing over last six months (US\$/month)
1.				
2.				
3.				
4.				
5.				
etc.				

Form FIN – 3.1
Financial Situation
Historical Financial Performance

Bidder's Legal Name: _____ Date: _____

JV Member Legal Name: _____ IFB No.: _____

Page _____ of _____ pages

To be completed by the Bidder and, in case of a JV, by each member

Financial information in US\$ equivalent	Historic information for previous ____ () years (US\$ equivalent in 000s)						
	Year 1	Year 2	Year 3	Year ...	Year n	Avg.	Avg. Ratio
Information from Balance Sheet							
Total Assets (TA)							
Total Liabilities (TL)							
Net Worth (NW)							
Current Assets (CA)							
Current Liabilities (CL)							
Information from Income Statement							
Total Revenue (TR)							

Financial information in US\$ equivalent	Historic information for previous ____ () years (US\$ equivalent in 000s)						
	Year 1	Year 2	Year 3	Year ...	Year n	Avg.	Avg. Ratio
Profits Before Taxes (PBT)							

Attached are copies of financial statements (balance sheets, including all related notes, and income statements) for the years required above complying with the following conditions:

- (a) Must reflect the financial situation of the Bidder or member to a JV, and not sister or parent companies
- (b) Historic financial statements must be audited by a certified accountant
- (c) Historic financial statements must be complete, including all notes to the financial statements
- (d) Historic financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted)

Form FIN – 3.2

Average Annual Turnover

Bidder's Legal Name: _____ Date: _____

JV Member Legal Name: _____ IFB No.: _____

Page _____ of _____ pages

Annual turnover data		
Year	Amount and Currency	US\$ equivalent
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
*Average Annual Turnover	_____	_____

*Average annual turnover calculated as total certified payments received for work in progress or completed, divided by the number of years specified in Section III, Evaluation Criteria, Sub-Factor 2.3.2.

Form FIN 3.3
Financial Resources

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total cash flow demands of the subject contract or contracts as indicated in Section III, Evaluation and Qualification Criteria

Source of financing	Amount (US\$ equivalent)
1.	
2.	
3.	
4.	

Form EXP 4.1

General Experience

Bidder's Legal Name: _____ Date: _____

JV Member Legal Name: _____ IFB No.: _____

Page _____ of _____ pages

Starting Month / Year	Ending Month / Year	Years*	Contract Identification	Role of Bidder
_____	_____		Contract name: Brief Description of the Works performed by the Bidder: Name of Employer: Address:	_____
_____	_____		Contract name: Brief Description of the Works performed by the Bidder: Name of Employer: Address:	_____
_____	_____		Contract name: Brief Description of the Works performed by the Bidder: Name of Employer: Address:	_____
_____	_____		Contract name: Brief Description of the Works performed by the Bidder: Name of Employer: Address:	_____

Starting Month / Year	Ending Month / Year	Years*	Contract Identification	Role of Bidder
_____	_____		Contract name: Brief Description of the Works performed by the Bidder: Name of Employer: Address:	_____
_____	_____		Contract name: Brief Description of the Works performed by the Bidder: Name of Employer: Address:	_____

*List calendar year for years with contracts with at least nine (9) months activity per year starting with the earliest year

Form EXP –4.2(a)

Specific Experience

Bidder's Legal Name: _____ Date: _____

JV Member Legal Name: _____ IFB No.: _____

Page _____ of _____ pages

Similar Contract Number: __ of __ required.	Information		
Contract Identification	_____		
Award date	_____		
Completion date	_____		
Role in Contract	<input type="checkbox"/> Contractor	<input type="checkbox"/> Management Contractor	<input type="checkbox"/> Subcontractor
Total contract amount	_____		US\$ _____ -
If member in a JV or subcontractor, specify participation of total contract amount	_____%	_____	US\$ _____
Employer's Name:	_____		
Address:	_____		
Telephone/fax number:	_____		
E-mail:	_____		

Form EXP –4.2(a) (cont.)
Specific Experience (cont.)

Bidder's Legal Name: _____ Page _____ of _____ pages

JV Member Legal Name: _____

Similar Contract No. __ [insert specific number] of [total number of contracts] __ required	Information
Description of the similarity in accordance with Sub-Factor 4.2a) of Section III:	
Amount	_____
Physical size	_____
Complexity	_____
Methods/Technology	_____
Physical Production Rate	_____

Form EXP –4.2(b)

Specific Experience in Key Activities

Bidder's Legal Name: _____ Date: _____

JV Member Legal Name: _____ IFB No.: _____

Subcontractor's Legal Name: _____ Page _____ of _____ pages

		Information	
Contract Identification	_____		
Award date	_____		
Completion date	_____		
Role in Contract	<input type="checkbox"/> Contractor	<input type="checkbox"/> Management Contractor	<input type="checkbox"/> Subcontract or
Total contract amount	_____		US\$_____
If member in a JV or subcontractor, specify participation of total contract amount	_____%	_____	US\$_____
Employer's Name:	_____		
Address:	_____ _____ _____		
Telephone/fax number:	_____ _____		
E-mail:	_____		

Form EXP –4.2 (b)(cont.)
Specific Experience in Key Activities (cont.)

Bidder's Legal Name: _____ Page _____ of _____ pages

JV Member Legal Name: _____

Subcontractor's Legal Name: _____

	Information
Description of the key activities in accordance with Sub-Factor 4.2b) of Section III:	

Form EXP –4.2(c)

Specific Experience in Managing ES aspects

Bidder’s Legal Name: _____ Date: _____

JV Member Legal Name: _____ RFB No.: _____

Subcontractor’s Legal Name: _____ Page _____ of _____ pages

1. Key Requirement no 1 in accordance with 4.2 (c): _____

Contract Identification				
Award date				
Completion date				
Role in Contract	Prime Contractor <input type="checkbox"/>	Member in JV <input type="checkbox"/>	Management Contractor <input type="checkbox"/>	Subcontractor <input type="checkbox"/>
Total Contract Amount			US\$	
Details of relevant experience				

2. Key Requirement no 2 in accordance with 4.2 (c): _____

3. Key Requirement no 3 in accordance with 4.2 (c): _____

Form of Bid Security

Form of Bid Security – Bank Guarantee

[The bank shall fill in this Bank Guarantee Form in accordance with the instructions indicated.]

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[Employer to insert its name and address]*

IFB No.:*[Employer to insert reference number for the Invitation for Bids]*

Alternative No.: *[Insert identification No if this is a Bid for an alternative]*

Date:*[Insert date of issue]*

BID GUARANTEE No.:*[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _____ *[insert name of the Bidder, which in the case of a joint venture shall be the name of the joint venture (whether legally constituted or prospective) or the names of all members thereof]*(hereinafter called "the Applicant") has submitted or will submit to the Beneficiary its Bid (hereinafter called "the Bid") for the execution of _____ under IFB No. _____

Furthermore, we understand that, according to the Beneficiary's conditions, Bids must be supported by a Bid guarantee.

At the request of the Applicant, we, as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (_____) upon receipt by us of the Beneficiary's complying demand, supported by the Beneficiary's statement, whether in the demand itself or a separate signed document accompanying or identifying the demand, stating that either the Bidder:

- (a) has withdrawn its Bid during the period of Bid validity set forth in the Bidder's Letter of Bid ("the Bid Validity Period"), or any extension thereto provided by the Bidder; or
- (b) having been notified of the acceptance of its Bid by the Beneficiary during the Bid Validity Period or any extension thereto provided by the Applicant, (i) has failed to execute the Contract Agreement, or (ii) has failed to furnish the Performance Security, in accordance with the Instructions to Bidders ("ITB") of the Beneficiary's bidding document.

This guarantee will expire: (a) if the Applicant is the successful Bidder, upon our receipt of copies of the contract agreement signed by the Applicant and the Performance Security issued to the Beneficiary in relation to such contract agreement; or (b) if the Applicant is not the successful Bidder, upon the earlier of (i) our receipt of a copy of the Beneficiary's notification to the Applicant of the results of the Bidding process; or (ii) twenty-eight days after the end of the Bid Validity Period.

Consequently, any demand for payment under this guarantee must be received by us at the office indicated above on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758.

[Signature(s)]

Note: All italicized text is for use in preparing this form and shall be deleted from the final product.

Manufacturer's Authorization

Date: _____

IFB No.: _____

To: _____

WHEREAS

We _____, who are official manufacturers of _____, having factories at _____, do hereby authorize _____ to submit a Bid the purpose of which is to provide the following goods, manufactured by us _____, and to subsequently negotiate and sign the Contract.

We hereby extend our full guarantee and warranty in accordance with Clause 27 of the General Conditions, with respect to the goods offered by the above firm.

Signed: _____

Name: _____

Title: _____

Duly authorized to sign this Authorization on behalf of:

Dated on _____ day of _____, _____

Section V - Eligible Countries

Eligibility for the Provision of Goods, Works and Non-Consulting Services in Bank-Financed Procurement

A. Provisions under Section 5 "Eligibility" of the Procurement Policy for Bank Group Funded Operations and Chapter A2 of the Operations Procurement Manual under Procurement Framework of the African Development Bank

The African Development Fund (ADF) permits firms and individuals from all countries to offer goods, works and services for ADF funded projects. However, the proceeds of any Financing undertaken in the operations of the African Development Bank (ADB) and the Nigeria Trust Fund (NTF) shall be used for procurement of goods and works, including the related services, provided by bidders from Eligible¹ Countries.² Any conditions for participation shall be limited to those that are essential to ensure the firm's capability to fulfill the contract in question. In the case of ADB and NTF, bidders from non-Member Countries offering goods, works and related services (including transportation and insurance) are not eligible even if they offer these from Eligible Member Countries. Any waiver to this rule will be in accordance with the Articles 17(1) (d) of the Agreement Establishing the African Development Bank and 4.1 of the Agreement Establishing the Nigeria Trust Fund.

B. Rules and Procedures for Procurement of Goods and Works

Overview

1. The eligibility criteria for participation in the supply of goods, works and related services, to be procured through the ADB and NTF Financing, derive from the requirements of the Agreement Establishing the African Development Bank, Article 17.1.d, and the Agreement Establishing the Nigeria Trust Fund, Article 4.1. The foregoing requirements basically prescribe two types of eligibility criteria:

1. The eligibility of the bidder;
2. The eligibility of the goods, works and related services.

¹ Refer to Bank Procurement Framework for additional information on Eligibility.

² "Eligible Countries" shall mean: (a) in the case of the African Development Bank and the Nigeria trust Fund, the Member Countries of the African Development Bank; and (b) in the case of the African Development Fund, any country.

Eligibility of the Bidder

2. The eligibility of the bidder shall be based on nationality, in accordance with the following rules:
 - (a) Natural Persons: A natural person is eligible if he or she is a national of a Member Country of the Bank, or a State Participant of the Fund. Where a person has more than one nationality, such a person shall be eligible if the nationality indicated in his or her bid is that of a Member Country of the Bank, or a State Participant of the Fund.
 - (b) Corporations: A corporation is eligible if it satisfies the following criteria:
 1. it is incorporated in a country that is a Member of the Bank, or State Participant of the Fund;
 2. it is a national of a country that is a Member of the Bank, or State Participant of the Fund, as determined by the law of its place of incorporation;
 3. it has its principal place of business in a country that is a Member of the Bank, or State Participant of the Fund.
 - (c) Joint Ventures and Associations: An unincorporated joint venture, partnership, or association, shall be eligible if more than 50% of the value of its works and/or services is executed by its members satisfying the eligibility requirements for individuals or corporations.

Eligibility of the Goods, Works and Related Services

3. In order to be eligible, the goods to be procured must have been mined, grown, or produced, in the form in which they are purchased, in an Eligible Member Country.
4. For works contracts, which may include civil works, plant construction, or turnkey contracts, the contractor must satisfy the nationality criteria of eligibility, either as a natural person, or corporation, or joint venture and association. Labour, equipment, and materials needed for carrying out the works contract, shall be supplied from Eligible Member Countries.
5. For contracts, which have been awarded on the basis of Cost, Insurance and Freight (CIF), or Carriage and Insurance Paid (CIP), bidders shall be free to arrange for ocean and other transportation, and the related insurance, from any Eligible Member Country. On the other hand, where goods are shipped on FOB basis, and the Bank has agreed to finance transportation and insurance separately, which are arranged by the purchaser, under a separate contract, the Bank shall be satisfied that the services are supplied from Eligible Member Countries.

List of Eligible Countries

6. List of Eligible countries can be found in African Development Bank's website:
<https://www.afdb.org/en/about-us/corporate-information/members/>

Ineligible Countries in reference to ITB 4.8 and ITB 5.1

7. In reference to ITB 4.8 and ITB 5.1, for the information of the Bidders, at the present time firms, goods and services from the following countries are excluded from this Bidding process:

Under ITB 4.8(a) and ITB 5.1: *[insert a list of the countries following approval by the Bank to apply the restriction or state "none"]*.

Under ITB 4.8(b) and ITB 5.1: *[insert a list of the countries following approval by the Bank to apply the restriction or state "none"]*

Section VI - Fraud and Corruption

(this Section shall not be changed)

1. Purpose

1.1 The Bank's Integrity Framework and this annex apply with respect to procurement under Bank Investment Project Financing operations.

2. Requirements

2.1 The Bank requires that Borrowers (including beneficiaries of Bank financing); bidders (applicants), consultants, contractors and suppliers; any sub-contractors, sub-consultants, service providers or suppliers; any agents (whether declared or not); and any of their personnel, observe the highest standard of ethics during the procurement process, selection and contract execution of Bank-financed contracts, and refrain from Fraud and Corruption.

2.2 To this end, the Bank:

- a. Defines, for the purposes of this provision, the terms set forth below as follows:
 - i. "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;
 - ii. "fraudulent practice" is any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;
 - iii. "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;
 - iv. "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
 - v. "obstructive practice" is:
 - (a) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive, or collusive practice;

and/or threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or

- (b) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph 2.2 e. below.
- b. Rejects a proposal for award if the Bank determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/ or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;
- c. In addition to the legal remedies set out in the relevant Legal Agreement, may take other appropriate actions, including declaring misprocurement, if the Bank determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the loan engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement process, selection and/or execution of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;
- d. Pursuant to the Bank's Integrity Framework and in accordance with the Bank's prevailing sanctions policies and procedures, may sanction a firm or individual, either indefinitely or for a stated period of time, including by publicly declaring such firm or individual ineligible (i) to be awarded or otherwise benefit from a Bank-financed contract, financially or in any other manner;¹ (ii) to be a nominated² sub-contractor, consultant, manufacturer or supplier, or service provider of an otherwise eligible firm being awarded a Bank-financed contract; and (iii) to receive the proceeds of any loan made by the Bank or otherwise to

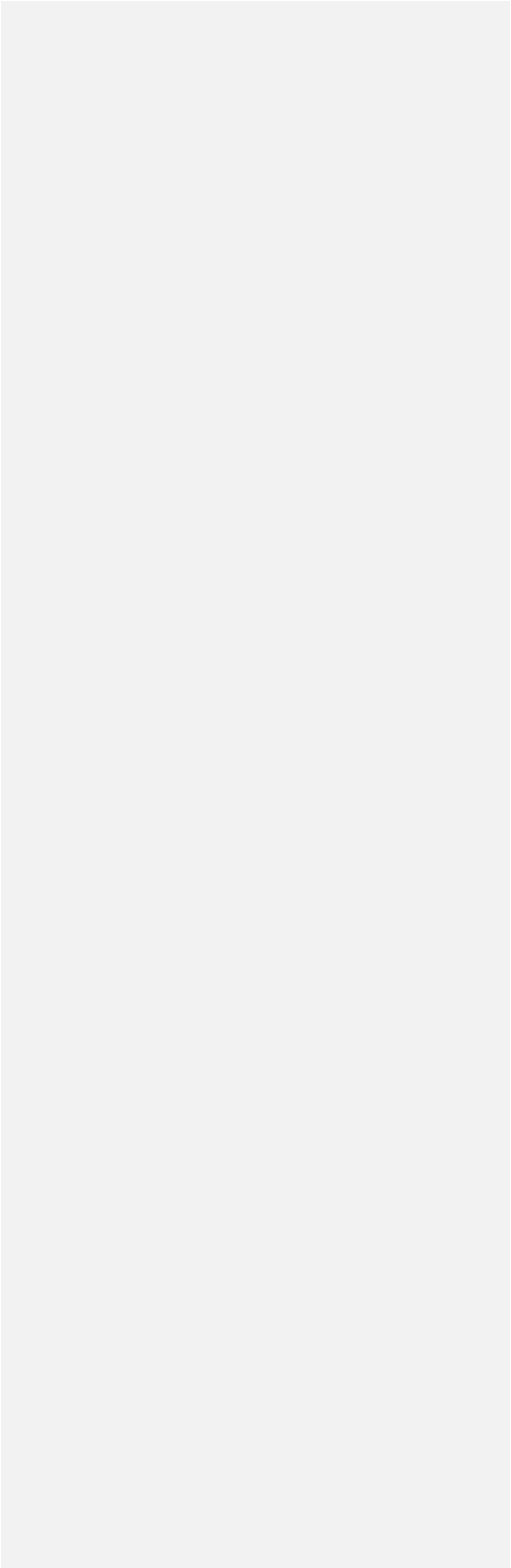
¹ For the avoidance of doubt, a sanctioned party's ineligibility to be awarded a contract shall include, without limitation, (i) applying for pre-qualification, expressing interest in a consultancy, and bidding, either directly or as a nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider, in respect of such contract, and (ii) entering into an addendum or amendment introducing a material modification to any existing contract.

² A nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider (different names are used depending on the particular bidding document) is one which has been: (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower.

participate further in the preparation or implementation of any Bank-financed project;

- e. Requires that a clause be included in bidding documents and in contracts financed by a Bank loan, requiring (i) bidders (applicants), consultants, contractors, and suppliers, and their sub-contractors, sub-consultants, service providers, suppliers, agents personnel, permit the Bank to inspect³ all accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have them audited by auditors appointed by the Bank.

³ Inspections in this context usually are investigative (i.e., forensic) in nature. They involve fact-finding activities undertaken by the Bank or persons appointed by the Bank to address specific matters related to investigations/audits, such as evaluating the veracity of an allegation of possible Fraud and Corruption, through the appropriate mechanisms. Such activity includes but is not limited to: accessing and examining a firm's or individual's financial records and information, and making copies thereof as relevant; accessing and examining any other documents, data and information (whether in hard copy or electronic format) deemed relevant for the investigation/audit, and making copies thereof as relevant; interviewing staff and other relevant individuals; performing physical inspections and site visits; and obtaining third party verification of information.



PART 2 - Employer's Requirements

Section VII - Employer's Requirements

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1. Employer's Requirements

Access to uninterrupted power supply in Federal Universities and University Teaching hospitals in Nigeria has been cited as a major challenge and barrier to effective learning, institutional operations, and student residency. Considering the role of education in economic growth and socio-economic development in Nigeria, the Ministry of Power resolved to embark on viable projects that will ensure the availability of reliable, sustainable, and affordable power to Nigeria's tertiary institutions. This led to the conception of the Energizing Education Programme (EEP).

The EEP seeks to provide adequate power supply (an estimated 90 MW total capacity) to thirty-seven (37) Federal Universities ("the Universities") and eight (8) University Teaching Hospitals across the Federal Republic of Nigeria, serving approximately 120,000 people. It also aims to provide streetlights to promote and facilitate safe, secure and productive learning environments and develop and operate training centers to train university students in renewable energy technology innovations. These Universities will be powered by electricity generation systems of 1MW to 2MW that can operate in an isolated or grid-supported mode.

Due to cost implications and time constraints, the projects under the EEP cannot be implemented at the same time. Therefore, the EEP has been divided into phases to ensure effective implementation.

Phase 1 of the EEP has been implemented with funds from the FGN with the REA as the Implementing Body. Nine (9) Universities and one (1) Teaching Hospital were selected to benefit from this phase and subsequently power supply has been provided through captive solar hybrid power plants, to seven (7) universities and will be provided to the remaining two (2) Universities and one (1) Teaching Hospital through captive gas-fired power plant solutions.

Phase 2 of the EEP is also being implemented by the REA but funded under the NEP supported by the World Bank. Seven (7) Federal Universities and two (2) University Teaching hospitals have been selected to benefit from this Phase. The Phase 2 has reached the EPC construction stage.

Phase 3 of the EEP is now currently implemented by the REA and funded under the NEP supported by the African Development Bank. Eight (8) Federal Universities and one (1) University Teaching hospital have been selected to benefit from this Phase. Activities leading to the implementation of Phase 3 have reached an advanced stage. It is planned that

all universities under this phase will make use of solar hybrid technology. Phase 3 builds on Phase 1 and Phase 2 experiences in particular to ensure long term sustainability of the power system.

In view of the giant strides achieved from the already implemented EEP Phase 1 and the ongoing phase 2, two (2) Central Monitoring platforms have already been implemented for the sole purpose of having a unified monitoring platform for the integration of all monitoring systems and by extension achieve the remote monitoring platforms for all the University locations (sites).

The essential benefits to be derived from the above is to enable the REA and the PMU to oversee the performances of each of the Solar Hybrid power plants to ensure compliance to the development objectives defined for the EEP Programme and Sustainability Plan.

The Two (2) Monitoring platforms are as follows.

1. Advanced Metering Infrastructure (AMI) Solutions.

The Employer requires the EPC Contractor to key into the existing smart metering platform to ensure a unified AMI platform across all the EEP Projects. The platform is in compliance with the AMI Specifications as defined in this section.

EPC Contractors are required to provide any hardware for integration of the meters with the platform, ensure all metering equipment is fully interoperable with the metering platform and provide all the functionality required by the Employer as outlined in these Technical Specifications. EPC Contractor will also be responsible for all costs and fees associated with the deployment and operation of this platform for a minimum period of one (1) year.

Website: <https://steama.co/contact>;

Email: eep@steama.co

Address: No. 2 Circle Square, Oxford Road. Manchester United Kingdom M1 7ED

2. Supervisory Control and Data Acquisition (SCADA).

The SCADA systems is a must have for the singular purpose to achieve the entire monitoring and control of the Solar Hybrid Power plant, it is expected that the EPC's will provide these platforms in line with the specifications of the IEC 61850 and other related international standards.

The EEP Phase I sites currently have achieved the integration of the Solar Hybrid Power plants through INACCESS Ltd, a platform with accurate Fault Recognition and Real Time Performance Monitoring that Guarantees Smooth Plant Operation. The EEP Phase II, Phase III and subsequent Phases will all be integrated into INACCESS for the above reasons. All onsite and remote monitoring is expected to utilize a single platform on the INACCESS platform.

Website:

<https://www.lapomikenergy.com>

Email : info@lapomikenergy.com

Address: 26 Total Gospel Road, Okuruama, Off Peter Odili street. Port Harcourt, Nigeria

1.1 Scope of Supply of Plant and Installation Services by the Contractor

The overall scope of the contract involves the following Six (6) items:

1. Engineering design, procurement, supply, transportation to site, off-loading, installation, quality control testing, integration with existing electrical system, commissioning, flawless synchronizing/paralleling with available power network (i.e. Grid and Diesel generator) performance testing & guarantee and handing over of Captive solar hybrid photovoltaic power plant at each of the eight (8) beneficiary locations.
2. Upgrading of upstream & downstream distribution networks for the location,
3. Installation and rehabilitation of existing streetlights within the institutions.
4. Design and installation of smart meters with end users which cover a total of 80% of projected energy consumption (rollout plan start with installation of meters at largest energy user first followed by second largest user etc)
5. Construction of a world class Workshop & Training Centre (WTC) building, which is fully equipped with electrical/ mechanical equipment, machines, furniture, and accessories for training of students on renewable energy technologies. During the construction stages, the EPC's will provide training to selected 20 female students in Science, Technology, Engineering and Mathematics (STEM) Faculties in the institution. During the Operations & Maintenance for One (1) year under Energizing Education Programme (EEP) Phase III, the EPC's will provide training to 100 students and 10 technical staff of the beneficiary university, and 15 personnel to be selected from REA, NERC and Ministry of Power. Thereafter a fourteen (14) year long term O & M to be mutually agreed upon after acceptable performance.

The approach for the second stage O & M will be done through a Special Purpose Vehicle (SPV) that will be formed with participants from the University and REA who will be charged with the responsibility for the management of long-term O & M in a tripartite agreement with the proposer. Further information on the SPV is as enumerated below.

The sustainability of the Energizing Education Programme is critical for the overall success of the Programme. Towards ensuring the sustainability of these projects for a period of 15 to 20 years, a Sustainability Plan, which seeks to implement proposed governance structures

and financial models, has been developed. The Sustainability Plan will encompass five major components:

1. Financial - development of a commercial model to cover all future OPEX costs.
2. Governance Structure & Operations – setting out clearly defined roles and responsibilities with management controls in place to safeguard funds.
3. Legal & Regulatory – supervise and ensure compliance with all relevant regulations during the O & M periods and support the contracting structure that adequately manages risk.
4. Energy Efficiency – ability to provide reliable and sustainable power supply to meet the load requirement using the installed capacity without the need for expansion; and
5. Engagement & Inclusion – setting out a clear path to participation for the university community, with a focus on student participation and gender inclusion.

The Sustainability Plan is intended to address the long-term Operation & Maintenance (O&M) as well as the mechanism for the replacement of major equipment through the 15 years period, for the 8 universities and the 1 teaching hospital. The proposed Governance Structure will establish a ‘Special Purpose Vehicle’(SPV) for each beneficiary institution which will manage the bundled service provider, address the concerns of the DisCos, manage resources and carry out general oversight on all operational and financial aspects of the project.

Each SPV will comprise of the respective beneficiary institutions (Federal Universities) who will have majority voting rights and will retain ownership of the energy systems as well as the project related assets; the Rural Electrification Agency (REA) who will have minority voting rights; and the Ministry of Finance Incorporated (MoFI).

The MoFI is the entity set up by the federal government of Nigeria to represent and administer the participation of all public institutions in any enterprise in part or in whole and as such, the interests of the Federal Ministry of Power and the Federal Ministry of Education will be represented through the MoFI. The MoFI will form part of the SPV for the reasons given below:

It will provide visibility and inclusion for both parent Ministries: the Ministry of Power to the REA and the Ministry of Education to the beneficiary institutions. The Ministry of Education is particularly relevant, as it will serve as a recourse mechanism in the event of a change in any of the beneficiary universities management and will mitigate any non-compliance by the new university management. The Federal Ministry of Power has a presence for the reason of visibility and advocacy, being the parent Ministry of the REA.

The respective SPVs will be responsible for the monitoring of energy usage and universities collections from end-users, operational decisions, developing and ensuring adherence to policies for the energy systems and training centre management, subject to approvals from the SPV board. The SPV will contract a Bundled Service Provider (Successful Proposer/EPC Contractor) for the O&M who will carry out the day-to-day operations and delivery of energy systems to the beneficiary institutions for a period of 15 years.

Engineering, Procurement and Construction (EPC) is to be implemented at the following selected beneficiary locations:

- 1) Modibbo Adama University (MAU)
- 2) Federal University Dutsin-Ma (FU DUTSINMA)
- 3) Federal University, Lafia (FULAFIA)
- 4) Federal University Lokoja (FU LOKOJA)
- 5) Federal University of Technology, Akure (FUTA)
- 6) University of Uyo (UNIUYO)
- 7) Federal University of Technology, Owerri (FUTO)
- 8) University of Port Harcourt & Teaching Hospital (UNIPORT & UPTH)

1.2 Site Information

The basic information of the sites is presented in the table 1.

Table 1: Site Information

Site Information								
PARAMETER	MAU YOLA	FUOMA	FU LAFIA	FU LOKOJA	FUTA	FU UYO	FUTO	UNIPORT & UPTH
Latitude	9.353112N	12.296554N	8.479608N	7.85896N	7.300930N	5.032659N	5.391858N	4.896941N
Longitude	12.490330E	7.441562E	8.565523E	6.68145E	5.130587E	7.978497E	6.993108E	6.916617E
Elevation (m)	215	518	170	189	379	63	62	15
Temperature (oC)	29.38	26.31	28.02	27.50	24.99	25.62	26.25	25.89

1. PROPOSED PLANT CAPACITIES & RELEVANT TECHNICAL DATA

The table below presents the technical data summaries of the proposed solar hybrid power plant in all the eight (8) beneficiary Universities.

Table 2: Solar Hybrid Plant Technical Data Summaries

Parameters	BMU/PCLA	FUDMA	FU LAFN	FU LOKOGAR	FUTA	FU UYO	FUTO	UNIPORT & UPMN
Solar resource (GHI)	2,266	2,298	2,078	2,062	1,928	1,738	1,862	1,718
Solar PV Plant (KWdc)	5,000	1,834	1,634	1,717	4,500	2,926	8,156	10,754
DG (kW) Cumulative	2,000	960	630	790	1,900	1,300	5,000	4,400
DG (kW) Individual Units	400 x 4	500 x 2	320 x 2	400 x 2	400 x 2 800 x 2	200 x 2 500 x 2	500 x 6	800 x 3 500 x 4
DG Type	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel	Diesel
BESS (MWh)	10	3	3	3	4	4	13	14
BESS Type	Lithium	Lithium	Lithium	Lithium	Lithium	Lithium	Lithium	Lithium
PCS (kW)	-5000	-1500	-1500	-1500	-2000	-2000	-6500	-7000
PV Rated Power (AC) (kWac)	4,100	1,600	1,300	1,400	3,700	2,400	7,000	9,000
PV Array power (DC) (kWp)	5,000	1,834	1,634	1,717	4,500	2,926	8,116	10,754
Ratio DC/AC	1.22	1.21	1.26	1.28	1.22	1.22	1.22	1.19
Energy Yield (MWh/year)	8,506	3,483	2,457	2,438	6,106	3,566	10,893	13,055
Specific Yield (kWh/kWp/year)	1,791	1,806	1,504	1,421	1,355	1,219	1,255	1,214
Performance Ratio	82%	81%	83%	83%	84%	84%	84%	84%
Guaranteed								
Expected Minimum Output (MWh/month)	544	228	156	156	358	218	692	881
Maximum SAIDI per quarter (hr)	33	33	33	33	33	33	33	33
Min. Renewable fraction (%)	>70%	>70%	>70%	>70%	>70%	>70%	>70%	>70%
Genset Run Time Hours (hrs/month)	9	18	22	19	34	19	19	16
Module Mounting Structure	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
Module Minimum Inclination (Degrees)	10	10	10	10	10	10	10	10

The data above is provided to the proposer for system design purposes only. The Employer does not accept any liability for the accuracy of the data.

The table 3 below states the definition of Daylight Hours and Nighttime Hours.

This time slots must be considered as relevant Daylight Hours and Nighttime Hours referred to in this bidding document.

Table 3: Definition of Daylight and Nighttime Hours

	M A U	FU D M A	FULA FIA	FUL OK OJA	FU TA	F U Y O	FUT O	UNIPO RT & UPTH
Daylight Hours	6AM- 6PM	6AM- 6PM	6:30A M- 6:30P M	6:30 AM- 6:30 PM	6:30 AM - 6:3 0P M	6:30 AM- 6:30 PM	6A M- 6P M	6:30A M- 6:30P M
Nighttime Hours	6P M- 6A M	6P M- 6AM	6:30P M- 6:30A M	6:30 PM- 6:30 AM	6:30 PM- 6:3 0A M	6:30P M- 6:30 AM	6P M- 6A M	6:30P M- 6:30A M
Targeted Power supply from Disco Grid	6P M- 6A M	6P M- 6AM	6:30P M- 6:30A M	6:30 PM- 6:30 AM	6:30 PM- 6:3 0A M	6:30P M- 6:30 AM	6P M- 6A M	6:30P M- 6:30A M

The figure 1 shows the simulated typical daily load profiles (kW vs H):

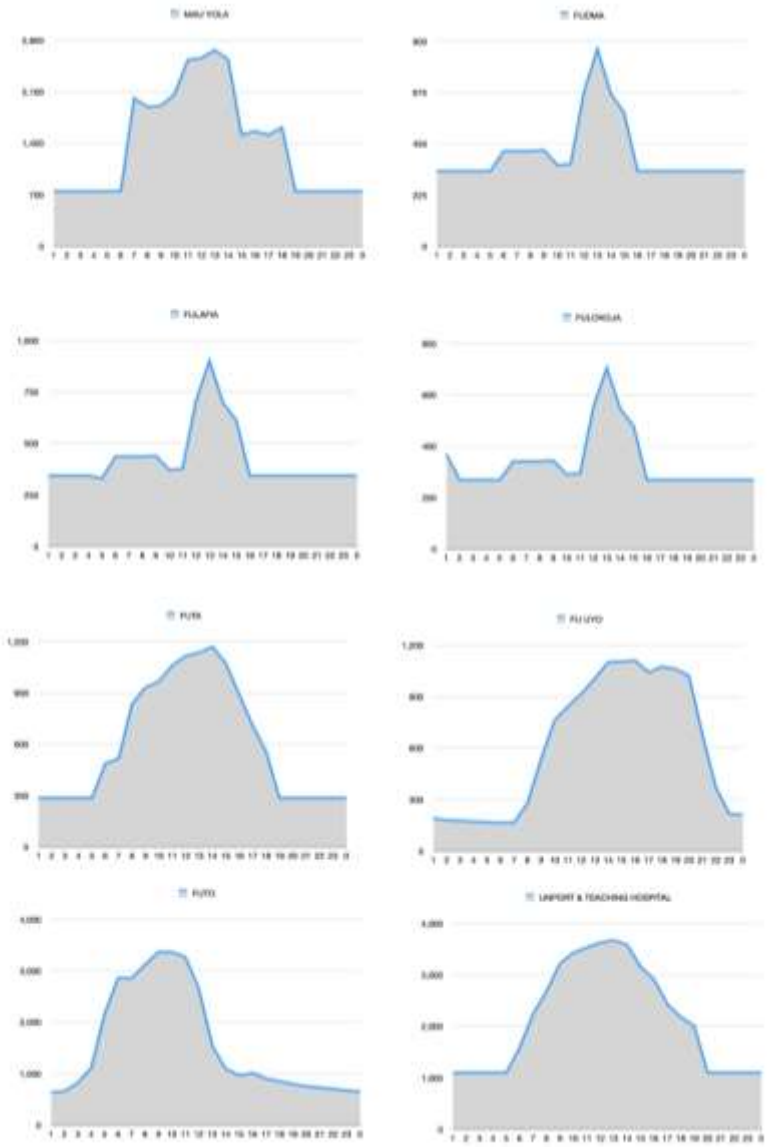


Figure 1: Homer simulated typical daily load profiles

The table below provides the data for the above-mentioned load profiles.

Table 4: Hourly Load Demands

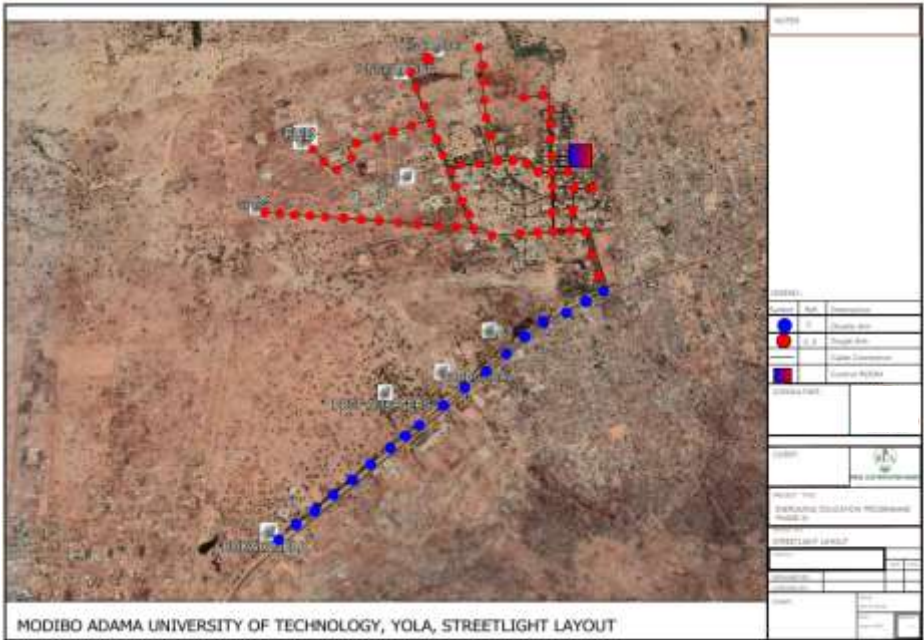
Hrs	MAU YOLA	FUDMA	FU LAFIA	FU LOKOJA	FUTA	FU UYO	FUTO	UNIPORT & UPTH
0	747	330	344	269	285	213	654	1,102
1	747	330	344	369	285	191	636	1,102
2	747	330	344	269	285	180	658	1,102
3	747	330	344	269	285	177	823	1,102
4	747	330	344	269	285	172	1,117	1,102
5	747	330	330	269	285	168	2,171	1,102
6	747	418	436	341	487	164	2,861	1,590
7	2,010	418	436	341	517	167	2,854	2,245
8	1,891	418	436	341	836	279	3,121	2,683
9	1,910	422	440	344	932	535	3,366	3,222
10	2,063	356	371	290	967	760	3,365	3,429
11	2,533	361	377	294	1,061	842	3,262	3,532
12	2,553	678	707	553	1,116	916	2,651	3,624
13	2,665	864	901	704	1,135	1,006	1,538	3,673
14	2,534	670	698	546	1,170	1,101	1,093	3,584
15	1,513	586	611	478	1,072	1,105	966	3,161
16	1,562	330	344	269	888	1,110	1,017	2,914
17	1,513	330	344	269	708	1,042	903	2,432
18	1,614	330	344	269	557	1,074	853	2,180
19	747	330	344	269	285	1,061	799	2,007
20	747	330	344	269	285	1,020	753	1,102
21	747	330	344	269	285	675	731	1,102
22	747	330	344	269	285	370	705	1,102
23	747	330	344	269	285	217	674	1,102
Peak Load (Day), KW	2,665	864	901	704	1,170	1,110	3,366	3,673
Peak Load (Night), KW	1,614	418	436	369	557	1,074	2,861	2,180
Ax. Daily Energy Con KWh	13,170	5,689	3,754	4,745	12,370	8,433	17,761	32,280

The data on load profiles above is provided to the proposer for system design and bid evaluation purposes only. The Employer does not accept any liability for the accuracy of the data.

2. REQUIREMENT FOR STREETLIGHTS WORKS

2.1 REQUIREMENT FOR STREETLIGHT WORKS AT MAU			
<i>Supply, install, test and commission new streetlights with all required items including the following which is not exhaustive:</i>			
Length of Road (m)	Pole Spacing (m)	No. Of Street light Poles	MINIMUM SCOPE
7,315	30	244	8.6m Single-arm outreach Galvanized Pole (229pcs)
			8.6m Double-arm outreach Galvanized Pole(15pcs)
			4c x 10mm ² cable PVC/SWA/PVC
			4c x 16mm ² cable PVC/SWA/PVC
			4c x 25mm ² cable PVC/SWA/PVC
			4c x 35mm ² cable PVC/SWA/PVC (home run)
			3c x 2.5mm ² cable PVC
			120W to 140W with minimum 18,000lumen Smart LED Luminaire complete with remote monitoring and motion sensor
			Provision of streetlighting distribution panel & control cubicle with photocell
			Concrete Pole Plinth with holding-down bolts & nuts

			Concrete Slab
			6A MCB (ABB, Schneider or equivalent)
			150A Cable Connector Bar

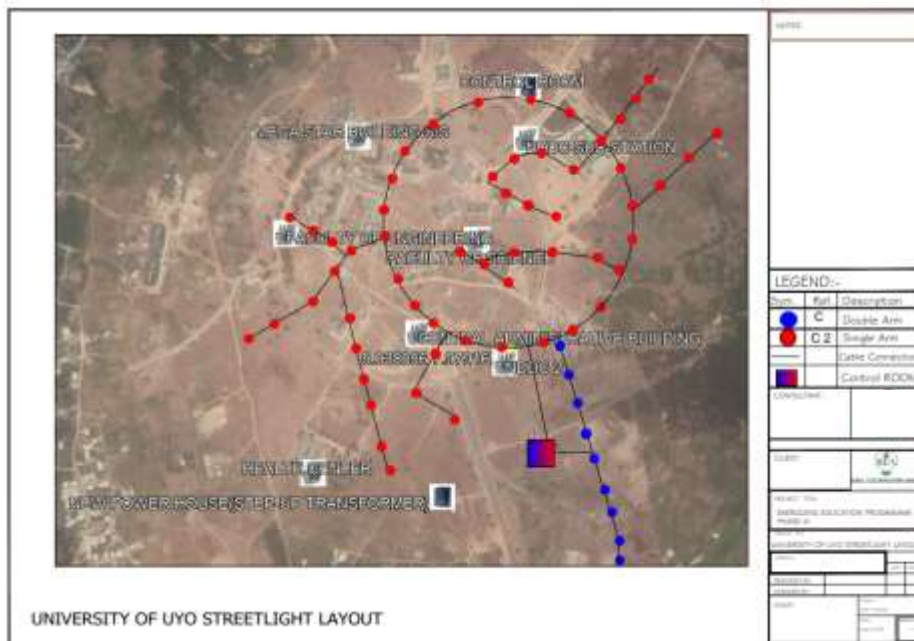


MAU Streetlight Layout

			6" earth rod
			Insulating Tape (3M Type)
			75mmØ heavy gauge uPVC pipe for cable sleeve
			Installation of luminaire with platform vehicle
			Placement of pole plinth in position with Hiab
			Erection/installation of poles with Hiab
			Excavate trench for pole base
			Pole numbering signage
			Excavate trench for armoured cable average 400mm wide minimum depth 800mm
			Thrust boring
			Remote Monitoring Hub, Fixed Asset Software & NOC (Optional)
			SubStation Earthing and other services
			Fencing of the Panels and reinforcement
			Cable lug, gland, and other accessories for complete installation
			Making good the tarmac and concrete work
			Community Relations & Services
			Testing and Commissioning

REQUIREMENT FOR STREETLIGHT WORKS AT UNIUYO			
<i>Supply, install, test and commission new streetlights with all required items including the following which is not exhaustive:</i>			
Length of Road (m)	Pole Spacing (m)	No. Of Streetlight Poles	MINIMUM SCOPE
9,300	30	310	8.6m Double-arm outreach Galvanized Pole (44pcs)
			8.6m Single-arm outreach Galvanized Pole (267pcs)
			4c x 10mm ² cable PVC/SWA/PVC
			4c x 16mm ² cable PVC/SWA/PVC
			4c x 25mm ² cable PVC/SWA/PVC
			4c x 35mm ² cable PVC/SWA/PVC (home run)
			3c x 2.5mm ² cable PVC
			150W to 180W with minimum 25,200lumen Smart LED Luminaire complete with remote monitoring and motion sensor
			Provision of streetlighting distribution panel & control cubicle with photocell
			Concrete Pole Plinth with holding-down bolts & nuts
			Concrete Slab
			6A MCB (ABB, Schneider or equivalent)
			150A Cable Connector Bar

			6" earth rod
			Insulating Tape (3M Type)
			75mmØ heavy gauge uPVC pipe for cable sleeve

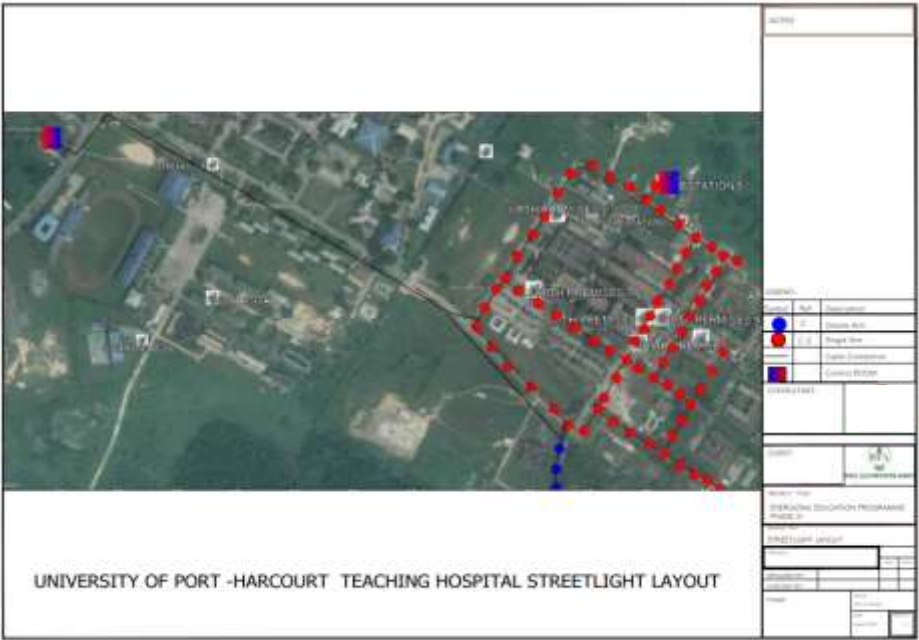


UNIUYO Streetlight Layout

			Installation of luminaire with platform vehicle
			Placement of pole plinth in position with Hiab
			Erection/installation of poles with Hiab
			Excavate trench for pole base
			Pole numbering signage
			Excavate trench for armoured cable average 400mm wide minimum depth 800mm
			Thrust boring
			Remote Monitoring Hub, Fixed Asset Software & NOC (Optional)
			Sub Station Earthing and other services
			Fencing of the Panels and reinforcement
			Cable lug, gland, and other accessories for complete installation
			Making good the tarmac and concrete work
			Community Relations & Services
			Testing and Commissioning with Load Bank

REQUIREMENT FOR STREETLIGHT WORKS AT UNIPOINT & TEACHING HOSPITAL			
<i>Supply, install, test and commission new streetlights with all required items including the following which is not exhaustive:</i>			
Length of Road (m)	Pole Spacing (m)	No. Of Streetlight Poles	MINIMUM SCOPE
19,600	30	654	8.6m Single-arm outreach Galvanized Pole (1350pcs)
			8.6m Double-arm outreach Galvanized Pole (133pcs)
			4c x 10mm ² cable PVC/SWA/PVC
			4c x 16mm ² cable PVC/SWA/PVC
			4c x 25mm ² cable PVC/SWA/PVC
			4c x 35mm ² cable PVC/SWA/PVC (home run)
			3c x 2.5mm ² cable PVC
			150W to 180W with minimum 25,200lumen Smart LED Luminaire complete with remote monitoring and motion sensor
			Provision of streetlighting distribution panel & control cubicle with photocell
			Concrete Pole Plinth with holding-down bolts & nuts
			Concrete Slab
			6A MCB (ABB, Schneider or equivalent)
			150A Cable Connector Bar

			6" earth rod
			Insulating Tape (3M Type)

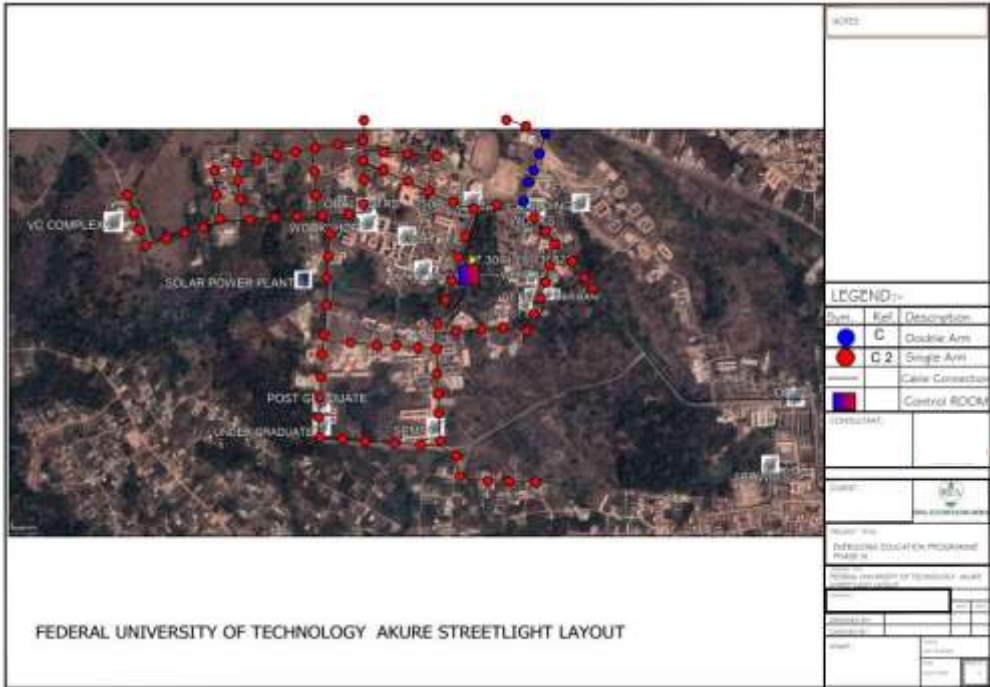


UNIPORT Streetlight Layout

			75mmØ heavy gauge uPVC pipe for cable sleeve
			Installation of luminaire with platform vehicle
			Placement of pole plinth in position with Hiab
			Erection/installation of poles with Hiab
			Excavate trench for pole base
			Pole numbering signage
			Excavate trench for armoured cable average 400mm wide minimum depth 800mm
			Thrust boring
			Remote Monitoring Hub, Fixed Asset Software & NOC (Optional)
			Sub Station Earthing and other services
			Fencing of the Panels and reinforcement
			Cable lug, gland and other accessories for complete installation
			Making good the tarmac and concrete work
			Community Relations & Services
			Testing and Commissioning with Load Bank

REQUIREMENT FOR STREETLIGHT WORKS AT FUTA			
<i>Supply, install, test and commission new streetlights with all required items including the following which is not exhaustive:</i>			
Length of Road (m)	Pole Spacing (m)	No. Of Streetlight Poles	MINIMUM SCOPE
10,536	30	351	8.6m Single-arm outreach Galvanized Pole (282pcs)
			8.6m Double-arm outreach Galvanized Pole(70pcs)
			4c x 10mm ² cable PVC/SWA/PVC
			4c x 16mm ² cable PVC/SWA/PVC
			4c x 25mm ² cable PVC/SWA/PVC
			4c x 35mm ² cable PVC/SWA/PVC (home run)
			3c x 2.5mm ² cable PVC
			150W to 180W with minimum 25,200lumen Smart LED Luminaire complete with remote monitoring and motion sensor
			Provision of streetlighting distribution panel & control cubicle with photocell
			Concrete Pole Plinth with holding-down bolts & nuts
			Concrete Slab
			6A MCB (ABB, Schneider or equivalent)

			150A Cable Connector Bar
			6" earth rod
			Insulating Tape (3M Type)

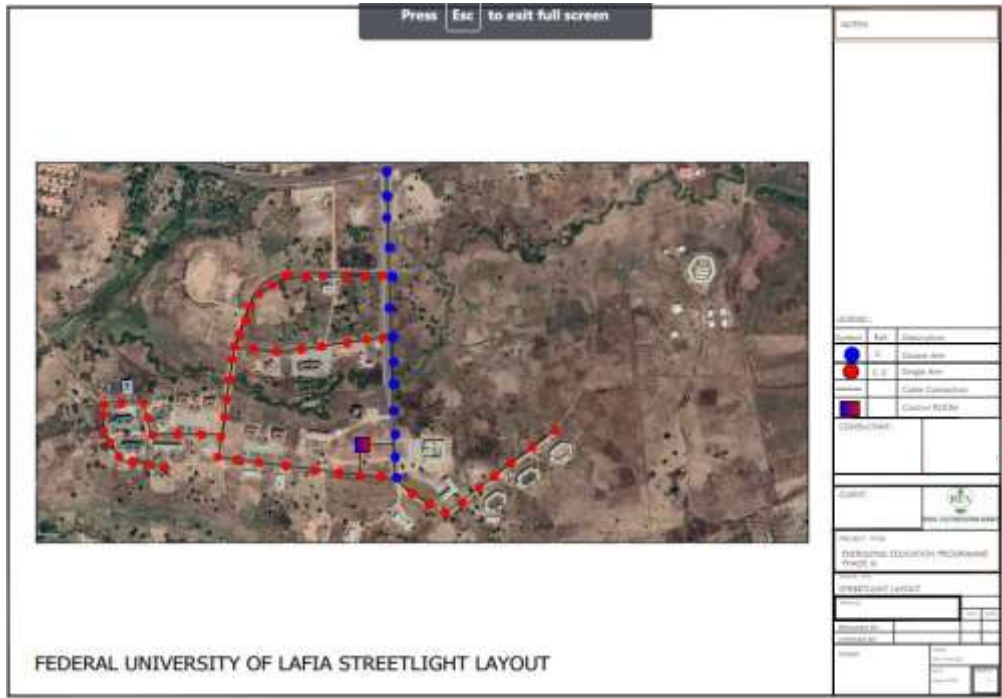


FUT Akure Streetlight Layout

			75mmØ heavy gauge uPVC pipe for cable sleeve
			Installation of luminaire with platform vehicle
			Placement of pole plinth in position with Hiab
			Erection/installation of poles with Hiab
			Excavate trench for pole base
			Pole numbering signage
			Excavate trench for armoured cable average 400mm wide minimum depth 800mm
			Thrust boring
			Remote Monitoring Hub, Fixed Asset Software & NOC (Optional)
			Sub Station Earthing and other services
			Fencing of the Panels and reinforcement
			Cable lug, gland, and other accessories for complete installation
			Making good the tarmac and concrete work
			Community Relations & Services
			Testing and Commissioning

REQUIREMENT FOR STREETLIGHT WORKS AT FULAFIA			
<i>Supply, install, test and commission new streetlights with all required items including the following which is not exhaustive:</i>			
Length of Road (m)	Pole Spacing (m)	No. Of Streetlight Poles	MINIMUM SCOPE
6,200	30	207	8.6m Single-arm outreach Galvanized Pole (167pcs)
			8.6m Double-arm outreach Galvanized Pole (40pcs)
			4c x 10mm ² cable PVC/SWA/PVC
			4c x 16mm ² cable PVC/SWA/PVC
			4c x 25mm ² cable PVC/SWA/PVC
			4c x 35mm ² cable PVC/SWA/PVC (home run)
			3c x 2.5mm ² cable PVC
			150W to 180W with minimum 25,200lumen Smart LED Luminaire complete with remote monitoring and motion sensor.
			Provision of streetlighting distribution panel & control cubicle with photocell
			Concrete Pole Plinth with holding-down bolts & nuts
			Concrete Slab
			6A MCB (ABB, Schneider or equivalent)

			150A Cable Connector Bar
			6" earth rod
			Insulating Tape (3M Type)



FU Lafia Streetlight Layout

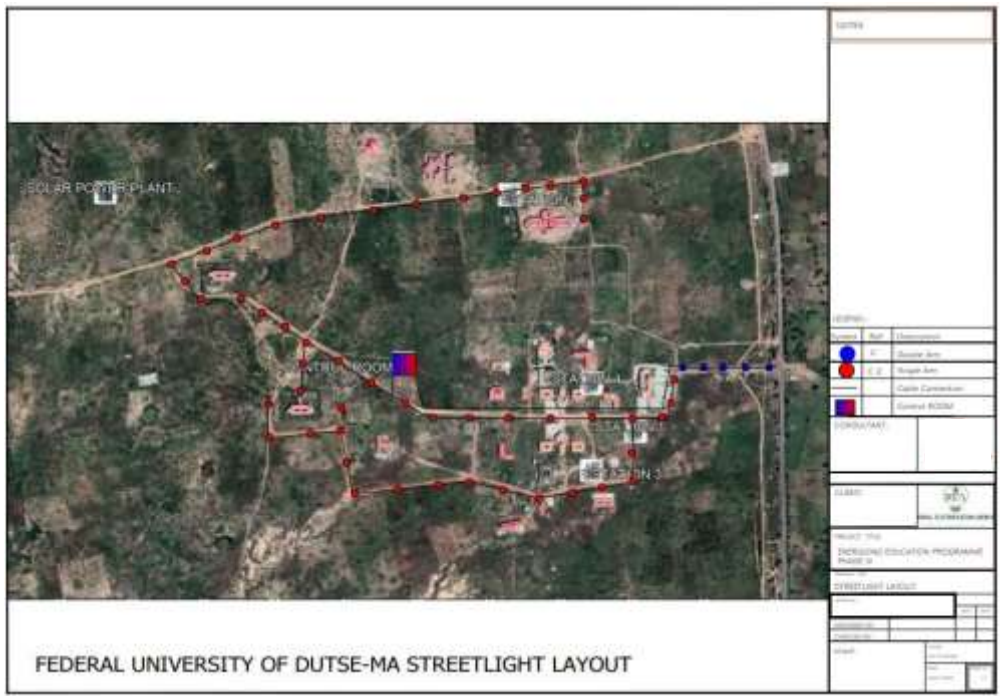
			75mmØ heavy gauge uPVC pipe for cable sleeve
			Installation of luminaire with platform vehicle
			Placement of pole plinth in position with Hiab
			Erection/installation of poles with Hiab
			Excavate trench for pole base
			Pole numbering signage
			Excavate trench for armoured cable average 400mm wide minimum depth 800mm
			Thrust boring
			Remote Monitoring Hub, Fixed Asset Software & NOC (Optional)
			Sub Station Earthing and other services
			Fencing of the Panels and reinforcement
			Cable lug, gland, and other accessories for complete installation
			Making good the tarmac and concrete work
			Community Relations & Services
			Testing and Commissioning with Load Bank

REQUIREMENT FOR STREETLIGHT WORKS AT FUDUTSIN MA

Supply, install, test and commission new streetlights with all required items including the following which is not exhaustive:

Length of Road (m)	Pole Spacing (m)	No. Of Streetlight Poles	MINIMUM SCOPE
4,000	30	133	8.6m Single-arm outreach Galvanized Pole (122pcs)
			8.6m Double-arm outreach Galvanized Pole (12pcs)
			4c x 10mm ² cable PVC/SWA/PVC
			4c x 16mm ² cable PVC/SWA/PVC
			4c x 25mm ² cable PVC/SWA/PVC
			4c x 35mm ² cable PVC/SWA/PVC (home run)
			3c x 2.5mm ² cable PVC
			150W to 180W with minimum 25,200lumen Smart LED Luminaire complete with remote monitoring and motion sensor
			Provision of streetlighting distribution panel & control cubicle with photocell
			Concrete Pole Plinth with holding-down bolts & nuts
			Concrete Slab
			6A MCB (ABB, Schneider or equivalent)
			150A Cable Connector Bar
			6" earth rod
Insulating Tape (3M Type)			

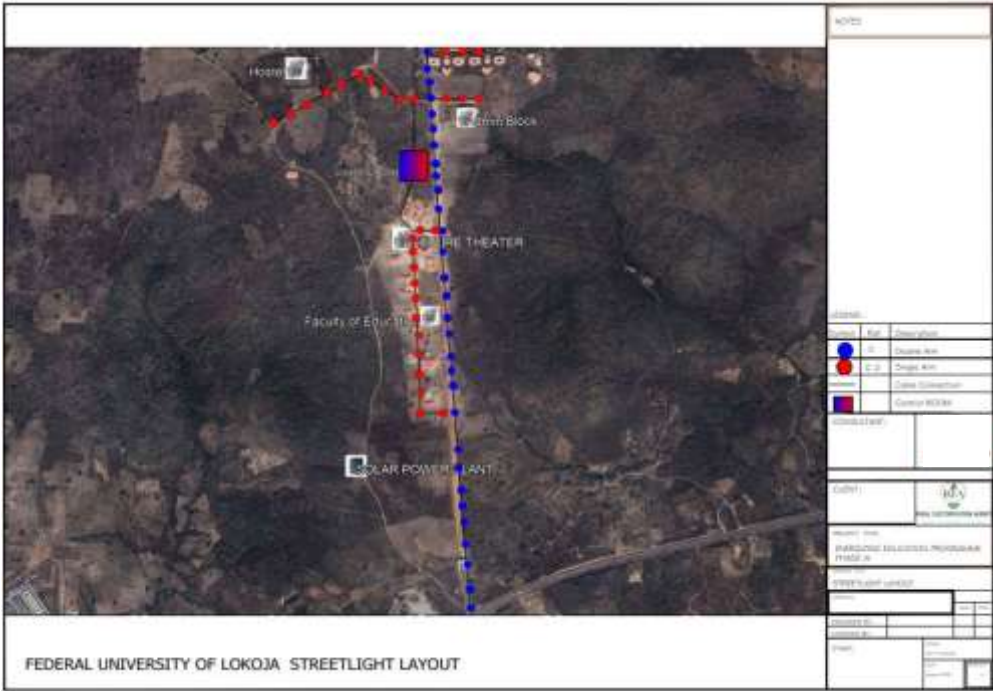
			75mmØ heavy gauge uPVC pipe for cable sleeve
			Installation of luminaire with platform vehicle
			Placement of pole plinth in position with Hiab
			Erection/installation of poles with Hiab
			Excavate trench for pole base
			Pole numbering signage
			Excavate trench for armoured cable average 400mm wide minimum depth 800mm
			Thrust boring
			Remote Monitoring Hub, Fixed Asset Software & NOC (Optional)
			Sub Station Earthing and other services
			Fencing of the Panels and reinforcement
			Cable lug, gland and other accessories for complete installation
			Making good the tarmac and concrete work
			Community Relations & Services
			Testing and Commissioning with Load Bank



Dutsin-Ma Streetlight Layout

REQUIREMENT FOR STREETLIGHT WORKS AT FU LOKOJA			
<i>Supply, install, test and commission new streetlights with all required items including the following which is not exhaustive:</i>			
Length of Road (m)	Pole Spacing (m)	No. Of Streetlight Poles	MINIMUM SCOPE
6,550	30	218	8.6m Single-arm outreach Galvanized Pole (167pcs)
			8.6m Double-arm outreach Galvanized Pole (52pcs)
			4c x 10mm ² cable PVC/SWA/PVC
			4c x 16mm ² cable PVC/SWA/PVC
			4c x 25mm ² cable PVC/SWA/PVC
			4c x 35mm ² cable PVC/SWA/PVC (home run)
			3c x 2.5mm ² cable PVC
			150W to 180W with minimum 25,200lumen Smart LED Luminaire complete with remote monitoring and motion sensor
			Provision of streetlighting distribution panel & control cubicle with photocell
			Concrete Pole Plinth with holding-down bolts & nuts
			Concrete Slab
			6A MCB (ABB, Schneider or equivalent)

			150A Cable Connector Bar
			6" earth rod
			Insulating Tape (3M Type)



FU Lokoja Streetlight Layout

			75mmØ heavy gauge uPVC pipe for cable sleeve
			Installation of luminaire with platform vehicle
			Placement of pole plinth in position with Hiab
			Erection/installation of poles with Hiab
			Excavate trench for pole base
			Pole numbering signage
			Excavate trench for armoured cable average 400mm wide minimum depth 800mm
			Thrust boring
			Remote Monitoring Hub, Fixed Asset Software & NOC (Optional)
			Sub Station Earthing and other services
			Fencing of the Panels and reinforcement
			Cable lug, gland, and other accessories for complete installation
			Making good the tarmac and concrete work
			Community Relations & Services
			Testing and Commissioning with Load Bank

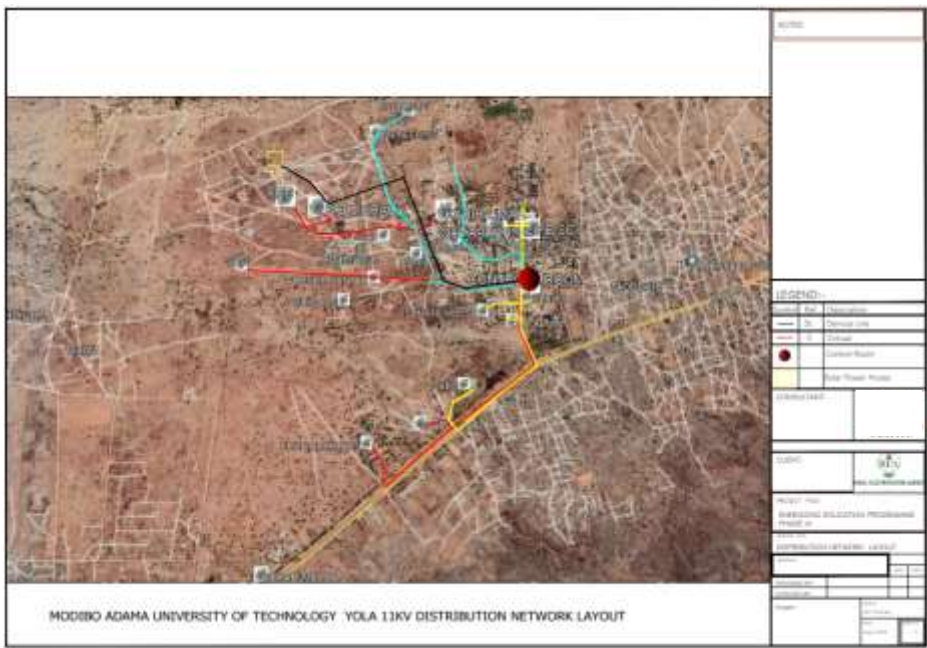
3. REQUIREMENT FOR UPGRADE OF UPSTREAM & DOWNSTREAM DISTRIBUTION NETWORK.

REQUIREMENTS FOR EEP PHASE III DISTRIBUTION NETWORK WORKS AT MAU YOLA	
DOWNSTREAM DISTRIBUTION WORKS (CONTROL ROOM, MV PANELS AND DISTRIBUTION NETWORK UPGRADE)	
1	Provision and installation of 11KV Double Bus bar Panel incoming
2	Provision and installation of 11KV Double Bus bar Panel outgoing
3	Provision and installation of 500KVA, 11/0.415KV transformers
4	800A Feeder Pillar
5	High Rupturing Capacity (HRC) Feeder fuses
6	3 X 185MM SQR. 11KV XLPE Cable
7	1X35MM SQR. XLPE CABLE
8	1 X 500MM SQR. MV CABLE
9	4 X 150MM SQR. CABLE
10	70MM SQR BARE COPPER WIRE
11	COPPER 1.2M LONG .02M DIAMETER EARTHING RODS
12	Sundry Installation Materials
13	Laying of Cable from PV Plant Yard to Control Room

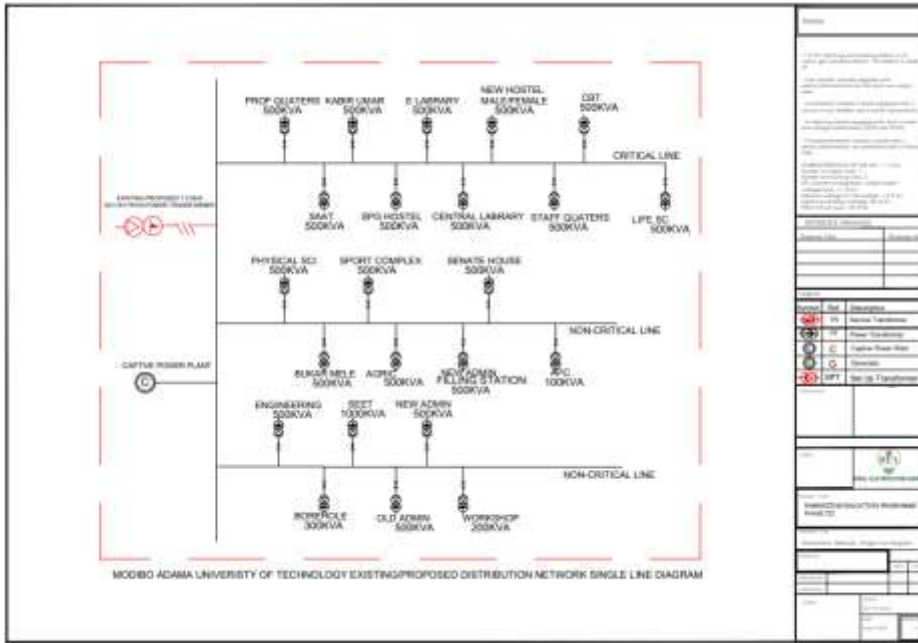
14	Remedial work for decongestion of take-off point
15	Provision of Control Room Building, Air conditioners and Furniture
DOWNSTREAM DISTRIBUTION WORKS (CONSTRUCTION OF 3KM SINGLE CIRCUIT 11KV LINE FOR CRITICAL LOADS)	
1	Galvanized Tie Strap s(11kV)
2	Pin Insulator - (11kV) Composite silicon type
3	Disc Insulators (11kV) Silicon type
4	Tension Clamp
5	HV Stay Insulator
6	7/8" Stay Wire (HV) metre
7	8'Stay Rod (HV)
8	Stay Thimble
9	Stay Block
10	16x51 B,N & W
11	16 x152 B,N & W

12	16x200/275 B,N & W
13	16x254 B,N & W
14	16x280/305 B,N & W
15	F/Washer for 22mm Dia
16	F/Washer for 18mm Dia
17	Pole Identification
18	Barbed Wire metre
19	Danger Plate
20	11kV Fiber Cross-arm
21	Galvanized Angle Iron (5"x3"x 3/8 x 9ft)
22	Aluminum Line Tap for 150mm ² conductor
23	150mm ² Aluminum conductor (AAC)
24	Galvanized copper Earthing Rod (6ft)
25	Bare Copper Wire (70mm ²)
26	10.36 metre RC Pole
27	Galvanized Channel Iron (5"x3/8"x3"x9ft)
28	Copper Earth Mat
29	Concrete foundation for RC Pole
30	Gang Isolators
31	Bush clearing/Tree cutting

32	Detailed Route Survey complete with four (4) sets of survey drawings
33	Testing and commissioning including NEMSA certification



Modibbo Adama University, MAU Distribution Network Layout



Modibbo Adama University, MAU Distribution Network Single Line Diagram

REQUIREMENTS FOR EEP PHASE III DISTRIBUTION NETWORK WORKS AT FEDERAL UNIVERSITY DUTSIN-MA (FU DUTSINMA)

DOWNSTREAM DISTRIBUTION WORKS (CONTROL ROOM, MV PANELS AND DISTRIBUTION NETWORK UPGRADE)

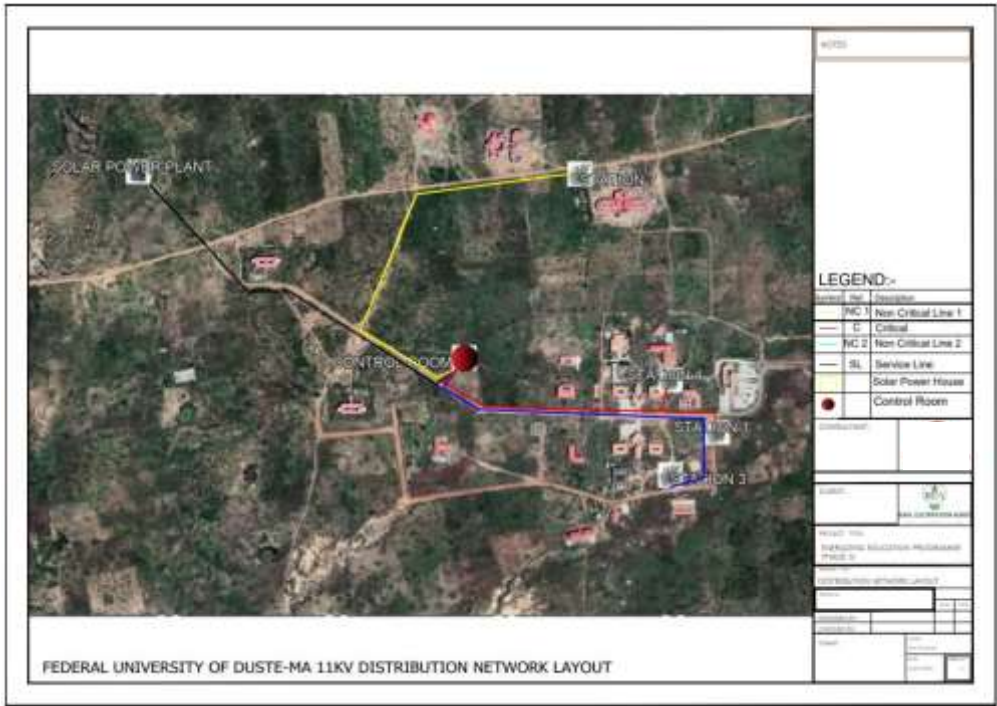
1	Provision and installation of 11KV Double Bus bar Panel incoming
2	Provision and installation of 11KV Double Bus bar Panel outgoing
3	Provision and installation of 500KVA,11/0.415KV transformers
4	800A Feeder Pillar
5	High Rupturing Capacity (HRC) Feeder fuses
6	3 X 185MM SQR. 11KV XLPE Cable
7	1X35MM SQR. XLPE CABLE
8	1 X 500MM SQR. MV CABLE
9	4 X 150MM SQR. CABLE
10	70MM SQR BARE COPPER WIRE
11	COPPER 1.2M LONG .02M DIAMETER EARTHING RODS

12	Sundry Installation Materials
13	Laying of Cable from PV Plant Yard to Control Room
14	Remedial work for decongestion of take-off point
15	Provision of Control Room Building, Air conditioners and Furniture
DOWNSTREAM DISTRIBUTION WORKS (CONSTRUCTION OF 5KM SINGLE CIRCUIT 11KV LINE FOR CRITICAL LOADS)	
1	Pin Insulator - (11kV) Composite silicon type
2	Disc Insulators (11kV) Silicon type
3	Tension Clamp
4	HV Stay Insulator
5	7/8" Stay Wire (HV) metre
6	8'Stay Rod (HV)
7	Stay Thimble
8	Stay Block
9	16x51 B,N & W
10	16 x152 B,N & W

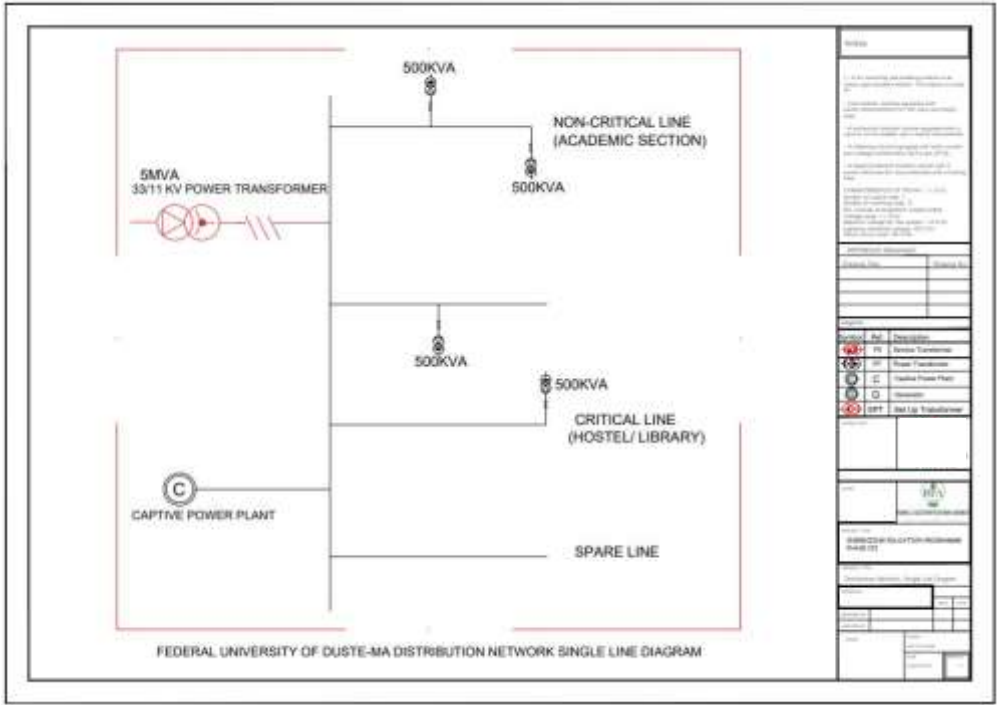
11	16x200/275 B,N & W
12	16x254 B,N & W
13	16x280/305 B,N & W
14	F/Washer for 22mm Dia
15	F/Washer for 18mm Dia
16	Pole Identification
17	Barbed Wire metre
18	Danger Plate
19	11kV Fiber Cross-arm
20	Galvanized Angle Iron (5"x3"x 3/8 x 9ft)
21	Aluminum Line Tap for 150mm ² conductor
22	150mm ² Aluminum conductor (AAC)
23	Galvanized copper Earthing Rod (6ft)
24	Bare Copper Wire (70mm ²)
25	10.36 metre RC Pole
26	Galvanized Channel Iron (5"x3/8"x3"x9ft)
27	Galvanized tie straps(11Kv)
28	Copper Earth Mat
29	Concrete foundation for RC Pole
30	Gang Isolators

31	Bush clearing/Tree cutting
32	Detailed Route Survey complete with four (4) sets of survey drawings
33	Testing and commissioning including NEMSA certification
UPSTREAM DISTRIBUTION WORKS (CONSTRUCTION OF PROPOSED 1X5MVA,33/11KV INJECTION SUBSTATION)	
34	Supply and install 4mm thick interlock paving stones all-round the Switch/Control room Building and conc. Kerb where necessary.
35	Provision for cutting of vegetable top soil of the Switch Yard and disposal
36	Provision for anti-weed over the whole surface Switchyard
37	Provision for imported laterite of 300mm Thick and compacted
38	Provision for Gantry floor with pure cement paste blinding to avoid weeds
39	Provision for the High-density polyethylene
40	Provision for Switch Yard graded granite of 225mm with appropriate concrete kerb
41	Level and compact driveway to receive concrete
42	Supply and spread along driveway, graded granite with appropriate concrete kerb
43	Provision for Reinforced conc. Substation Transformer and Station Transformer plinth
44	Provision for the construction of Gantry with standard steel foundations with concrete work where necessary
45	Provision for 4no. Halogen Light at strategic location in the Switch Yard
46	Provision for 1 x 5 MVA 33/11kV Transformer

47	Coupling & Positioning of Power Transformer
48	Supply and installation of 33kV 3-phase isolator.
49	Supply and installation of 33kv 3-phase isolator/earthing Switch
50	Supply and Installation of 33KV Surge Arrester
51	Supply and Installation of 33KV Circuit Breaker
52	Underground Cable
53	Substation earthing complete with earthing pit, earthing mat, rods, clamps and copper.
54	Provision for 1 set of 33kV control/relay Transformer Panel
55	Provision for complete metering & Protection equipment and materials
56	Supply and installation of AC Distribution Board and 2No battery room extractor fan
57	supply and Installation of DC Distribution Board and emergency lighting system
58	supply and Installation of battery bank and charger unit complete with the rack.
59	H.T Rubber Mats
60	Fire safety Equipment
61	Loading, Haulage and off-loading of Power Transformer
62	testing and commissioning of the entire substation works.
63	"As Built" drawings both hard and electronic copies (6 sets)



FEDERAL UNIVERSITY, DUTSIN-MA, FUDMA, Distribution Network Layout



Dutsin-Ma Distribution Network Single Line Diagram

REQUIREMENT FOR EEP PHASE III DISTRIBUTION NETWORK WORKS AT FU LAFIA	
DOWNSTREAM DISTRIBUTION WORKS (CONTROL ROOM, MV PANELS AND DISTRIBUTION NETWORK UPGRADE)	
1	Provision and installation of 11KV Double Bus bar Panel incoming
2	Provision and installation of 11KV Double Bus bar Panel outgoing
3	Provision and installation of 500KVA, 11/0.415KV transformers
4	800A Feeder Pillar
5	3 X 185MM SQR. 11KV XLPE Cable
6	1X35MM SQR. XLPE CABLE
7	1 X 500MM SQR. MV CABLE
8	4 X 150MM SQR. CABLE
9	70MM SQR BARE COPPER WIRE
10	COPPER 1.2M LONG .02M DIAMETER EARTHING RODS
11	Sundry Installation Materials
12	Laying of Cable from PV Plant Yard to Control Room

13	Remedial work for decongestion of take-off point
14	Provision of Control Room Building, Air conditioners and Furniture
DOWNSTREAM DISTRIBUTION WORKS (CONSTRUCTION OF 2KM SINGLE CIRCUIT 11KV LINE FOR CRITICAL LOADS)	
1	Galvanized Tie Straps(11kV)
2	Pin Insulator - (11kV) Composite silicon type
3	Disc Insulators (11kV) Silicon type
4	Tension Clamp
5	HV Stay Insulator
6	7/8" Stay Wire (HV) metre
7	8'Stay Rod (HV)
8	Stay Thimble
9	Stay Block
10	16x51 B,N & W

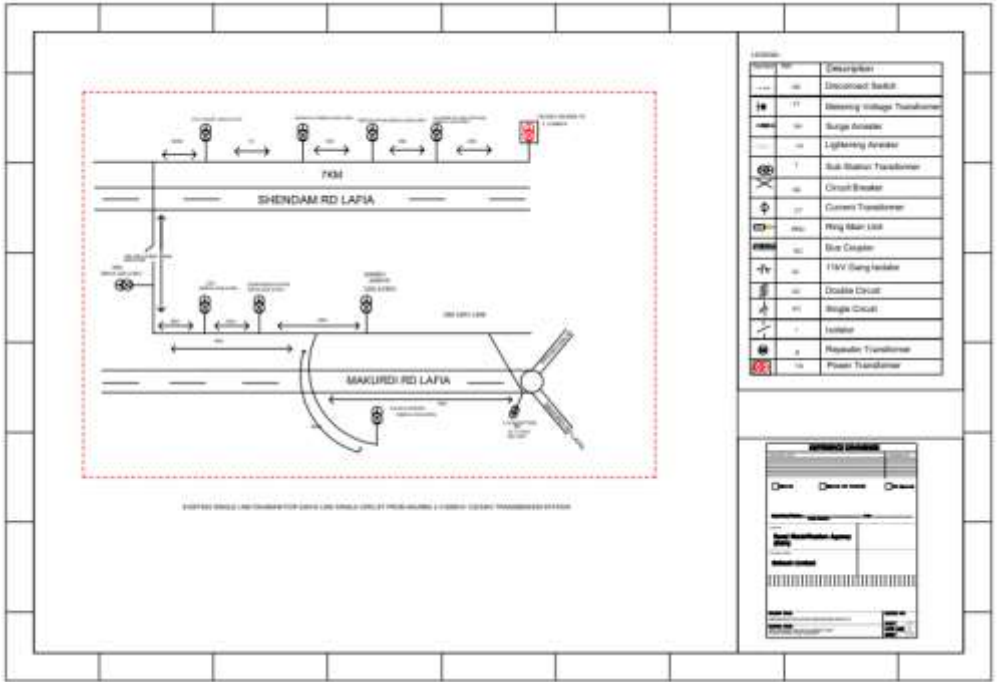
11	16 x152 B,N & W
12	16x200/275 B,N & W
13	16x254 B,N & W
14	16x280/305 B,N & W
15	F/Washer for 22mm Dia
16	F/Washer for 18mm Dia
17	Pole Identification
18	Barbed Wire metre
19	Danger Plate
20	11kV Fiber Cross-arm
21	Galvanized Angle Iron (5"x3"x 3/8 x 9ft)
22	Aluminum Line Tap for 150mm ² conductor
23	150mm ² Aluminum conductor (AAC)
24	Galvanized copper Earthing Rod (6ft)
25	Bare Copper Wire (70mm ²)
26	10.36 metre RC Pole
27	Galvanized Channel Iron (5"x3/8"x3"x9ft)
28	Copper Earth Mat
29	Concrete foundation for RC Pole

30	Gang Isolators
31	Bush clearing/Tree cutting
32	Detailed Route Survey complete with four (4) sets of survey drawings
33	Testing and commissioning including NEMSA certification
UPSTREAM DISTRIBUTION WORKS (CONSTRUCTION OF PROPOSED 1X5MVA, 33/11KV INJECTION SUBSTATION)	
34	Supply and install 4mm thick interlock paving stones all-round the Switch/Control room Building and conc. Kerb where necessary.
36	Provision for cutting of vegetable top soil of the Switch Yard and disposal
37	Provision for anti-weed over the whole surface Switchyard
38	Provision for imported laterite of 300mm Thick and compacted
39	Provision for Gantry floor with pure cement paste blinding to avoid weeds
40	Provision for the High-density polyethylene
41	Provision for Switch Yard graded granite of 225mm with appropriate concrete kerb
42	Level and compact driveway to receive concrete
43	Supply and spread along driveway, graded granite with appropriate concrete kerb
44	Provision for Reinforced conc. Substation Transformer and Station Transformer plinth
45	Provision for the construction of Gantry with standard steel foundations with concrete work where necessary
46	Provision for 4no. Halogen Light at strategic location in the Switch Yard

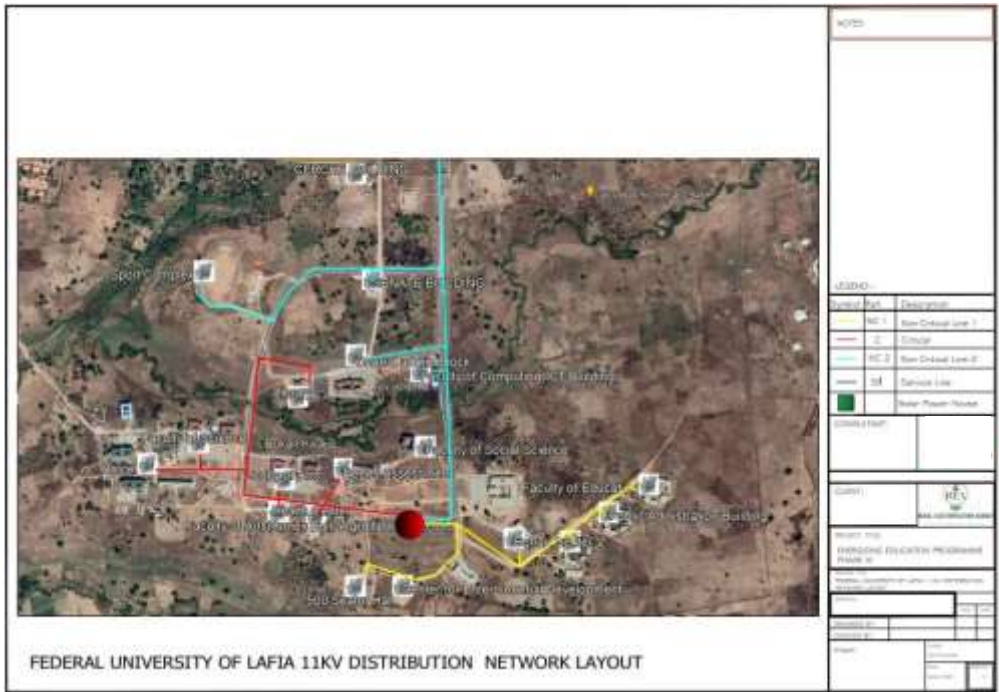
47	Provision for 1 x 5 MVA 33/11kV Transformer
48	Coupling & Positioning of Power Transformer
49	Supply and installation of 33kV 3-phase isolator.
50	Supply and installation of 33kv 3-phase isolator/earthing Switch
51	Supply and Installation of 33KV Surge Arrester
52	Supply and Installation of 33KV Circuit Breaker
53	Underground Cable
54	Substation earthing complete with earthing pit, earthing mat, rods, clamps and copper.
55	Provision for 1 set of 33kV control/relay Transformer Panel
56	Provision for complete metering & Protection equipment and materials
57	Supply and installation of AC Distribution Board and 2No battery room extractor fan
58	supply and Installation of DC Distribution Board and emergency lighting system
59	supply and Installation of battery bank and charger unit complete with the rack.
60	H.T Rubber Mats
61	Fire safety Equipment
62	Loading, Haulage and off-loading of Power Transformer
63	testing and commissioning of the entire substation works.
64	"As Built" drawings both hard and electronic copies (6 sets)
SECTION B: CONSTRUCTION OF DEDICATED 25KM SINGLE CIRCUIT 33KV INCOMER	

65	Galvanized Tie Straps(33kV)
66	Pin Insulator - (33kV) Composite silicon type
67	Disc Insulator(33kV) Silicon type
68	Tension Clamp
69	HV Stay Insulator
70	7/8" Stay Wire(HV)
71	8'Stay Rod(HV)
72	Stay Thimble
73	Stay Block
74	16x51 B,N & W
75	16 x152 B,N & W No 1,500
76	16x200/275 B,N & W
77	16x254 B,N & W
78	16x280/305 B,N & W
79	F/Washer for 22mm Dia
80	F/Washer for 18mm Dia
81	Pole Identification
82	Barbed Wire metre
83	Danger Plate
84	33 kV Fiber Cross-arm

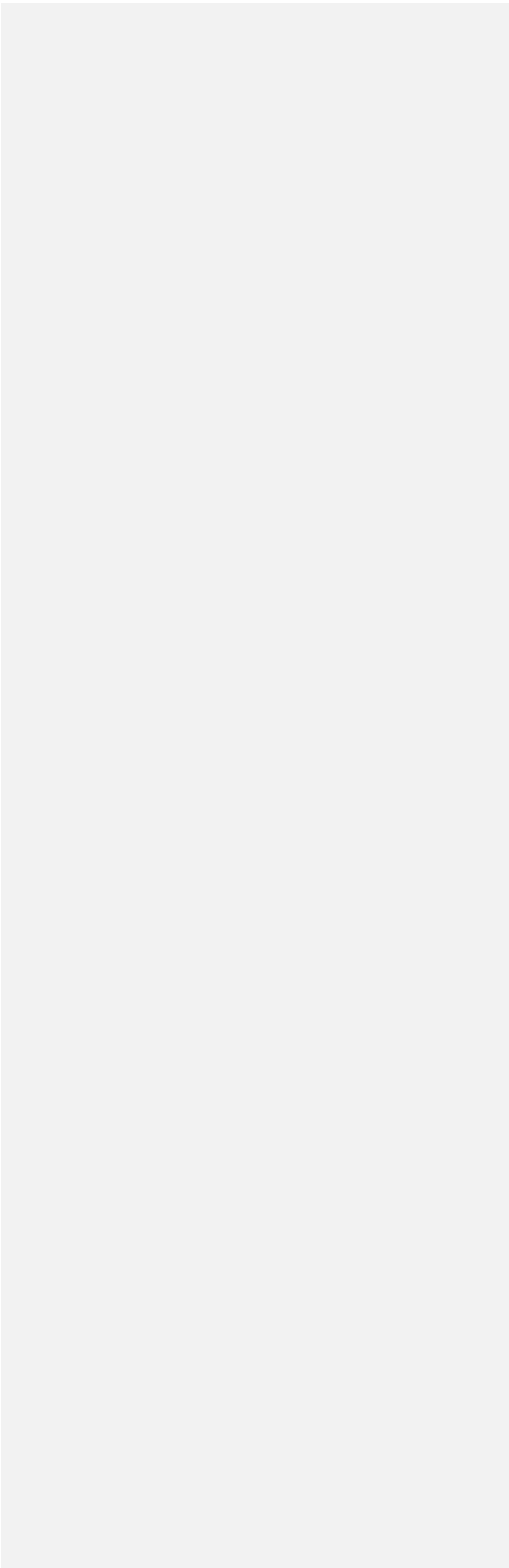
85	Galvanised Angle Iron (5"x3"x 3/8 x 9ft)
86	Aluminium Line Tap for 150mm2 conductor
87	Galvanised copper Earthing Rod (6ft)
88	Bare Copper Wire (70mm2)
89	10.36 metre RC Pole
90	Galvanised Channel Iron (5"x3/8"x3"x9ft)
91	Copper Earth Mat
92	150mm2 AAC (m)
93	Concrete foundation for RC Pole
94	Gang Isolator
95	Bush clearing/Tree cutting
96	Detailed Route Survey complete with four(4) sets of survey drawings
97	Testing and commissioning including NEMSA certification



FEDERAL UNIVERSITY, UPSTREAM DISTRIBUTION NETWORK SINGLE LINE DIAGRAM



FU Lafia 11KV Distribution Network Layout



**REQUIREMENT FOR EEP PHASE III DISTRIBUTION NETWORK WORKS AT FU
LOKOJA**

**DOWNSTREAM DISTRIBUTION WORKS (CONTROL ROOM, MV PANELS AND
DISTRIBUTION NETWORK UPGRADE)**

1	Provision and installation of 11KV Double Bus bar Panel incoming
2	Provision and installation of 11KV Double Bus bar Panel outgoing
3	Provision and installation of 500KVA,11/0.415KV transformers
4	800A Feeder Pillar
5	3 X 185MM SQR. 11KV XLPE Cable
6	1X35MM SQR. XLPE CABLE
7	1 X 500MM SQR. MV CABLE
8	4 X 150MM SQR. CABLE
9	70MM SQR BARE COPPER WIRE
10	COPPER 1.2M LONG .02M DIAMETER EARTHING RODS
11	Sundry Installation Materials
12	Laying of Cable from PV Plant Yard to Control Room
13	Remedial work for decongestion of take-off point

14	Provision of Control Room Building, Air conditioners and Furniture
DOWNSTREAM DISTRIBUTION WORKS	
CONSTRUCTION OF 9KM SINGLE CIRCUIT 11KV DISTRIBUTION LINE FOR NEW LOADS	
1	Pin Insulator - (11kV) Composite silicon type
2	Disc Insulators (11kV) Silicon type
3	Tension Clamp
4	HV Stay Insulator
5	7/8" Stay Wire (HV) metre
6	8'Stay Rod (HV)
7	Stay Thimble
8	Stay Block
9	16x51 B,N & W
10	16 x152 B,N & W
11	16x200/275 B,N & W
12	16x254 B,N & W
13	16x280/305 B,N & W

14	F/Washer for 22mm Dia
15	F/Washer for 18mm Dia
16	Pole Identification
17	Barbed Wire metre
18	Danger Plate
19	11kV Fiber Cross-arm
20	Galvanized Angle Iron (5"x3"x 3/8 x 9ft)
21	Aluminum Line Tap for 150mm2 conductor
22	150mm2 Aluminum conductor (AAC)
23	Galvanized copper Earthing Rod (6ft)
24	Bare Copper Wire (70mm2)
25	10.36 metre RC Pole
26	Galvanized Channel Iron (5"x3/8"x3"x9ft)
27	Copper Earth Mat
28	Concrete foundation for RC Pole
29	Gang Isolators
30	Bush clearing/Tree cutting
31	Detailed Route Survey complete with four (4) sets of survey drawings
32	Testing and commissioning including NEMSA certification

SUBSTATION WORKS (CONSTRUCTION OF PROPOSED 1X5MVA, 33/11KV INJECTION SUBSTATION)	
32	Supply and install 4mm thick interlock paving stones all-round the Switch/Control room Building and conc. Kerb where necessary.
33	Provision for cutting of vegetable top soil of the Switch Yard and disposal
34	Provision for anti-weed over the whole surface Switchyard
35	Provision for imported laterite of 300mm Thick and compacted
36	Provision for Gantry floor with pure cement paste blinding to avoid weeds
37	Provision for the High-density polyethylene
38	Provision for Switch Yard graded granite of 225mm with appropriate concrete kerb
39	Level and compact driveway to receive concrete
40	Supply and spread along driveway, graded granite with appropriate concrete kerb
41	Provision for Reinforced conc. Substation Transformer and Station Transformer plinth
42	Provision for the construction of Gantry with standard steel foundations with concrete work where necessary
43	Provision for 4no. Halogen Light at strategic location in the Switch Yard
44	Provision for 1 x 5 MVA 33/11kV Transformer

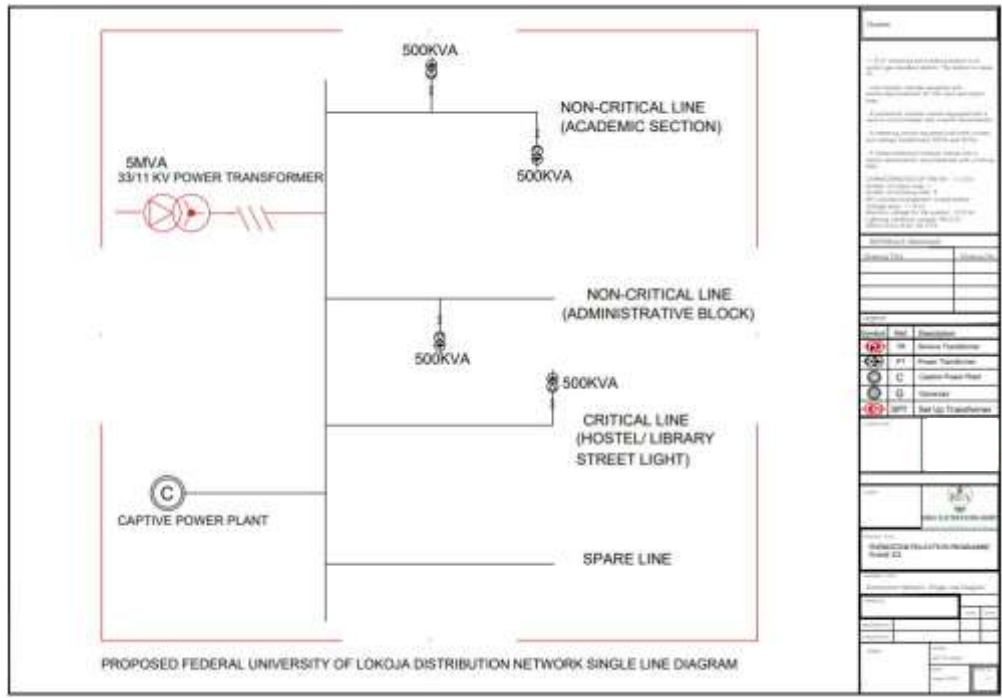
45	Coupling & Positioning of Power Transformer
46	Supply and installation of 33kV 3-phase isolator.
47	Supply and installation of 33kv 3-phase isolator/earthing Switch
48	Supply and Installation of 33KV Surge Arrester
49	Supply and Installation of 33KV Circuit Breaker
50	Underground Cable
51	Substation earthing complete with earthing pit, earthing mat, rods, clamps and copper.
52	Provision for 1 set of 33kV control/relay Transformer Panel
53	Provision for complete metering & Protection equipment and materials
54	Supply and installation of AC Distribution Board and 2No battery room extractor fan
55	supply and Installation of DC Distribution Board and emergency lighting system
56	supply and Installation of battery bank and charger unit complete with the rack.
57	H.T Rubber Mats
58	Fire safety Equipment
59	Loading, Haulage and off-loading of Power Transformer
60	testing and commissioning of the entire substation works.
61	"As Built" drawings both hard and electronic copies (6 sets)
SECTION B: CONSTRUCTION OF DEDICATED 25KM SINGLE CIRCUIT 33KV INCOMER	

62	Galvanized Tie Straps(33kV)
63	Pin Insulator - (33kV) Composite silicon type
64	Disc Insulator(33kV) Silicon type
65	Tension Clamp
66	HV Stay Insulator
67	7/8" Stay Wire(HV)
68	8'Stay Rod(HV)
69	Stay Thimble
70	Stay Block
71	16x51 B,N & W
72	16 x152 B,N & W No 1,500
73	16x200/275 B,N & W
74	16x254 B,N & W
75	16x280/305 B,N & W
76	F/Washer for 22mm Dia
77	F/Washer for 18mm Dia
78	Pole Identification
79	Barbed Wire metre
80	Danger Plate
81	33 kV Fiber Cross-arm

82	Galvanised Angle Iron (5"x3"x 3/8 x 9ft)
83	Aluminium Line Tap for 150mm2 conductor
84	Galvanised copper Earthing Rod (6ft)
85	Bare Copper Wire (70mm2)
86	10.36 metre RC Pole
87	Galvanised Channel Iron (5"x3/8"x3"x9ft)
88	Copper Earth Mat
89	150mm2 AAC (m)
90	Concrete foundation for RC Pole
91	Gang Isolator
92	Bush clearing/Tree cutting
93	Detailed Route Survey complete with four(4) sets of survey drawings
94	Testing and commissioning including NEMSA certification



FU Lokoja 11KV Distribution Network Layout



FEDERAL UNIVERSITY, LOKOJA EXISTING/PROPOSED DISTRIBUTION NETWORK SINGLE LINE DIAGRAM

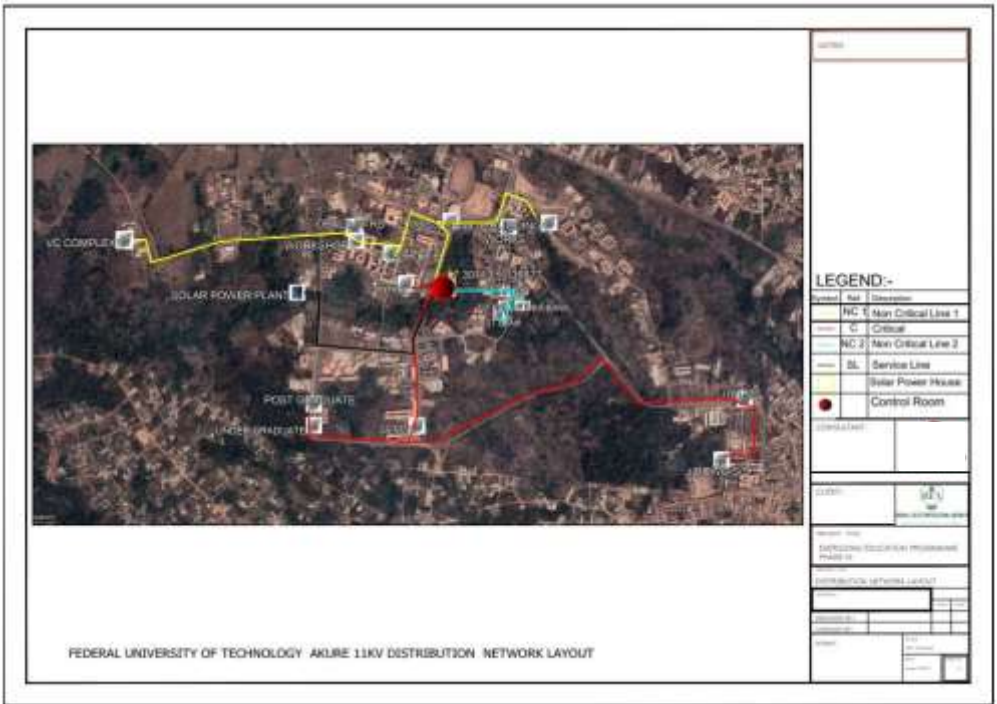
REQUIREMENT FOR EEP PHASE III DISTRIBUTION NETWORK WORKS AT FUTA

DOWNSTREAM DISTRIBUTION WORKS (CONTROL ROOM, MV PANELS AND DISTRIBUTION NETWORK UPGRADE)+

1	Provision and installation of 11KV D+ouble Bus bar Panel incoming
2	Provision and installation of 11KV Double Bus bar Panel outgoing
3	Provision of 800A Low Voltage Feeder Pillars
4	High Rupturing Capacity (HRC) Feeder fuses
5	Laying of Cable from PV Plant Yard to Control Room
6	Remedial work for decongestion of take-off point
7	Provision of Control Room Building, Air conditioners and Furniture

DOWNSTREAM DISTRIBUTION WORKS (CONSTRUCTION OF 2KM SINGLE CIRCUIT 11KV LINE FOR CRITICAL LOADS)	
1	Galvanized Tie Straps(11kV)
2	Pin Insulator - (11kV) Composite silicon type
3	Disc Insulators (11kV) Silicon type
4	Tension Clamp
5	HV Stay Insulator
6	7/8" Stay Wire (HV) metre
7	8' Stay Rod (HV)
8	Stay Thimble
9	Stay Block
10	16x51 B,N & W
11	16 x152 B,N & W
12	16x200/275 B,N & W
13	16x254 B,N & W
14	16x280/305 B,N & W
15	F/Washer for 22mm Dia

16	F/Washer for 18mm Dia
17	Pole Identification
18	Barbed Wire metre
19	Danger Plate
20	11kV Fiber Cross-arm
21	Galvanized Angle Iron (5"x3"x 3/8 x 9ft)
22	Aluminum Line Tap for 150mm2 conductor
23	150mm2 Aluminum conductor (AAC)
24	Galvanized copper Earthing Rod (6ft)
25	Bare Copper Wire (70mm2)
26	10.36 metre RC Pole
27	Galvanized Channel Iron (5"x3/8"x3"x9ft)
28	Copper Earth Mat
29	Concrete foundation for RC Pole
30	Gang Isolators
31	Bush clearing/Tree cutting
32	Detailed Route Survey complete with four (4) sets of survey drawings
33	Testing and commissioning including NEMSA certification



FUTA 11KV DISTRIBUTION NETWORK LAYOUT

REQUIREMENTS FOR EEP PHASE III DISTRIBUTION NETWORK WORKS AT FUUYO	
DOWNSTREAM DISTRIBUTION WORKS (CONTROL ROOM, MV PANELS AND DISTRIBUTION NETWORK UPGRADE)	
1	Provision and installation of 11KV Double Bus bar Panel incoming
2	Provision and installation of 11KV Double Bus bar Panel outgoing
3	Provision of 800A Low Voltage Feeder Pillars
4	High Rupturing Capacity (HRC) Feeder fuses
5	Laying of Cable from PV Plant Yard to Control Room
6	Remedial work for decongestion of take-off point
7	Provision of Control Room Building, Air conditioners and Furniture
DOWNSTREAM DISTRIBUTION WORKS (CONSTRUCTION OF 2KM SINGLE CIRCUIT 11KV LINE FOR CRITICAL LOADS)	
1	Galvanized Tie Straps(11kV)

2	Pin Insulator - (11kV) Composite silicon type
3	Disc Insulators (11kV) Silicon type
4	Tension Clamp
5	HV Stay Insulator
6	7/8" Stay Wire (HV) metre
7	8' Stay Rod (HV)
8	Stay Thimble
9	Stay Block
10	16x51 B,N & W
11	16 x152 B,N & W
12	16x200/275 B,N & W
13	16x254 B,N & W
14	16x280/305 B,N & W
15	F/Washer for 22mm Dia
16	F/Washer for 18mm Dia
17	Pole Identification
18	Barbed Wire metre
19	Danger Plate
20	11kV Fiber Cross-arm
21	Galvanized Angle Iron (5"x3"x 3/8 x 9ft)

22	Aluminum Line Tap for 150mm ² conductor
23	150mm ² Aluminum conductor (AAC)
24	Galvanized copper Earthing Rod (6ft)
25	Bare Copper Wire (70mm ²)
26	10.36 metre RC Pole
27	Galvanized Channel Iron (5"x3/8"x3"x9ft)
28	Copper Earth Mat
29	Concrete foundation for RC Pole
30	Gang Isolators
31	Bush clearing/Tree cutting
32	Detailed Route Survey complete with four (4) sets of survey drawings
33	Testing and commissioning including NEMSA certification
SUBSTATION WORKS (CONSTRUCTION OF PROPOSED 1X5MVA, 33/11KV INJECTION SUBSTATION)	
34	Supply and install 4mm thick interlock paving stones all-round the Switch/Control room Building and conc. Kerb where necessary.
35	Provision for cutting of vegetable top soil of the Switch Yard and disposal
36	Provision for anti-weed over the whole surface Switchyard
37	Provision for imported laterite of 300mm Thick and compacted
38	Provision for Gantry floor with pure cement paste blinding to avoid weeds

39	Provision for the High-density polyethylene
40	Provision for Switch Yard graded granite of 225mm with appropriate concrete kerb
41	Level and compact driveway to receive concrete
42	Supply and spread along driveway, graded granite with appropriate concrete kerb
43	Provision for Reinforced conc. Substation Transformer and Station Transformer plinth
44	Provision for the construction of Gantry with standard steel foundations with concrete work where necessary
45	Provision for 4no. Halogen Light at strategic location in the Switch Yard
46	Provision for 1 x 5 MVA 33/11kV Transformer
47	Coupling & Positioning of Power Transformer
48	Supply and installation of 33kV 3-phase isolator.
49	Supply and installation of 33kv 3-phase isolator/earthing Switch
50	Supply and Installation of 33KV Surge Arrester
51	Supply and Installation of 33KV Circuit Breaker
52	Underground Cable
53	Substation earthing complete with earthing pit, earthing mat, rods, clamps and copper.
54	Provision for 1 set of 33kV control/relay Transformer Panel
55	Provision for complete metering & Protection equipment and materials
56	Supply and installation of AC Distribution Board and 2No battery room extractor fan
57	supply and Installation of DC Distribution Board and emergency lighting system

58	supply and Installation of battery bank and charger unit complete with the rack.
59	H.T Rubber Mats
60	Fire safety Equipment
61	Loading, Haulage and off-loading of Power Transformer
62	testing and commissioning of the entire substation works.
63	"As Built" drawings both hard and electronic copies (6 sets)

REQUIREMENT FOR EEP PHASE III DISTRIBUTION NETWORK WORKS AT FUTO	
DOWNSTREAM DISTRIBUTION WORKS (CONTROL ROOM, MV PANELS AND DISTRIBUTION NETWORK UPGRADE)	
1	Provision and installation of 11KV Double Bus bar Panel incoming
2	Provision and installation of 11KV Double Bus bar Panel outgoing
3	Provision and installation of 500KVA,11/0.415KV transformers
4	800A Feeder Pillar
5	High Rupturing Capacity feeder fuses
6	3 X 185MM SQR. 11KV XLPE Cable
7	1X35MM SQR. XLPE CABLE
8	Copper 1.2M Long .02M Diameter Earthing Rods
9	1 X 500MM SQR. MV CABLE
10	4 X 150MM SQR. CABLE

11	70MM SQR BARE COPPER WIRE
12	Sundry Installation Materials
13	Laying of Cable from PV Plant Yard to Control Room
14	0.415KV Low voltage Line Reticulation
Section B: UPSTREAM DISTRIBUTION WORKS- CONSTRUCTION OF DEDICATED 25KM SINGLE CIRCUIT 33KV INCOMER LINE	
1	Galvanized Tie Straps(33kV)
2	Pin Insulator - (33kV) Composite silicon type
3	Disc Insulator(33kV) Silicon type
4	Tension Clamp
6	HV Stay Insulator
7	7/8" Stay Wire(HV)

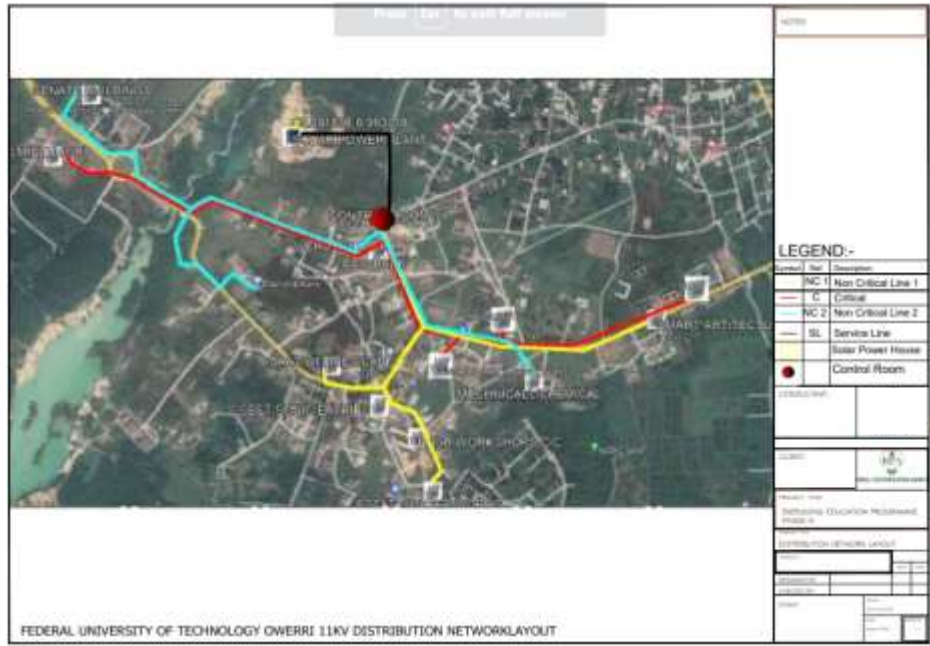
8	8'Stay Rod(HV)
9	Stay Thimble
10	Stay Block
11	16x51 B,N & W
12	16 x152 B,N & W No 1,500
13	16x200/275 B,N & W
14	16x254 B,N & W
15	16x280/305 B,N & W
16	F/Washer for 22mm Dia
17	F/Washer for 18mm Dia
18	Pole Identification
19	Barbed Wire metre
20	Danger Plate
21	33 kV Fiber Cross-arm
22	Galvanised Angle Iron (5"x3"x 3/8 x 9ft)
23	Aluminium Line Tap for 150mm ² conductor
24	Galvanised copper Earthing Rod (6ft)
25	Bare Copper Wire (70mm ²)
26	10.36 metre RC Pole
27	Galvanised Channel Iron (5"x3/8"x3"x9ft)

28	Copper Earth Mat
29	150mm ² AAC (m)
30	Concrete foundation for RC Pole
31	Gang Isolators
32	Bush clearing/Tree cutting
33	Detailed Route Survey complete with four (4) sets of survey drawings
34	Testing and commissioning including NEMSA certification
DOWNSTREAM DISTRIBUTION WORKS (CONSTRUCTION OF 2KM SINGLE CIRCUIT 11KV LINE FOR CRITICAL LOADS)	
35	Galvanized Tie Straps(11kV)
36	Pin Insulator - (11kV) Composite silicon type
3387	Disc Insulators (11kV) Silicon type
39	Tension Clamp
41	HV Stay Insulator
41	7/8" Stay Wire (HV) metre
42	8'Stay Rod (HV)
43	Stay Thimble
44	Stay Block

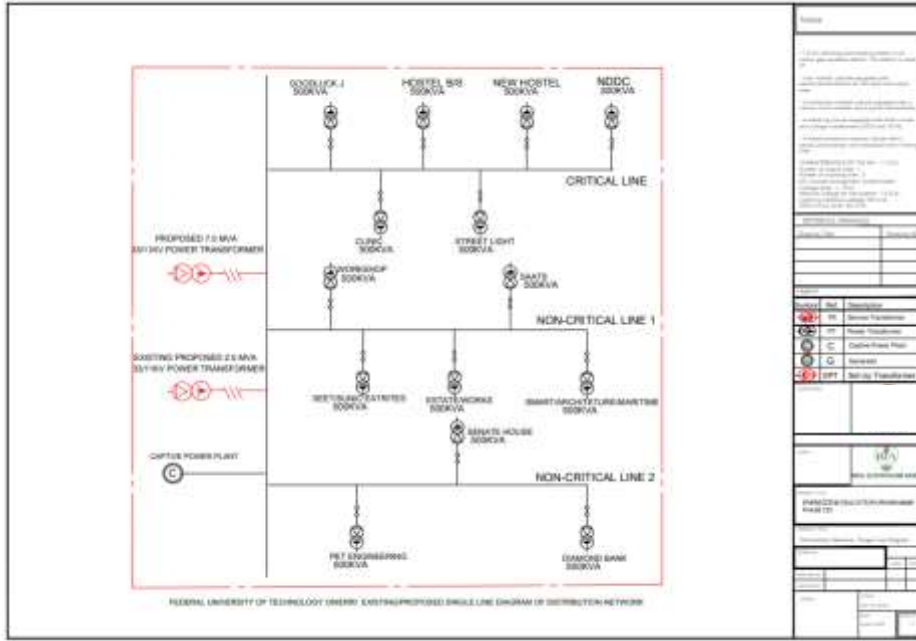
45	16x51 B,N & W
46	16 x152 B,N & W
47	16x200/275 B,N & W
48	16x254 B,N & W
49	16x280/305 B,N & W
50	F/Washer for 22mm Dia
51	F/Washer for 18mm Dia
52	Pole Identification
53	Barbed Wire metre
54	Danger Plate
55	11kV Fiber Cross-arm
56	Galvanized Angle Iron (5"x3"x 3/8 x 9ft)
57	Aluminum Line Tap for 150mm ² conductor
58	150mm ² Aluminum conductor (AAC)
59	Galvanized copper Earthing Rod (6ft)
60	Bare Copper Wire (70mm ²)
61	10.36 metre RC Pole
62	Galvanized Channel Iron (5"x3/8"x3"x9ft)
63	Copper Earth Mat
64	Concrete foundation for RC Pole

65	Gang Isolators
66	Bush clearing/Tree cutting
67	Detailed Route Survey complete with four (4) sets of survey drawings
68	Testing and commissioning including NEMSA certification
SUBSTATION WORKS (CONSTRUCTION OF PROPOSED 1 X7.5 5MVA, 33/11kV INJECTION SUBSTATION)	
69	Supply and install 4mm thick interlock paving stones all-round the Switch/Control room Building and conc. Kerb where necessary.
70	Provision for cutting of vegetable top soil of the Switch Yard and disposal
71	Provision for anti-weed over the whole surface Switchyard
72	Provision for imported laterite of 300mm Thick and compacted
73	Provision for Gantry floor with pure cement paste blinding to avoid weeds
74	Provision for the High-density polyethylene
75	Provision for Switch Yard graded granite of 225mm with appropriate concrete kerb
76	Level and compact driveway to receive concrete
77	Supply and spread along driveway, graded granite with appropriate concrete kerb
78	Provision for Reinforced conc. Substation Transformer and Station Transformer plinth
79	Provision for the construction of Gantry with standard steel foundations with concrete work where necessary
80	Provision for 4no. Halogen Light at strategic location in the Switch Yard

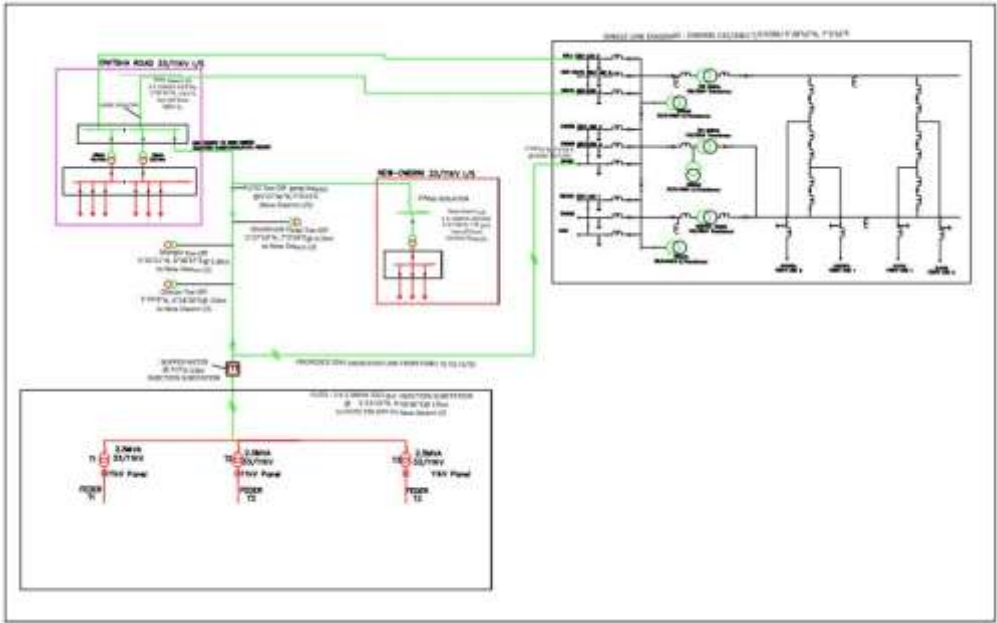
81	Provision for 1 x 7.5 MVA 33/11Kv Transformer
82	Coupling & Positioning of Power Transformer
83	Supply and installation of 33kV 3-phase isolator.
84	Supply and installation of 33kv 3-phase isolator/earthing Switch
85	Supply and Installation of 33KV Surge Arrester
86	Supply and Installation of 33KV Circuit Breaker
87	Underground Cable
88	Substation earthing complete with earthing pit, earthing mat, rods, clamps and copper.
89	Provision for 1 set of 33kV control/relay Transformer Panel
90	Provision for complete metering & Protection equipment and materials
91	Supply and installation of AC Distribution Board and 2No battery room extractor fan
92	supply and Installation of DC Distribution Board and emergency lighting system
93	supply and Installation of battery bank and charger unit complete with the rack.
94	H.T Rubber Mats
95	Fire safety Equipment
96	Loading, Haulage and off-loading of Power Transformer
97	testing and commissioning of the entire substation works.
98	"As Built" drawings both hard and electronic copies (6 sets)



Federal University of Technology, FUTO 11KV Distribution Network Layout



FUTO Distribution Network Single Line Diagram



Proposed FUTO Upstream 33KV interconnection from Egbu TS-FUTO

REQUIREMENT FOR EEP PHASE III DISTRIBUTION NETWORK WORKS AT UNIPORT & UPTH

DOWNSTREAM DISTRIBUTION WORKS (CONTROL ROOM, MV PANELS AND DISTRIBUTION NETWORK UPGRADE)

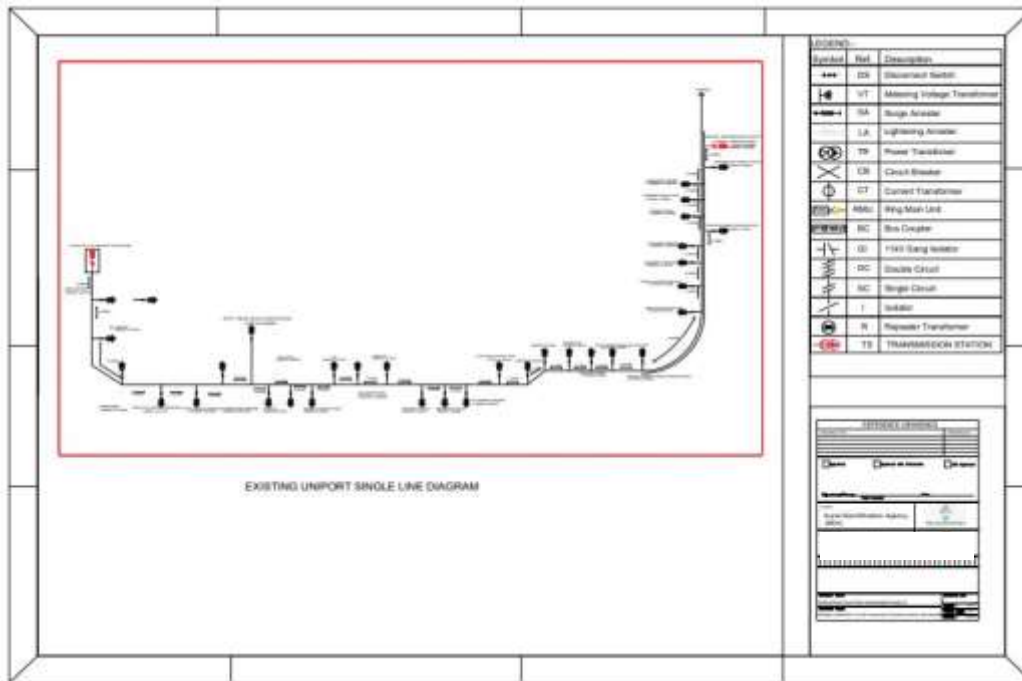
1	Provision and installation of 11KV Double Bus bar Panel incoming
2	Provision and installation of 11KV Double Bus bar Panel outgoing
3	Provision and installation of 500KVA,11/0.415KV transformers
4	800A Feeder Pillar
5	High Rupturing Cable feeder fuses
6	provision of Control Room Building, Air conditioners and Furniture
7	1X35MM SQR. XLPE CABLE
8	500MM SQR. MV CABLE
9	1 X 500MM SQR. MV CABLE
10	4 X 150MM SQR. CABLE
11	70MM SQR BARE COPPER WIRE
12	Sundry Installation Materials
13	Laying of Cable from PV Plant Yard to Control Room
14	Copper 1.2M Long .02M Diameter Earthing Rods

15	0.415KV Low voltage Line Reticulation
16	3 X 95MM SQR. 11KV XLPE Cable for Underground HT Line Reticulation (1KM)
17	Remedial work for decongestion of Take-off point
SECTION B: DOWNSTREAM DISTRIBUTION WORKS (CONTROL ROOM, MV PANELS AND DISTRIBUTION NETWORK UPGRADE)	
1	Provision and installation of 11KV Double Bus bar Panel incoming
2	Provision and installation of 11KV Double Bus bar Panel outgoing
3	Provision and installation of 500KVA,11/0.415KV transformers
4	Provision of Control Room Building, Air conditioners and Furniture
5	800A Feeder Pillar
6	3 X 185MM SQR. 11KV XLPE Cable
7	1X35MM SQR. XLPE CABLE
8	1 X 500MM SQR. MV CABLE
9	4 X 150MM SQR. CABLE
10	70MM SQR BARE COPPER WIRE
11	Sundry Installation Materials
12	Laying of Cable from PV Plant Yard to Control Room
13	Copper 1.2M Long .02M Diameter Earthing Rods
14	0.415KV Low voltage Line Reticulation
15	3 X 95MM SQR. 11KV XLPE Cable for Underground HT Line Reticulation (1KM)
16	Remedial work for decongestion of Take-offpoint

Section B: UPSTREAM DISTRIBUTION WORKS- CONSTRUCTION OF DEDICATED 9KM SINGLE CIRCUIT 33KV INCOMER LINE

1	Galvanized Tie Straps(33kV)
2	Pin Insulator - (33kV) Composite silicon type
3	Disc Insulator(33kV) Silicon type
4	Tension Clamp
5	HV Stay Insulator
6	7/8" Stay Wire(HV)
7	8'Stay Rod(HV)
8	Stay Thimble
9	Stay Block
10	16x51 B,N & W
11	16 x152 B,N & W No 1,500
12	16x200/275 B,N & W
13	16x254 B,N & W
14	16x280/305 B,N & W
15	F/Washer for 22mm Dia
16	F/Washer for 18mm Dia
17	Pole Identification

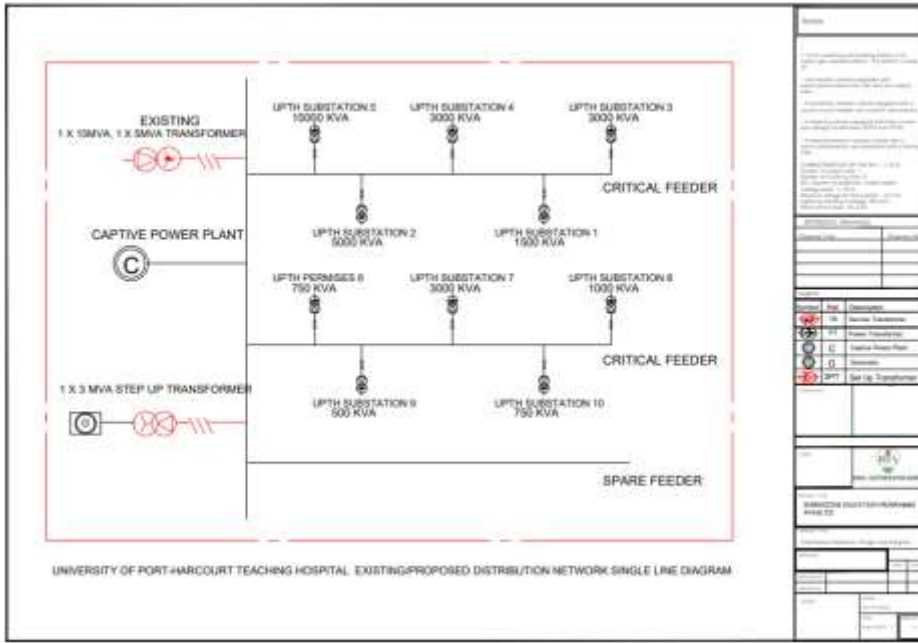
18	Barbed Wire metre
19	Danger Plate
20	33 kV Fiber Cross-arm
21	Galvanised Angle Iron (5"x3"x 3/8 x 9ft)
22	Aluminium Line Tap for 150mm ² conductor
23	Galvanised copper Earthing Rod (6ft)
24	Bare Copper Wire (70mm ²)
25	10.36 metre RC Pole
26	Galvanised Channel Iron (5"x3/8"x3"x9ft)
27	Copper Earth Mat
28	150mm ² AAC (m)
29	Concrete foundation for RC Pole
30	Gang Isolator
31	Bush clearing/Tree cutting
32	Detailed Route Survey complete with four(4) sets of survey drawings
33	Testing and commissioning including NEMSA certification



UNIVERSITY OF PORTHARCOURT EXISTING/PROPOSED DISTRIBUTION NETWORK SINGLE LINE DIAGRAM



UNIPORT 11KV Distribution Network Layout



UNIVERSITY OF PORTHARCOURT TEACHING HOSPITAL EXISTING/PROPOSED DISTRIBUTION NETWORK SINGLE LINE DIAGRAM

1.3 Project Scope

1. The Captive Solar PV Power Plant installations are to be integrated into the Medium Voltage Electrical networks at each location. The scope of work for the eight (8) Captive PV plants mentioned above shall include the following, in complete conformity with subsequent sections of the specifications:

Commented [AA1]: To be changed to 8

- a. Site survey, planning, design, manufacturing, transportation to site, insurance, supply at site, unloading, handling, storage, installation, integration, testing, commissioning & demonstration for acceptance of all equipment/ materials and miscellaneous items required to complete the plant and the battery energy storage system.
- b. The MV network as shown on the drawings provided for each institution.
- c. The control panels shall be designed and sized to accommodate all incoming power. The panel will have outgoings as required. Feeder pillars will be deployed downstream as required to link the load centres of each entire site's distribution Network.
- d. Supply of LV and MV cables for the electrical network
- e. Supply of gantry, cut-out fuse, isolator, surge arresters and accessories required.
- f. Supply of the auxiliary Power supply unit (Battery Charger with Batteries)
- g. Civil works associated with the outdoor substation and the main electrical room
- h. Civil works required for the installation of the packaged substation/feeder pillars and cable route.
- i. Construction of the outdoor substation and installation of equipment supplied in applicable Lots.
- j. The Power network design services involved shall be carried out in order to firm up the design proposal and the concept established in the brief and Employer's requirements.

- The design services will involve calculation and report of the same for project manager review. Engineering design shall be organized according to the site conditions.
- k. Testing and Commissioning of the entire electrical network.
- l. Design, construction as well as supply, installation and testing. of training equipment, tools, infrastructure for state-of-the-art Training Centre
- m. Documentation & Training of the beneficiary's manpower in maintaining and operating all the equipment installed. This will include but not be limited to:
- i. Description of solar PV system and its major components.
 - ii. Location and Identification of all components, wiring and conduits.
 - iii. A method of showing/determining how the system is working/producing.
 - iv. Identification of shut-down/isolation equipment in case of faults/error.
 - v. How to read production of kWh from the system.
- n. One year operation and maintenance of the plant starting after the conduct of Provisional Acceptance. The conduct and successful commissioning tests and supplying power to the institution after 72 hours load tests and signing off by the Owner's Engineer will trigger the start of O & M. Any fuel cost for Diesel-Generators following commissioning shall be covered by the Management Company. Other costs incurred for operation and maintenance shall be covered by the Contractor.

2. The scope of the electrical medium voltage works is as described below:

- a. Supply of Transformers, Packaged Substations and Medium Voltage Switchgear as required
- b. Supply of Synchronisation Panel and Feeder Pillars

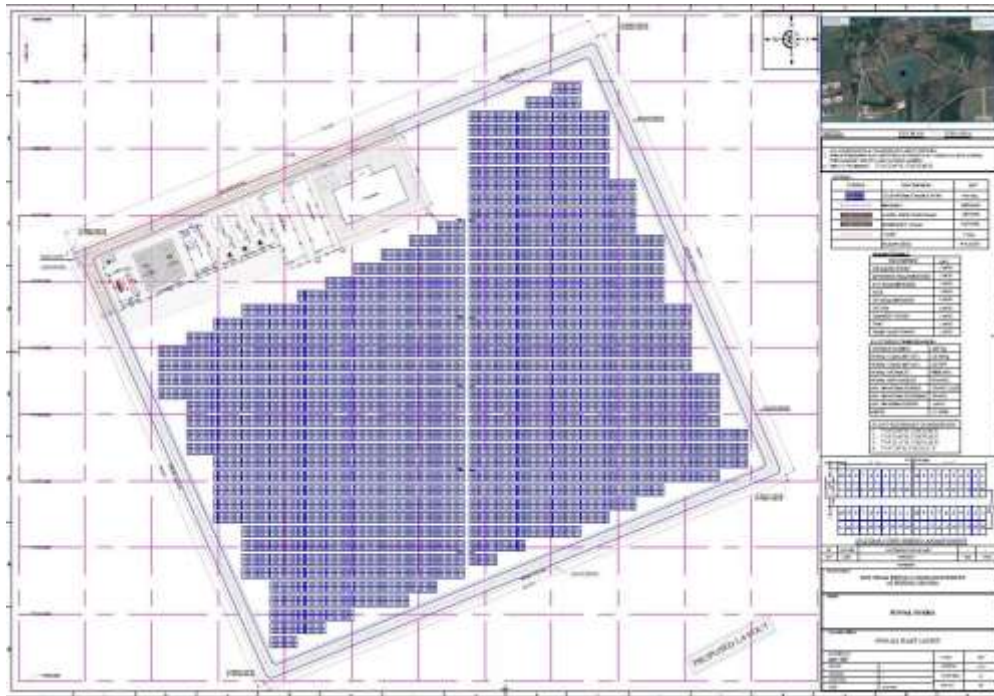
- c. Supply of LV & MV Cables, Outdoor 11KV/33KV Utility Substation Materials, Civil Works, and Installation of MV-LV Equipment to be supplied as required
 - d. Design and upgrade of MV and LV Power Distribution Network as required
 - e. Installation and Upgrade of Streetlights as required.
3. The equipment and materials for each Captive PV plant shall include the following:
- a. PV panels with ground mounting structure
 - b. String and/or Central inverters
 - c. Battery Inverters
 - d. Batteries and enclosures
 - e. Battery management systems
 - f. Protection and Control system
 - g. Online remote Monitoring & Control System Mandatory spares, maintenance tools & tackles as identified by the contractor
 - h. Any other associated materials, equipment, and accessories necessary for the installation, operation, and maintenance of the above system.
4. The scope of the first-year operation and maintenance includes the following:
- a. Operation and Maintenance of the complete plant including all services required to keep the operational limits as specified under functional guarantee table.
 - b. Diesel fuel supply and payment of the same is NOT part of the proposer's scope of service.
5. All other associated works/items not listed in the schedule of works but required for completion of the project shall be deemed to have been included in the scope of this proposal. The contractor's proposal shall clearly identify all features described in the specifications or in any supporting reference material that will not be implemented; otherwise, those features shall become binding as part of the final contract. An analysis of the functional and performance requirements of this specification and/or site surveys, design, and engineering may lead the contractor to conclude that additional items are required that are not specifically mentioned in this specification.
6. The contractor shall be responsible for providing at no added cost to the Employer all such additional items such that a viable and fully functional Captive Solar PV Plant is implemented that meets or exceeds the capacity and performance

requirements specified. Such materials shall be considered to be within the scope of the contract. To the extent possible, the contractor shall identify and include all such additional items in their proposal. The offered items shall be designed to operate in varying environments. Adequate measures shall be taken to provide protection against contaminants, pollutants, water & moisture, lightning & short circuit, vibration, and electro-magnetic interference etc.

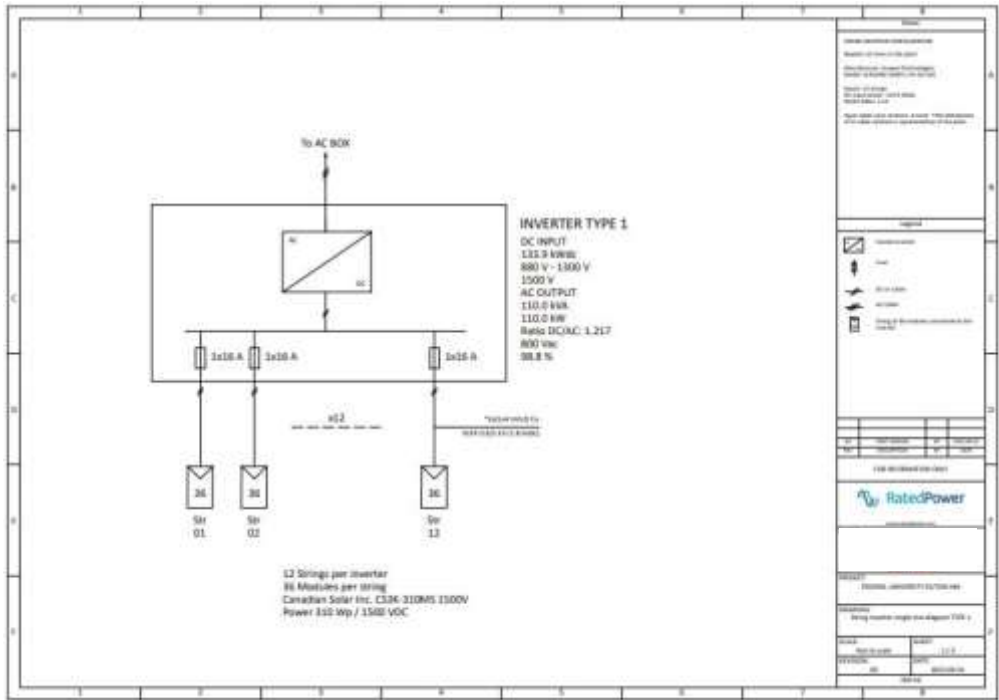
7. The contractors are advised to visit sites (at their own expense), prior to the submission of the bid, and make surveys and assessments and revalidate energy requirements as deemed necessary for proposal submission. The site visits after contract award shall be made which shall include all necessary surveys to allow the Proposers to perform the design and implementation functions. Any additional equipment/system required for successful implementation of a captive Solar PV Plant and not covered during the initial site visit before submission of the proposal shall be supplied. No payment on this account shall be paid by the Employer. This project shall meet all requirements in this document and other specifications included that apply.

CONCEPTUAL DRAWINGS. (All drawings are for information purposes only)

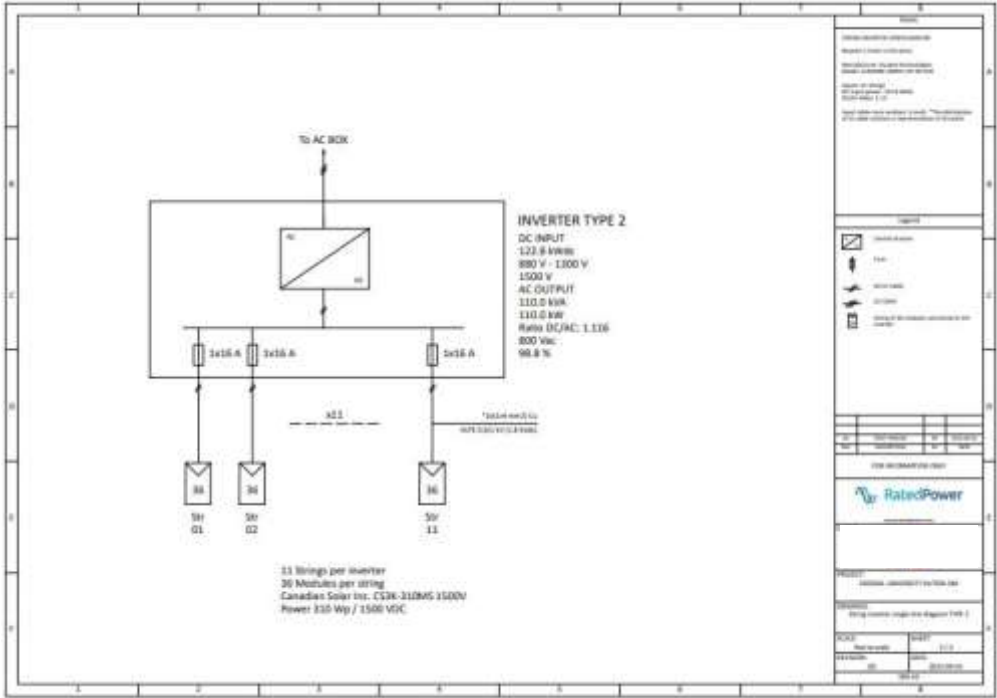
1. Solar PV Hybrid Power Plant. (Sample site layout)



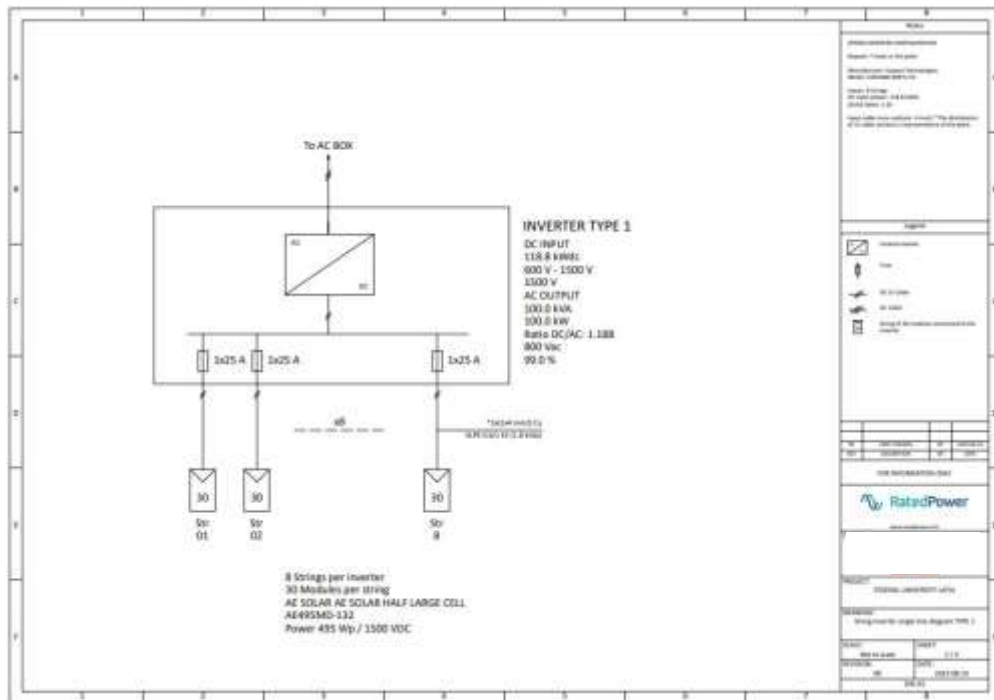
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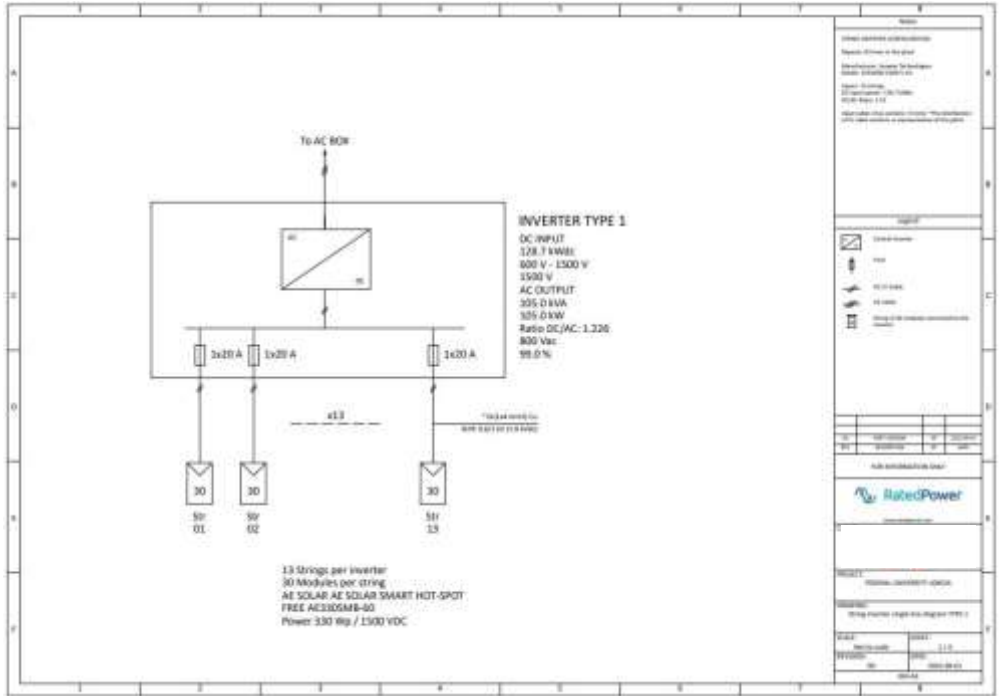
Inverter Type 1



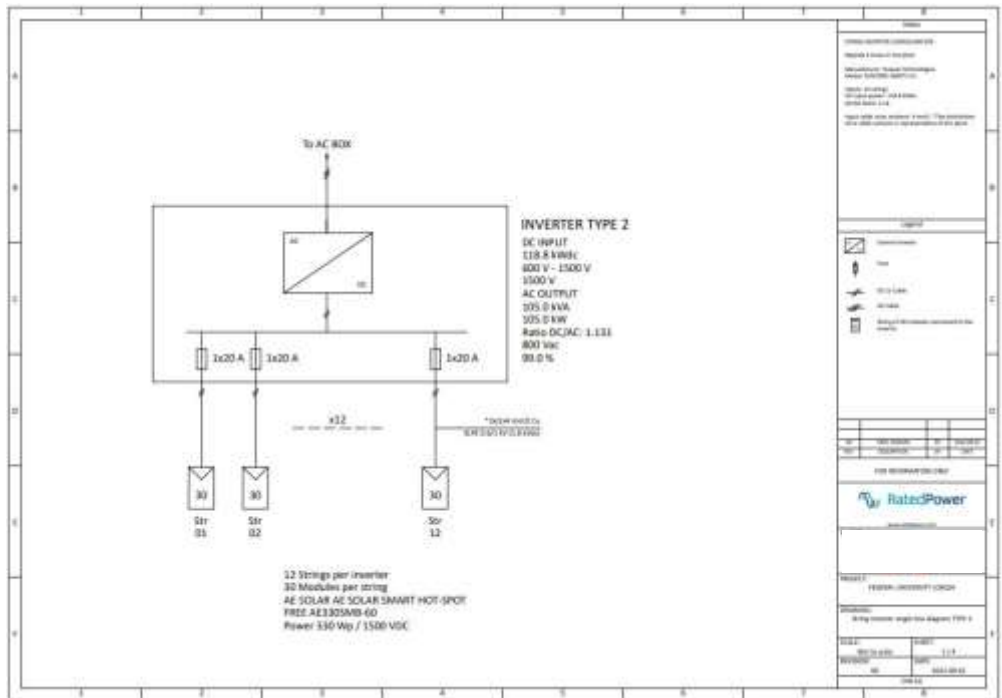
Inverter Type 2



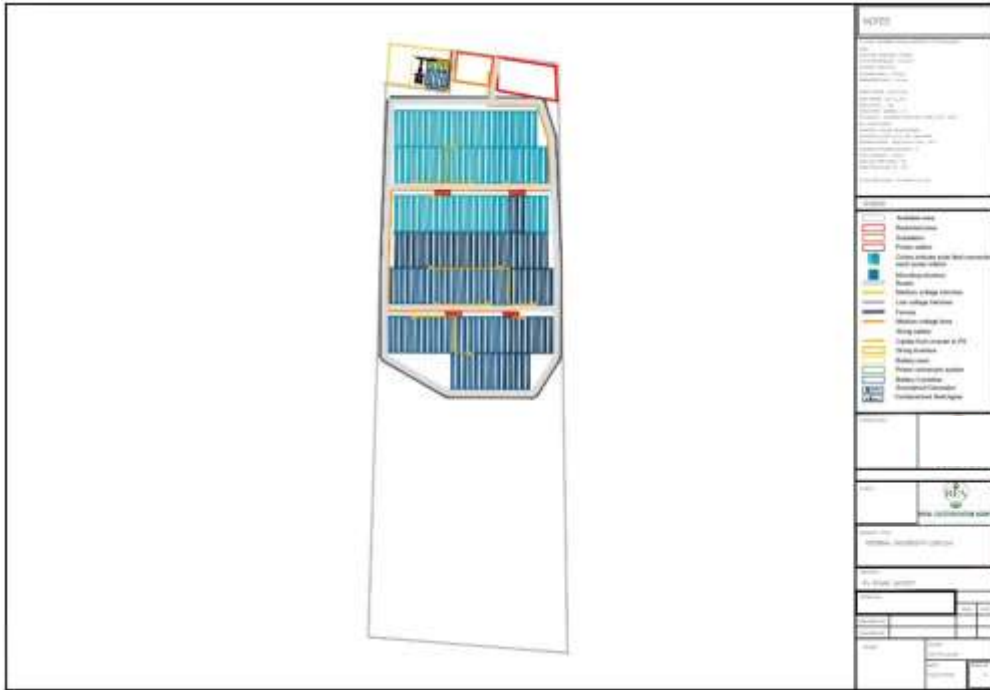
Inverter Type 1



Inverter Type 1

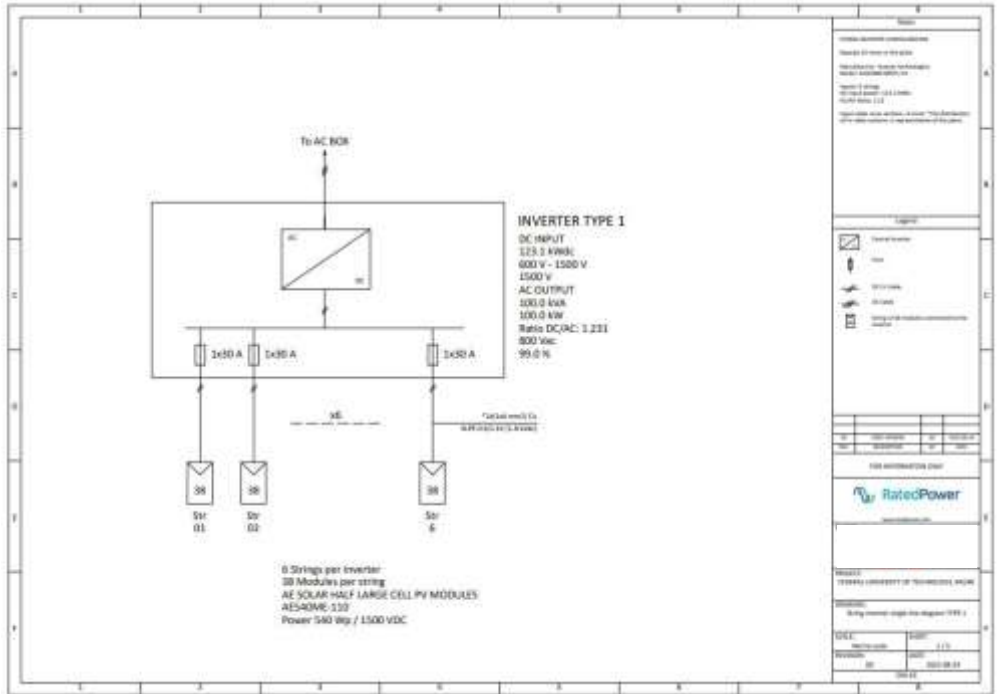


Inverter Type 2

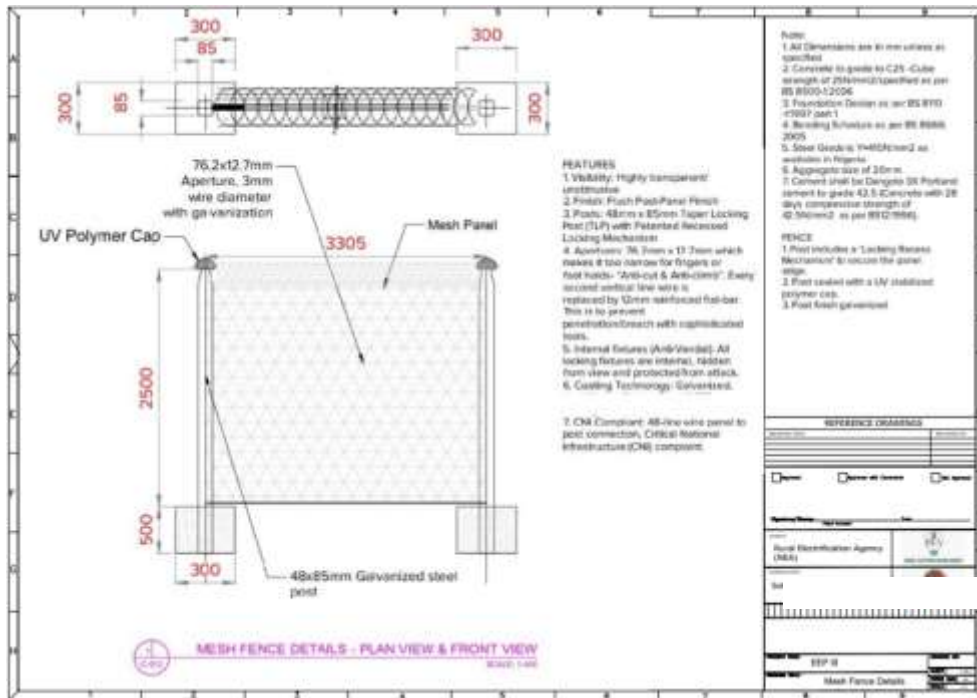


PV Plan Layout

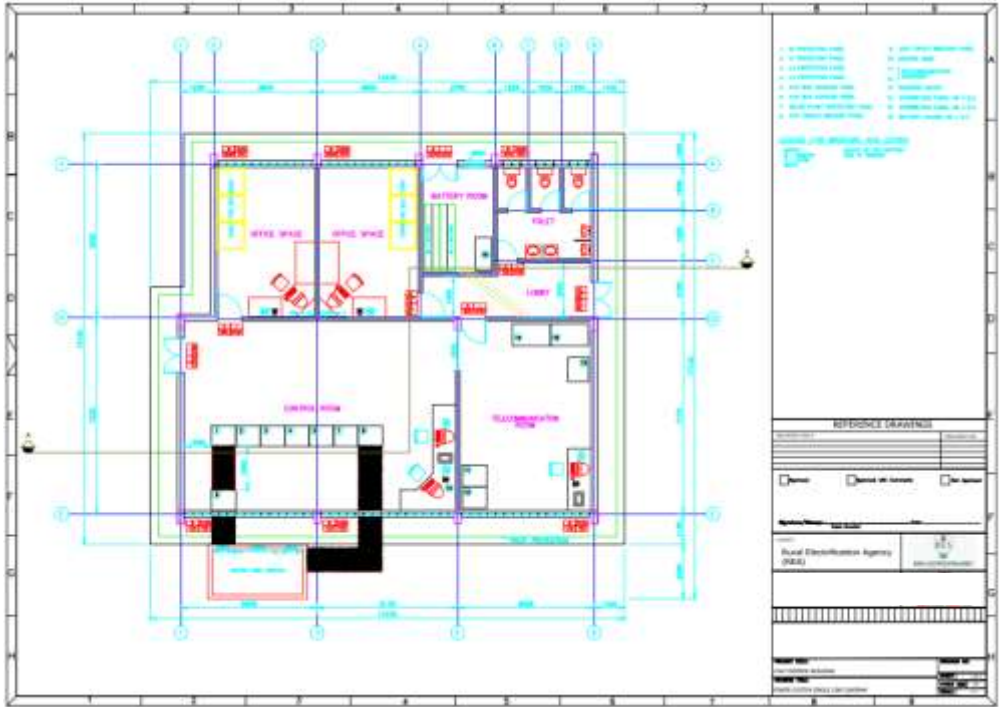
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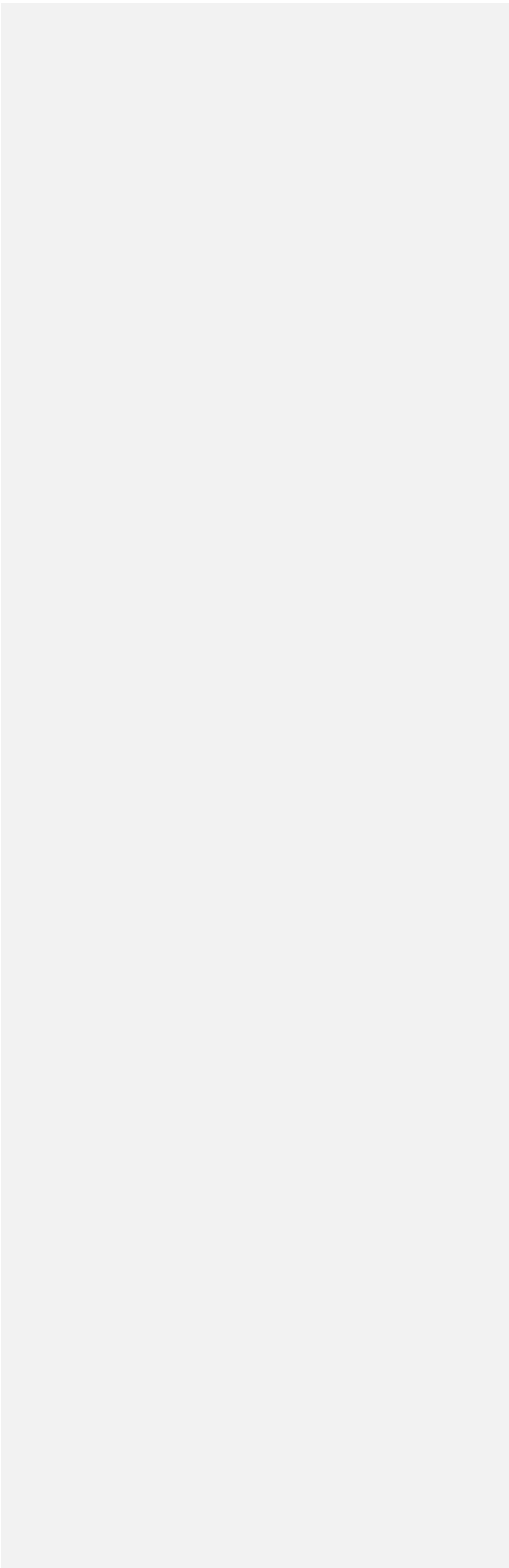
Inverter Type 1

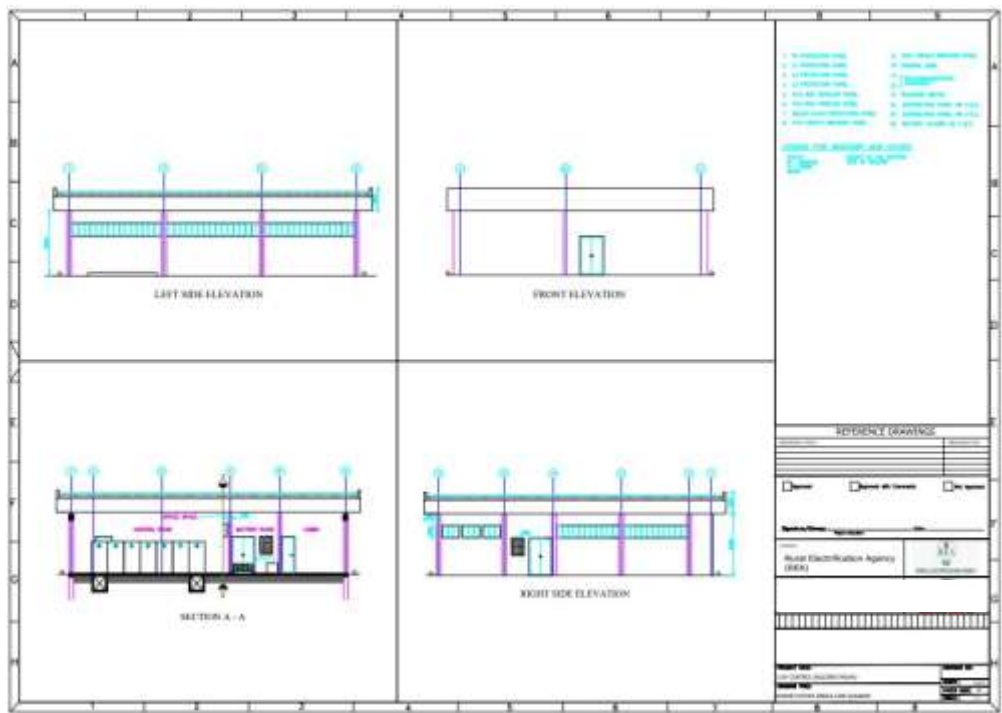


Typical Gate and Chain Link Fence (I)

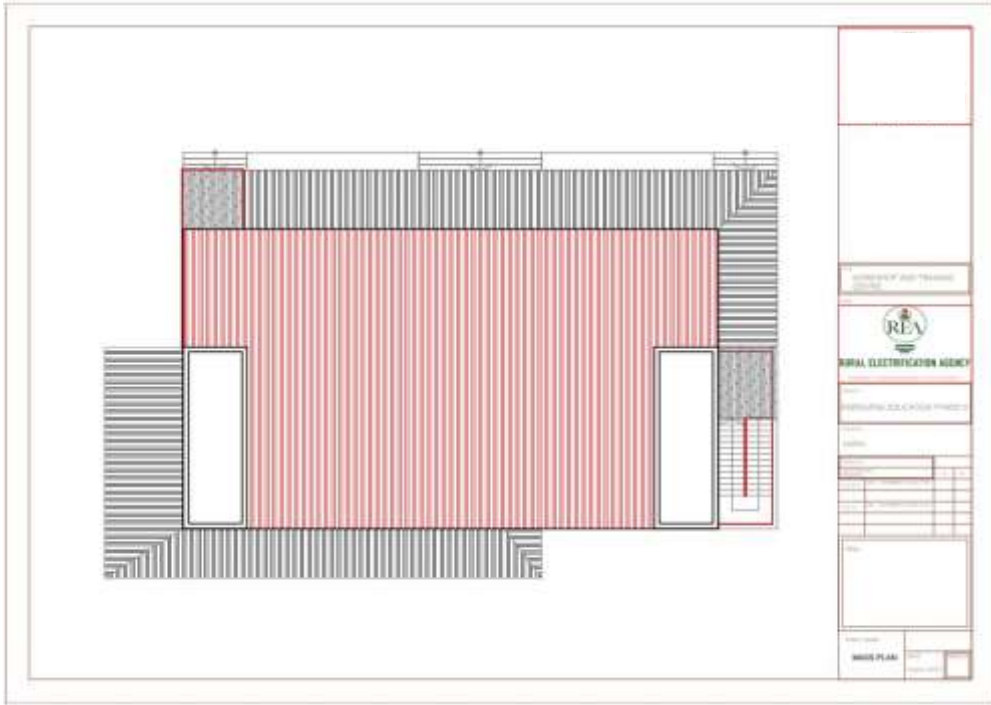


Typical Drawing of Control Buildings, where they apply

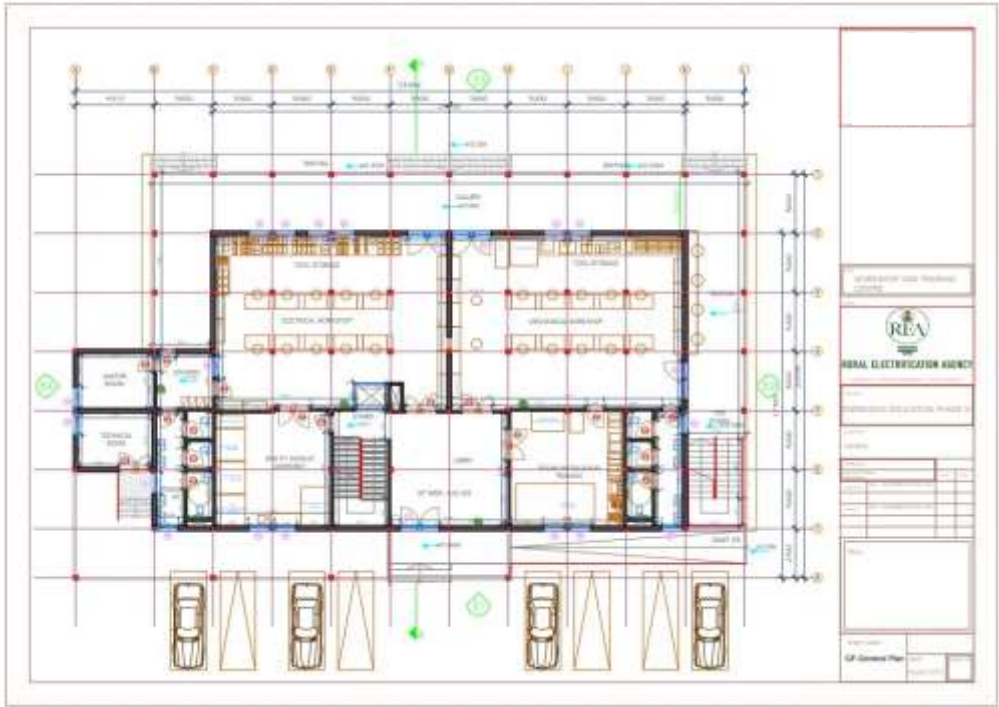




Typical Drawing of Control Buildings, where they apply



Mass Plan



GF – General Plan



F1 – General Plan



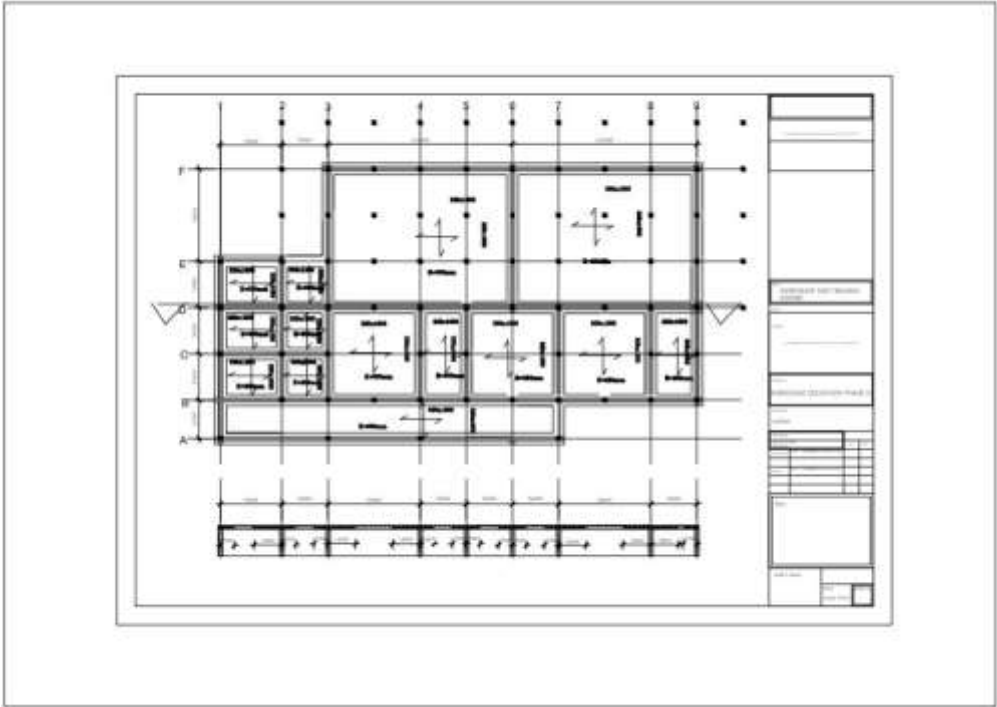
Extensions E1 – E3



Extensions E2 – E4

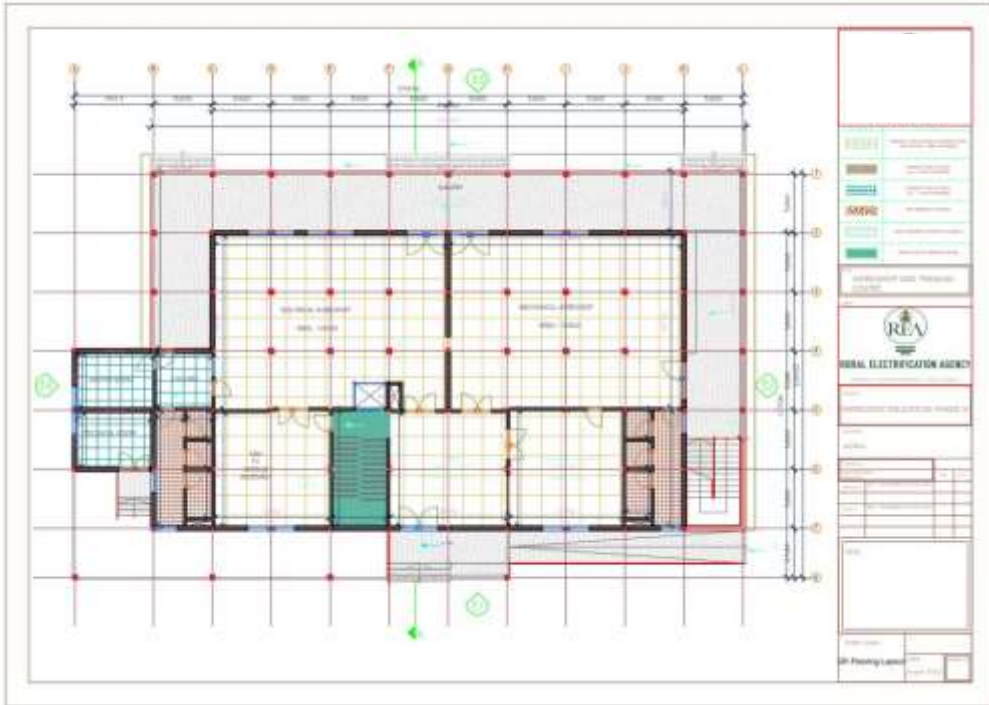


GF – Ceiling Layout

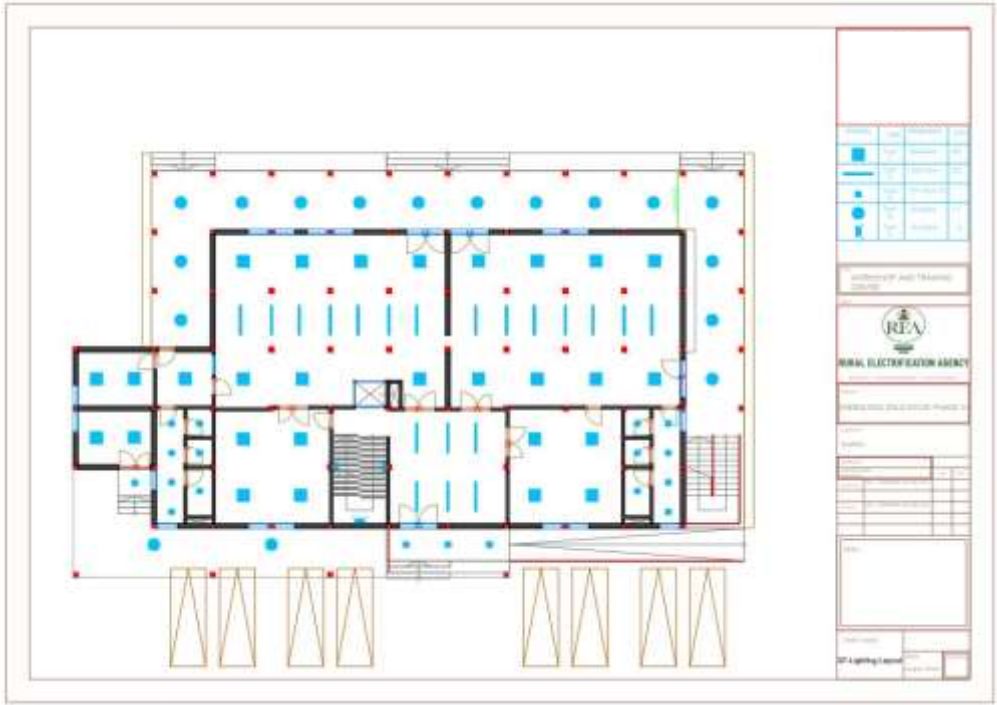


Foundation

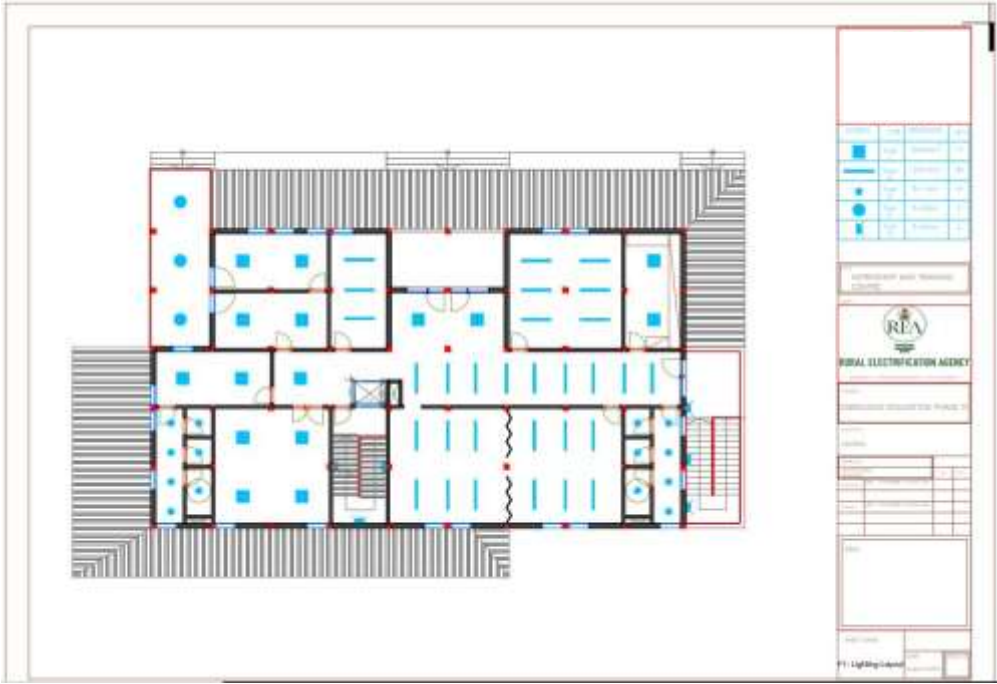
To be noted: the design of foundation for the WTC will be based on Soil Investigation report for each site.



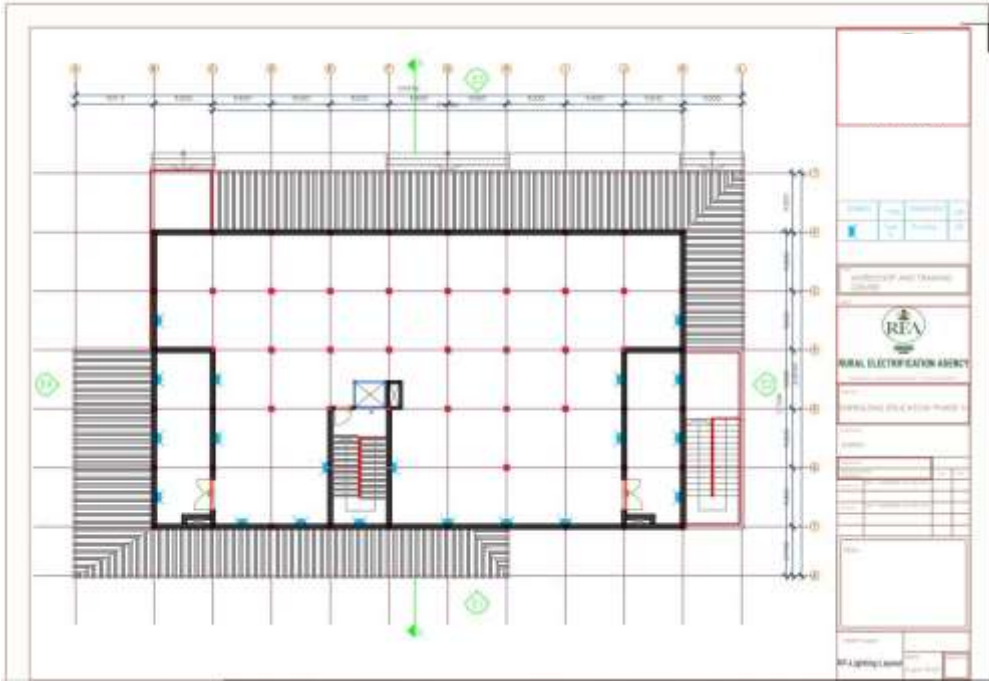
GF – Flooring Layout



GF – Lighting Layout



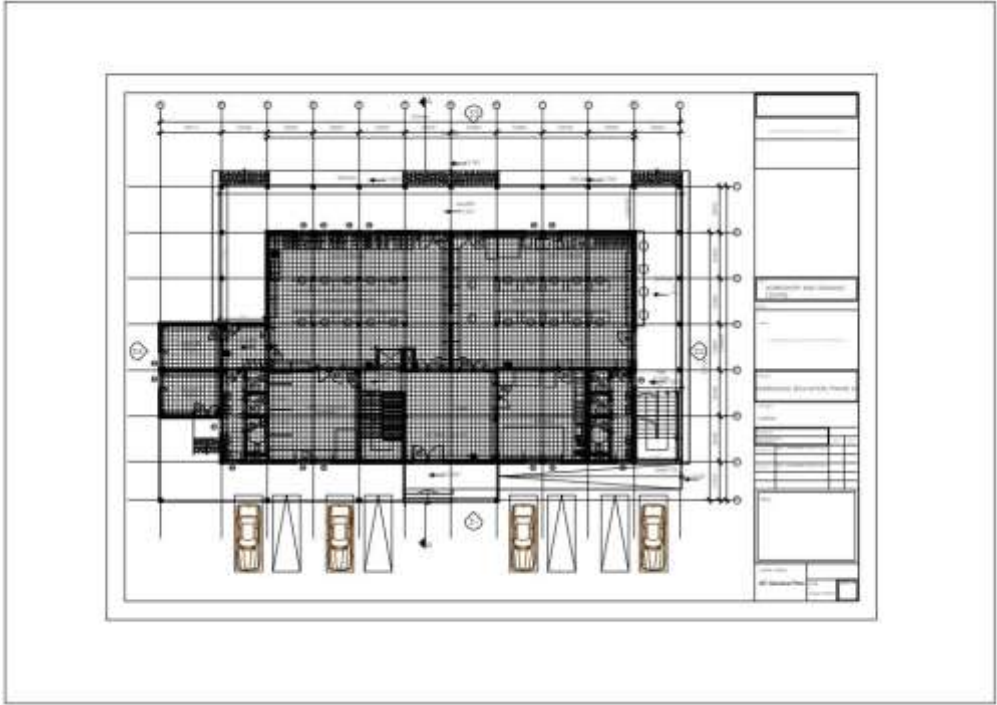
F1 – Lighting Layout



RF – Lighting Layout



GF – General Plan

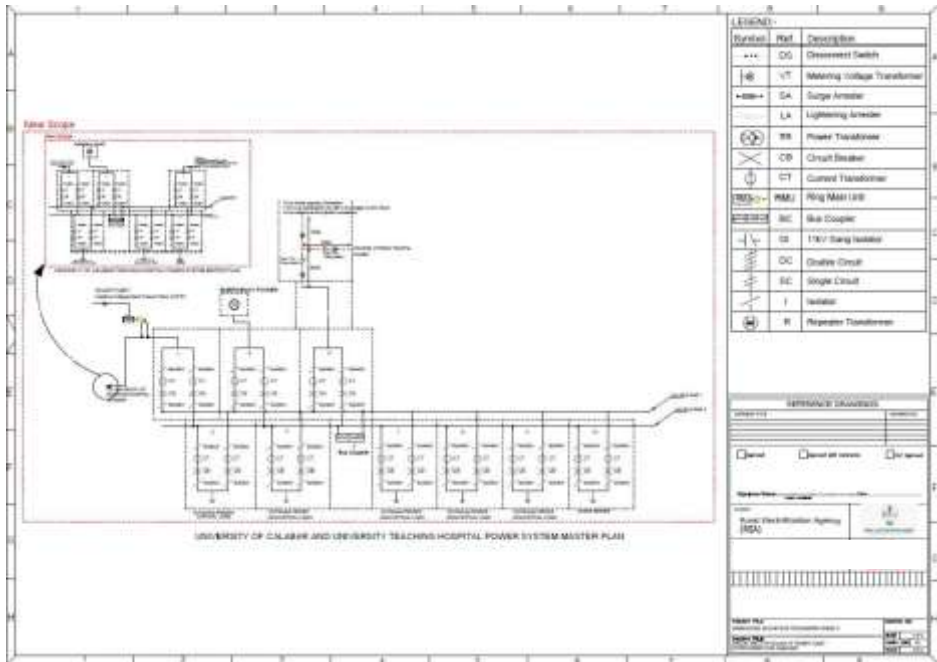


GF – General Plan



FF – Ceiling Layout

3. DISTRIBUTION NETWORK (SLD) (Sample site SLD)



4. STREETLIGHTS LAYOUT

This is dependent on the University Layout; some streetlights exist by use of High-Pressure Sodium lamps (HPS), High- or Low-Pressure Mercury lamps, etc. These fittings will be replaced with Light Emitting Diodes (LED) types and new ones installed at designated new locations. The power supply network cabling should be rehabilitated by replacing faulty underground cables & controls, also new Power Control Kiosk with Automatic switch device will need to be installed at new areas for complete illumination of the major roads within the institution,

PERFORMANCE

Certain performance requirements, materials, features, and design requirements are specified herein. It is not the intention of these specifications to specify in complete detail the various components of the equipment; this is left to the experience and practice of the Proposer who must furnish equipment, which must meet in all respects the specified requirement regarding performance, durability and satisfactory operation. However, certain features, materials and design requirements are specified and intended to establish minimum standards for the work. The equipment offered must conform in all respects to high standards of engineering, design and workmanship and be capable of performing in operation up to the guarantee/warranty stated in this document in a manner also stated in said section. Additional accessories used for satisfactory operation and completeness must be provided as part of this Bid.

1.4 Photovoltaic (PV System)

1.4.1 Definitions

The term photovoltaic (PV) system refers to major equipment items such as PV modules, array structures and foundations, the complete Battery Energy Storage Systems, all required electrical equipment and connections, and a DC/AC inverter. Additional equipment includes wiring, connectors, protective devices (such as surge suppression, overcurrent devices, etc.), grounding, junction boxes and enclosures, controls, instrumentation, and all other items needed for a safe and fully functional PV system. The system must meet the minimum performance requirements as specified in the Schedule of Requirements Section, and the proposer/contractor must demonstrate system performance per the requirements identified herein to the satisfaction of the Employer as a condition of acceptance.

The PV System is composed of:

- a) The assembly and connection of the following items:
 - PV modules, which are assembled in series to form strings. Several strings can be connected in parallel within PV DC Boxes. A PV sub-array designates a group of PV modules connected together;
 - PV inverter, ideally of string type. A PV inverter and its corresponding PV sub-array(s) form a PV block;
 - One AC PV Combiner Cabinet (PVCC), which aims to combine all PV blocks to be connected on the same busbar, emergency stop and other protections.
- b) Alternate Current (AC) and Direct Current (DC) cables and connectors;
- c) Protection and switching devices;
- d) Mounting structure to incline PV modules 10-15° depending on the project site, towards the perfect South to optimize the solar irradiation collection;
- e) Earthing and Lightning Protection System (LPS); and
- f) One weather station.

1.4.2 Codes and Standards

The Contractor shall ensure that the design, construction and testing of the PV System and selected equipment are according to internationally recognized standards such as IEC and codes in their latest edition and Nigerian standards, where applicable.

Standards required for specific components are specified in their respective sections in the table “Minimum technical requirements”.

All equipment and services supplied shall comply with the standards listed below.

1.4.3 PV General

- 1) IEC 61215 - Terrestrial photovoltaic (PV) modules - Design qualification and type approval
- 2) IEC 61730 - Photovoltaic (PV) module safety qualification
- 3) IEC 61701 - Salt mist corrosion testing of photovoltaic (PV) modules
- 4) IEC 62716 - Photovoltaic (PV) modules - Ammonia corrosion testing
- 5) IEC TS 62804 - Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation - Part 1: Crystalline silicon
- 6) IEC 60891 - Photovoltaic devices - Procedures for Temperature and Irradiance Corrections to Measured I-V Characteristics
- 7) IEC 60904 - Photovoltaic devices
- 8) IEC 61829 - Photovoltaic (PV) array - On-Site Measurement of I-V Characteristics
- 9) IEC 61853 - PV Module performance testing and energy rating
- 10) IEC 62548 - Photovoltaic (PV) Arrays – Design Requirement
- 11) EN 62852 - Connectors for DC application in photovoltaic systems - Safety requirements and tests

1.4.4 Inverters

- 1) IEC 62093 - Balance-of-system components for photovoltaic systems - Design qualification natural environments
- 2) IEC 62109 - Safety of power converters for use in photovoltaic power systems
- 3) IEC 62116 - Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures
- 4) IEC 60730 - Automatic electrical controls
- 5) IEC 61683 - Photovoltaic systems - Power conditioners - Procedure for measuring efficiency
- 6) IEC 61000 - Electromagnetic compatibility (EMC)
- 7) IEC 61727 - Photovoltaic (PV) systems - Characteristics of the utility interface
- 8) IEC 62477 - Safety requirements for power electronic converter systems and equipment

1.4.5 Electrical Installation

- 1) EN 50618 - Electric cables for photovoltaic systems
- 2) IEC 60364 - Low Voltage Electrical Installations, in particular (but not limited to):
 - a) IEC 60364 -7-712: Requirements for special installation or locations - solar photovoltaic power supply systems
 - b) IEC 60364-4-41: Protection for safety – protection against shock
 - c) IEC 60364-6: Verification
- 3) IEC 62305 - Protection against lightning
- 4) IEC 62053 - Electricity metering equipment (AC)
- 5) NESIS 2015

1.4.6 Performance Monitoring

- 1) IEC 61724 - Photovoltaic System Performance
- 2) IEC 62446 - Photovoltaic Systems – Requirements for testing, documentation and maintenance
- 3) ISO 9845-1, Solar energy - Reference solar spectral irradiance at the ground at different receiving conditions, Part 1: Direct normal and hemispherical solar irradiance for air mass 1.5
- 4) ISO 9847 - Solar energy - Calibration of field pyranometers by comparison to a reference pyranometer
- 5) ISO 9060, Solar energy - Specification and classification of instruments for measuring hemispherical solar and direct solar radiation
- 6) ISO 9901, Solar energy - Field pyranometers – Recommended practice for use

1.4.7 Nigerian Standards

In case of redundancy and/or inconsistencies between Nigerian standards and updated IEC standards or minimum requirements as specified in this document, the strictest criteria shall apply.

1.4.8 Others

- 1) IEC 60068 - Environmental testing – Part 2-78: Tests – Test Cab: Damp heat steady state and Part 2-21: Tests – Test U: Robustness of terminations and integral mounting devices
- 2) IEC 62093 - Balance-of-system components for photovoltaic systems - Design qualification natural environments
- 3) IEC 62852 - Connectors for DC-application in photovoltaic systems - Safety requirements and tests
- 4) IEC 60529 - Degrees of protection provided by enclosures (IP Code)
- 5) ISO 12944 - Paints and varnishes - Corrosion protection of steel structures by protective paint systems

- 6) ISO 9223 – Corrosion of metals and alloys – Corrosivity of atmospheres – classification, determination and estimation

1.4.9 *Guaranteed Expected Output of Power Plant*

The table below states the Guaranteed Expected Output of the power plant in MWh per month during Daylight Hours, the maximum SAIDI (System Average Interruption Duration Index) per quarter during Daylight Hours allowed, and the annual minimum Solar-Battery Energy Fraction [in %] of the Guaranteed Expected Output or the total energy delivered during Daylight Hours, whatever value is lower.

University	Guaranteed Expected Output of the plant during Daylight Hours [MWh/month]	Maximum SAIDI per quarter during Daylight Hours (hr)	Minimum Solar-Battery Energy Fraction) during Daylight Hours [%]
MAU YOLA	544	33	75%
FUDMA	228	33	75%
FU LAFIA	156	33	75%
FU LOKOJA	156	33	75%
FUTA	358	33	75%
FU UYO	218	33	75%
FUTO	692	33	75%
UNIPORT & UPTH	881	33	75%

The Contractor shall provide the Guaranteed expected output of the power plant in MWh per month, comply with the maximum SAIDI (System Average Interruption Duration Index) per quarter and meet the annual minimum renewable fraction [%] of the Guaranteed expected output or the total energy delivered, whatever value is lower.

2. Specifications

2.1 Technical Specifications

The systems must meet the minimum performance requirements as specified, and the proposer/contractor must demonstrate system performance per the requirements identified herein to the satisfaction of the Employer as a condition of acceptance.

Technical Standards:

1. All components shall be at minimum Underwriters Laboratories (UL) listed and conform to regulatory guidelines.
2. All components must be warrantied for a minimum of 25 years (panels) and 10 years (inverter and other related components).
3. A long term maintenance contract may be entered into between the beneficiary and the Proposer/contractor for the lifecycle of the system separate from this contract.
4. Minimum output of the system shall be specified, guaranteed, and warrantied in accordance with operational limits laid out in the functional guarantee table.
5. The system must be able to withstand Category 2 hurricane winds or higher. Calculations showing the appropriate mounting methods to be used shall be submitted before work is commenced.
6. A minimum border of 1 m from the edge of all plant space shall be applied.
7. Access to all junction boxes, conduit and the solar PV panels must be always available. Walkway space with a minimum of 1m between every two rows shall be applied for the ground mounted.
8. Minimum expected outputs are suggested for each system; these must be adhered to and/or surpassed.
9. The rating of the system shall consist of the total sum of the nominal power rating of the inverter or the solar PV panels, whichever is the less.
10. The rating of the system shall conform to the IEEE standard.
11. Wherever possible, the system orientation should face south. Where this is not possible, the proposer/contractor must position the PV modules in such a manner that the maximum power is obtained with the sun's movements during the day.
12. The systems must meet safety and workmanship standards. Guarantee of Workmanship to surpass IEE Regulations.
13. Manufacturer's authorization must be provided.

14. After sales service for a period of 3 years must be provided. Accessible in/from the beneficiary's country (Nigeria).
15. Guaranteed Expected Output in MWh per month during Daylight Hours, and maximum System Average Interruption Duration Index (SAIDI) during Daylight Hours must be maintained together with the Solar-Battery Energy Fraction during Daylight Hours as outlined in the functional guarantee table. The minimum Solar-Battery Energy Fraction during Daylight Hours may decrease by up to 10% percent in 15 years linearly due to degradation. During Nighttime Hours, the system shall work as a battery + diesel- based UPS (uninterrupted power supply). The UPS takes up power supply to the loads.
16. Contractor shall be guided by the management of the beneficiary in respect of availability of work site, timeframe of installation, and disposal of waste.
17. The inverter location must be agreed with the beneficiary and the layout of the cable/conduit runs.
18. Appropriate and approved methods of sealing cores in walls, roofs or slabs must be employed
19. All conduit and cable must be UV rated. All exposed material supports; saddles and screws shall be made of stainless steel.
20. Cable ties should be avoided, and metal clips (stainless steel) should be used to secure wiring and conduit. No wires shall be left unsecured.
21. Protection for fall hazards of 6 ft or greater.
22. PV source circuits must be placed in a metallic raceway when inside buildings prior to the first grounded DC disconnect.
23. All metallic raceways electrically must be bonded to a suitable grounding point.
24. Ground mounted box and all internal components must be UL rated for wet conditions.
25. Shading of panels should be avoided as much as possible – this includes shading from trees, walls, parapets, superstructures, and roof structures.
26. A minimum slope angle of 10 degrees should be employed for the installation depending on location.
27. PV rated wiring shall be used in all installations.
28. The job site shall be clean and clear of debris at the end of every working day.
29. The contractor is expected to follow all necessary and relevant minimum standard safety procedures in carrying out his work. The minimum safety equipment to be used on each site: steel toe boots, safety harnesses while on roofs and vest or shirts identifying personnel. Hardhats, protective eyewear, safety plan established, ladders attached to building, controlled access zone (monitor and worker pair), mandatory safety training for employees.
30. All trench work must be demarcated, and appropriate caution signs and warnings employed. (Following IEE Regulations).
31. All cables must be enclosed in PVC conduit in accordance with electrical technical standards applicable in Nigeria.
32. Line or Load side connection: Installations to load can either be connected on the line or load side of the connection (in an appropriate load control room in

- the facility).
33. Civil Works: some construction may be necessary to house the inverter, battery bank and associated electrical housing. Trench work may also be necessary. All housing must be of weatherproof construction of suitable and sound material: concrete, fiberglass, treated wood.
 34. Inverter location and conduit runs where possible a suitable location of the inverter and the electrical run of conduits and cables were identified. These, however, should be the final decision of the beneficiary.
 35. The system and its components must be NEW. PV Panels, inverters and other major equipment which has been used in any other way for a previous installation or turned on for any other reason before being commissioned by the contractor will not be accepted.
 36. The available electrical supply is 230-240 Volts with a cycle of 50 Hz and for the three-phase is 380-415 Volts. Proposers should review connection points carefully and specify/design the system accordingly.
 37. Nigeria is a tropical island with two seasons, a dry season, and a wet season.
 38. The PV system will be expected to perform satisfactorily in relative humidity up to eighty-five percent (85%) and temperature as high as forty-five degrees Celsius (45°C).
 39. The PV system (inclusive of all nuts and bolts) must be able to withstand a saline environment.
 40. The design must be suitable for ground mounted installation and such that it maximizes the annual energy production utilizing the available space before, to achieve the indicated MW output.
 41. Installation of any structure for array panel mounting or equipment housing must have no (ZERO) impact on structural integrity of the existing structures.
 42. The PV system must support remote monitoring of important parameters. The operator interface must be intuitive such that operating personnel must be able to operate the system easily after having received some basic training provided by the contractor.
 43. The design and installation must minimize the risk of vandalism, theft and personal injury in the installation and operation of the system; a complete Video Surveillance System (VSS) for the entire Power plant is recommended.
 44. All equipment and electrical hardware used in this system, including overcurrent protection, disconnects, surge suppression devices, conduit, wiring and terminals, must be approved, recognized, and listed for the intended application by UL or tested by other recognized laboratory according to IEC or similar standard, and have appropriate voltage, current and temperature ratings for the application.
 45. Inverters, controllers and PV modules must have specific listings as noted elsewhere in this document. All circuit breakers, fuses and disconnects must be listed or recognized for use in Direct Current (DC) circuits where applicable.

Equipment only rated for use in AC circuits will not be permitted for use in DC circuits.

46. All wiring (conductors) must be properly sized and rated for the application, including ampacity (including temperature and other deratings), location/application (exposure to elements, enclosure) and voltage drop.
47. Apart from module interconnect wiring, all terminations must use listed box terminal or compression type connections and must be made within an appropriate junction box or enclosure. Exposed field splices between conductors will not be permitted. Twist-on wire splices, crimped, soldered, or taped connections are not permitted for the required field-installed wiring of DC circuits. However, wire splices in the electrical panel will be allowed for connections to existing branch circuits for extension to the inverter sub panel. Proper torque specifications must be provided for all the required field connections.
48. The system conductors must have appropriate means for disconnecting and overcurrent protection, and require the use of switches, fuses, and circuit breakers as applicable. All overcurrent devices must have trip ratings.
49. A weather-tight, vented, locking, pad mountable enclosure must be supplied by the contractor, suitable for housing the inverter, controllers, AC/DC disconnect devices, and source circuit combiner boxes (as required), in an outdoor or indoor environment as required for the specific application.
50. The power output of the PV module must be reported under standard test conditions (STC). Current versus voltage (I-V) curve of the intended modules to be used must be submitted with the bid.
51. An outdoor rated disconnect device must be installed on the systems at the interface between the PV system inverter and the primary electrical system served by the utility grid. This disconnect device must be a visible break, lockable device, and must be installed at a convenient location on the outside of the premises near the utility service entrance and meter.
52. All electrical equipment, enclosures, disconnects and overcurrent devices must be clearly marked and identified.
53. All metallic module frames, panel/array support structures, metal enclosures, panel boards and the inverter cabinets must be properly bonded to a common grounding conductor and terminated at a ground rod or system installed at the utility service entrance point. If a ground rod or system is not already present, a grounding rod or network must be installed with a preferred maximum earth resistance of five ohms (5Ω). All grounding connections and terminations must be made accessible for routine inspections and maintenance as required. The neutral conductor of the inverter output must be grounded at the electrical service panel. No other AC connections to the grounding system are required.
54. The PV system must have an Integrated Grounding system: instead of connecting a ground wire to each module, the array must be grounded directly to the rails with the patented Sharp talon clip or similar, which in turn greatly reduces Labour time and complexity.
55. The PV system must be provided with a communication interface which must

be able to support, at a minimum:

- a) Real time data logging
 - b) Event logging
 - c) Supervisory control
 - d) Operational modes
 - e) Set point editing
 - f) The size of the rating and name plate must depend upon space availability, but they must be reasonably sized for clarity and clear inscription.
56. The proposer will be responsible for all necessary clearances from the competent authorities; the system provided must meet the NERC's Requirements for Grid Interconnection of Renewable Generation Systems and any other Nigerian regulatory requirements.
 57. Online monitoring and reporting by select personnel of the beneficiary must be provided/ presented as part of the handover/training ceremony.
 58. The proposer must submit "as built" drawings of the complete system as part of this contract.
 59. Surge suppression on the DC and AC side of the inverter must be provided by deployment of SPD type I, type II or type III where necessary.
 60. The output of the string (or Central) inverter must automatically synchronize the AC output of the Battery Inverter and/or Diesel Generators to the exact required AC voltage and frequency.
 61. The string (or Central) inverter control unit(s) must be designed to operate the PV system near its Maximum Power Point (MPP) - the operating point where the combined values of the current and voltage of the solar modules result in a maximum power output.
 62. The inverters must be a true sine wave inverter for a grid forming PV system.
 63. The contractor must carry out all standard performance tests, routine, functional and quality assurance tests as specified in the relevant specifications/standards for PV systems of this type.
 64. No testing at the place of manufacture must release the proposer/contractor from any of their obligations under the contract or negate the Employer's right to inspect, test and, where necessary, reject the system at the point of final delivery in the Employer's designated installation site.
 65. All Equipment and accessories must comply with the requirement of standards published by international standards' bodies such as IEEE, UL, IEC, etc. for design, manufacture and installation of grid connected PV systems. The list of standards adopted must be indicated in the bid along with a certified copy showing compliance. These certificates must have been issued within the last two (2) years from the date of bid opening or still valid at the date of bid opening; this must be shown by clearly stating the expiration date.
 66. The PV Module and system must be provided with acceptable Test & Certified

- documents, which is to be confirmed through Factory Acceptance Test (FAT) by the consultant and employer's representatives. The cost for these FATs shall be borne by the proposer
67. The quality of equipment supplied must be generally controlled to meet the guidelines for engineering design included in the specifications/standards and codes listed in the relevant specifications/standards shall include at a minimum:
 - a) NERC and NEMSA Requirements for Grid Interconnection of Renewable Generation Systems.(see: https://nerc.gov.ng/index.php/component/remository/Regulations/orderb_v.2/page.3/?Itemid=0 & [https://rea.gov.ng/May272021REA-Harmonised- Technical-Standard.pdf](https://rea.gov.ng/May272021REA-Harmonised-Technical-Standard.pdf))
 - b) UL 1703 – Standard for Flat-Plate Photovoltaic Modules and Panels or similar IEC standards
 - c) UL 1741 – Standard for Inverters, Converters, Controllers, and Interconnection System Equipment for Use with Distributed Energy Resources or similar IEC standards
 68. PV modules must qualify (enclose test reports/certificate from IEC/UL or equivalent accredited laboratory) as per relevant standards. Additionally, the performance of PV modules at STC must be tested and approved by one of the IEC/UL or equivalent Accredited Testing Laboratories and the STC report/certificate must accompany the bid.
 69. At the end of the Contract, two (2) types of manuals must be provided; a product manual and an operations and maintenance (O&M) manual. These manuals (product and O&M) must be provided for all equipment items supplied for this bid, especially if the system is made up of items from different manufacturers.
 70. When written instructions include Shop Drawings and other information previously reviewed by the Employer, only those editions thereof which were approved by the Employer, and which accurately depict the equipment installed, must be incorporated in the instructions.
 71. The Product Manuals must include but not be limited to literature on the PV module and the components of the Balance of System (BoS).
 72. The O&M Manuals must give a step-by-step procedure for any operation likely to be carried out during the life of the system including lifting, erection, testing, operation, calibration, dismantling and repair and must include but not necessarily limited to the following detailed information, as applicable for the item:
 - a) Manufacturer's name.
 - b) Date of manufacture.
 - c) Contractor's address, telephone number, facsimile number, and Name of contact person in case of failure or complaint.
 - d) Equipment function, normal operating characteristics and limiting operations.
 - e) Assembly, disassembly, installation and mounting, adjustment, checking instructions and storage.
 - f) Operating instructions for start-up, routine and normal operation,

regulation and control, shutdown, and emergency conditions.

- g) A guide to troubleshooting (troubleshooting procedures, with a cross-reference between symptoms and corrective recommendations).
73. The Contractor's warranty provides a twenty-five (25) year guarantee/warranty against any manufacturing/design/installation defects for the mechanical structures, electrical works, and 2 years for overall workmanship of the PV system and 10 years for the inverter.
 74. Outline, cross-section, and assembly drawings; engineering data; electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, word description of wiring diagrams and interconnection diagrams and any other appropriate information must be provided.
 75. A maintenance schedule showing preventative activities to be performed on the system.
 76. Recommended spare parts giving full particulars for the PV system must be furnished/listed, as part of this bid.
 77. Spare modules must be provided at a minimum quantity equal to one percent (1%) of the number of modules installed in the array field. Spare inverters with the capacity of two percent (2 %) of the total installed inverter capacity.
 78. Information on the PV modules being offered including physical dimensions, weight, maximum power point power rating at STC (including both the mean value anticipated from a lot of panels and the standard deviation), current-voltage curves at STC and product certifications must be supplied.
 79. Warranty documentation including statement of duration of warranty period and contact phone numbers and addresses for warranty issues must be supplied.
 80. The proposer/contractor must submit an assessment report, including installation schedule, two (2) weeks after starting the contract. This report must include at a minimum the following, to facilitate the installation of the PV system:
 - a) The upgrades/work to be done.
 - b) The type of mounting structure to be used.
 - c) A schematic drawing showing the general arrangement (Power Conditioning Unit(s) (Inverter(s)), Junction Boxes, AC and DC Distribution Boards, Meters, etc.).
 - d) A dimensioned layout of the PV modules – including design for roof and ground mounting.
 - e) The proposer/contractor must provide Installation and Commissioning instructions/schedule including electrical drawings indicating the interconnectivity of the system.
 81. The proposer/contractor is responsible for the installation of the PV systems and the associated equipment. This includes all civil works required for the complete system installation.
 82. The proposer/contractor must provide qualified personnel, such as an engineer who has adequate experience with the installation of PV systems, to carry out the

installation, site testing and commissioning of all equipment supplied under this contract.

83. All installation work must be carried out in accordance with relevant International Standards and Codes of practice.
84. To create a uniformed appearance of the array, spacing between individual modules must be kept to a minimum, and the overall layout kept in consistency with the overall architectural features of the building and property. As much as possible, all mechanical hardware, conduit, junction boxes and other equipment must be concealed beneath and/or behind the array, and all other electrical work performed neatly and as inconspicuously as possible.
85. The proposer/contractor must thoroughly clean the PV modules of any dirt/dust or settled debris (if applicable) accumulated during installation and commissioning, before acceptance, at no additional cost.
86. When all installation work is satisfactorily completed, the proposer/contractor must inform the Employer in writing that the equipment/system is ready for commissioning and subsequent handing over to the Employer.
87. Before the taking over of the system, the proposer/contractor must carry out all routine and functional tests as specified in the relevant standards on the assembled PV systems with all accessories of the equipment in the presence of the Employer's representative and furnish copies of these test reports for approval before acceptance.
88. The equipment must be tested for a minimum of 72 hours load test with a load bank of commensurate capacity following installation of all systems as per the application to determine at a minimum that the system:
 - (a) Is properly installed and grounded.
 - (b) Meets its operating specifications.
 - (c) Can deliver specified power.
 - (d) Protective devices are installed and functioning correctly.
89. All the required equipment to conduct the tests must be provided by the contractor.
90. Until final field tests are acceptable to the Employer, the proposer/contractor must make all necessary changes, readjustments, and replacements at no additional cost to the Employer.
91. Defects which cannot be corrected by installation adjustments will be sufficient grounds for rejection of any equipment.
92. The proposer/contractor must be fully responsible for the proper operation of equipment during tests and instruction periods and must neither have nor make any claim for damage which may occur to equipment prior to the time when the Employer formally takes over the operation thereof.

2.1.1 General Specifications

The system design and equipment for the PV plant shall be of proven technology, in accordance with best industry practice and with a strong track record in similar tropical

maritime environments experienced at the site. Equipment should have a design life of 25 years.

The system is to be designed and installed in accordance with the most recent version (including amendments) of the following standards and codes:

- Nigerian codes and regulations (NEMSA, NERC, etc)
- IEC 60364
- IEC 61140
- IEC 60479
- IEC 60038
- IEC 60051
- IEC 62305 - Lightning Protection
- IEC 63092-2 Edition 1.0 2020-09
- ISO 22111:2019
- EN 1997-1:2004
- ISO 23469:2005
- IEC 60071-1
- IEC 60076-1
- IEEE 998:2012

Notwithstanding, all relevant Standards shall also be conformed to, in addition to the above codes.

- A. Minimum design loads on structures - Dead and live loads and load combinations
- B. Minimum design loads on structures - Wind loads
- C. Minimum design loads on structures - Earthquake loads
- D. Minimum design loads on structures (known as the SAA Loading Code) - Earthquake loads - Commentary (Supplement to AS 1170.4- 1993)

- For Electrical installation works, it is assumed the proposer shall comply with the latest NERC/TCN/NEMSA Technical Specification and Standards.

For DC System, the following IEC standards, but not limited to shall be adhered to:

- IEC 61727:2004 Photovoltaic (PV) Systems - Characteristics of the Utility Interface
- IEC TS 61836 Solar photovoltaic energy systems
- IEC 60364-7-712 - Low voltage electrical installations – Part 7-712: Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems
- IEC 62116:2014 - Utility-interconnected photovoltaic inverters – Test

- procedure of islanding prevention measures
- BS EN 60068-2-14:2009 - Environmental testing
- IEC 61215 - Terrestrial photovoltaic (PV) modules - Design qualification and type approval - Part 1-1: Special requirements for testing of crystalline silicon photovoltaic (PV) modules
- IEC 61646 – Thin-film terrestrial photovoltaic (PV) modules – Design qualification and type approval
- IEC 61730 – Photovoltaic (PV) module safety qualification
- IEC 61701 – Salt Mist Corrosion Testing of Photovoltaic (PV) Modules
- IEC 61853-1 – Photovoltaic (PV) module performance testing and energy rating – Part 1: Irradiance and temperature performance measurements and power rating
- IEC 62109-1, 2 – Safety of power converters for use in photovoltaic power systems.
- IEC 61683 – Photovoltaic Systems - Power Conditioners - Procedure for Measuring Efficiency.

2.1.2 Civil Works

1. Earthworks shall be carried out in a manner not to cause any environmental and hydrological issues.
2. Temporary drainage measures during earthworks shall be provided to ensure no untoward issues caused to the existing structures and surrounding areas.
3. Permanent drainage shall be designed complying to the estimated rainfall intensity for a return period of 25 years to ensure surface water flow can be controlled and channeled to the nearest stream or river.
4. Environmental protection during earthworks such as silt traps and silt fences, including check-dams etc., shall be provided, adequately complying with the EIA requirements.
5. Drains/waterways/culverts located along the main roads or crossing any roads shall conform to the relevant Nigerian codes and requirements. The PV plant shall be provided with necessary external roads.
6. Oil spill containment systems shall be provided for step-up transformers and diesel generators.
7. Control Buildings which shall house the PV Plant monitoring system, 11kV Switchgear with Protection system and associated DC System, LVAC System, SCADA System, Strategic Spare storage area with necessary building M&E facilities shall be provided based on each location's requirements.

2.1.3 PV Modules

The Contractor shall supply and install a minimum quantity of PV modules to achieve the minimum required capacity (defined at Standard Test Conditions) as specified for each site in table 2 of the solar hybrid plant technical data summaries. PV modules shall be from a Tier 1 manufacturer and shall be selected for a design life of 25 years under the prevailing site environmental conditions.

PV modules technology shall be of crystalline silicon (c-Si) type, either monocrystalline or polycrystalline, composed of 72 cells or higher.

All PV modules supplied for the projects bid for shall be of the same series (same technology, same size) and from the same manufacturer, so that modules can be easily swapped from one site to another one if needed. This requirement aims to optimize and facilitate the spare part management during future operation. Preferably, all PV modules shall have the same peak power, but different power classes from the same series can be accepted on an exceptional basis for sites having limited available areas (which may require the use of higher efficiency PV modules). In all cases, PV modules shall be identical (same power class) within each site.

The PV module manufacturer shall comply with the minimum qualification criteria as follows:

- a. More than 5 years of experience in manufacturing PV Modules
- b. More than 1500 MWp annual manufacturing capacity (year before the tender publication)
- c. Manufacturing facilities certified according to ISO9001 and ISO14001

Evidence for each qualification criteria shall be provided in the bid.

The proposed PV module shall have been deployed and in successful operation (ideally in similar environmental conditions) for at least 12 months in commercial financed non-recourse project for a plant of minimum 20 MWp. Evidence of successful operation of this PV module shall be provided in the bid.

PV modules shall comply with the minimum specific technical requirements described in the following table.

2.1.4 PV Modules – Minimum Technical Requirements

N°	Parameter	Requirement
1	Technical Characteristics	
1.1	PV Module technology	c-Si
1.2	Number of cells per modules	72 or higher
1.3	Module rated power at STC	≥ 660Wp for FUTO and UNIPORT; and 400 Wp for other Universities

N°	Parameter	Requirement
1.4	Module Efficiency at STC	$\geq 20\%$
1.5	Temperature coefficient on power at STC (negative on sign)	Not less than $-0.45\%/^{\circ}\text{C}$
1.6	Nominal Power Tolerances from Manufacturer (used for acceptance to the module)	$0\% \leq P_{nom} \leq +3\%$; or $0 W_p \leq P_{nom} \leq +5 W_p$
1.7	Module Maximum System Voltage	1,000 V DC
1.8	Module operating temperature range	-10°C to $+75^{\circ}\text{C}$ or wider
1.9	Junction Box (rear side of the module)	IP 67 rated with at least 3 by-pass diodes
1.10	Frame	Material: Anodized Aluminium
1.11	Connectors	$\geq \text{IP65}$ Type MC4 or equivalent
1.12	Permanent labelling	Serial number (or bar code) Model type and reference Technical data at STC (Peak power, Voc, Isc, Impp, Vmpp)
2	Warranty	
2.1	Performance warranty (year 1): power output guaranteed during the first year of operation	Minimum 97.5%
2.2	Performance warranty (year 2 to 25): linear degradation coefficient on power output	Maximum of $-0.6\%/year$
2.5	Product warranty against manufacturing defects	Minimum 12 years
3	Certification	

N°	Parameter	Requirement
3.1	IEC 61215 - Terrestrial photovoltaic (PV) modules - Design qualification and type approval	
3.2	IEC 61730 - Photovoltaic (PV) module safety qualification	
3.3	IEC 61701 - Salt mist corrosion testing of photovoltaic (PV) modules	
3.4	IEC 62716 - PV modules Ammonia corrosion testing	
3.5	PID free certificate issued by a reputable third-party laboratory according to IEC TS 62804 - Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation - Part 1: Crystalline silicon	
3.6	PV module manufacturing facility certified according to ISO9001 et ISO14001	
3.7	EU declaration of conformity	

The quality of equipment supplied is controlled by the Contractor to meet the guidelines for engineering design and installation included in the standards and codes listed in the above standards and codes section.

All transportation, storage, handling, and installation of the modules shall be in accordance with the specifications from the manufacturer, as to not void the module manufacturer's warranty.

2.1.5 PV Mounting Structure

The mounting structure shall be ground mounted and fixed type with a tilt angle of 5°-15° (decided during detailed design phase depending on the project site) facing perfect South. The structure shall be designed for a minimum duration of 25 years and to withstand all possible static, dynamic and seasonal load at site conditions. It shall withstand a wind speed of 175 km/h.

The Contractor shall design the mounting structure and related foundations according to geotechnical study results and the topography of each site. Foundations for the ground mounted structure shall consider the necessary drainage requirements (specially to allow water evacuation during the wet season). The Contractor shall provide all structural studies and calculations during the detailed engineering phase. The norm applicable to the execution of the calculation notes will be Eurocode 1. The purpose of the Eurocode rules is to fix the values of the climatic overloads (wind) and to give methods for evaluating the corresponding efforts on the whole of a construction or on its different parts.

The proposed mounting structures shall have proven track record and shall have been installed in PV projects totaling more than 20 MWp capacity with a minimum project size of 500kWp and a minimum project operational duration of 2 years (as of 2023). Evidence of such qualification criteria shall be provided in the bid.

The row-to-row distance shall be selected to minimize the shading losses (<1.5%) and shall be defined to be able to drive safely a vehicle between the rows (recommended distance of 3.5 meters). Row spacing of minimum 2 meters may be acceptable for specific sites in case of limited area availability. In case the mounting structure design and proposed site layout does not allow to drive a vehicle between the rows, internal roads shall be planned to be able to access different parts of the PV array with a vehicle. In all cases, a perimeter road of at least 4 meters all around the PV array shall be planned. The mounting shall be done with standard tools.

The mounting structure shall comply with the minimum specific technical requirements described in the following table.

PV mounting structure - Minimum technical requirements

N°	Parameter	Requirement
1	Technical Characteristics	
1.1	Near shading losses	< 1.5%
1.2	Minimum height of lowest part of the PV modules	0.75 m (from ground level)
1.3	Maximum height of the highest part of the PV modules	2.5 m (from ground level)
1.4	Row to row distance	3.5 m recommended 2 m as a minimum value, subject to shading losses
1.5	Tilt angle and azimuth	To be tendered for 10° towards perfect South, subject to final optimization
1.6	Material	Anodized aluminium or Hot-dip galvanized steel with protection level for local site conditions defined as per ISO 9223

N°	Parameter	Requirement
1.7	Screws, bolts and nuts	Stainless steel SS304 Antitheft type
1.8	Maximum wind speed	175 km/h as per local civil codes With panels installed, shall be designed, and certified by a suitably qualified engineer, to withstand category 2 hurricane winds and equivalent wind gusts (in accordance with ISO 2394).
1.9	Clamping type	Accepted by the PV module manufacturer
2	Warranty	
2.1	Product warranty against manufacturing defects	Minimum 10 years

In case steel construction elements shall be in contact with aluminium, the two materials shall be separated with isolating and sustainable material (such as EPDM) in order to avoid corrosion at the contact point (due to galvanic incompatibility).

Preassembled parts are preferred for the installation. Drilling, cutting, welding, etc. shall be avoided as much as possible on jobsite. When absolutely required, it shall be treated to ensure corrosion protection as per recommendations in ISO 9223. In addition, the mounting structure shall be designed in order to allow the installation of a support for the two reference cells (part of the weather station) to be installed in the plane of the PV modules.

1. The array mounting structure must be made of stainless steel (grade 316 or 304), aluminum, or hot-dipped galvanized steel or Fiber-reinforced plastic (FRP).
2. Fasteners are to be made of stainless steel (grade 316 or 304) or galvanized steel. Bare carbon steel fasteners are not acceptable.
3. For pile-type foundations the following tests are to be conducted:
 - A. Vertical pull-out tests.

B. Lateral load tests; and

C. Independent laboratory analysis of soil suitability and corrosion potential.

4. The array mounting structure, with panels installed, shall be designed, and certified by a suitably qualified engineer, to resist wind gusts of at least 90m/s at 3 sec intervals (in accordance with ISO 2394).
5. The design of the array mounting structure should be such that parts are pre-cut at the factory and do not need to be cut in the field. This is so that any corrosion-resistant coatings (e.g., anodization or galvanic layer) on the mounting structure's members are not compromised by being cut.
6. All sharp edges are to be removed at the factory, to prevent injury during construction, and to prevent damage to cabling. Protruding members (e.g. module rails) are to be capped to prevent injury to passing maintenance personnel.
7. PV module installation manuals are to be provided, showing that the mounting system used complies with the module manufacturer's requirements (e.g. location and spacing of mounting clamps on module frames).
8. The bottom of the lowest panel on ground-mounted arrays should be at least 750 mm from ground level, to prevent excessive vegetation maintenance. No live components of the system (e.g. circuit breakers, fuses) are to be installed below 750 mm above ground. The exception is the ground-mounted inverters (where used), which must be installed on concrete plinths on a base of compacted aggregate. The aggregate base must be at least 1.5 m x 1.5 m to prevent vegetative growth over time.
9. Spacing between rows is to ensure that self-shading from the array is minimized (less than 1.5%).
10. The array setback from the perimeter fence shall be at least 5 m, subject to local council requirements.
11. Sufficient space for vehicle access must be provided around transformer stations and RMU's. It is assumed that the internal access shall be designed at a minimum of 4 meters while the external excess shall be as per Local Council requirements.

2.1.6 PV Inverters

PV inverters shall be of string-type with a minimum rated power of 60 kW and a three phase + Neutral AC nominal voltage output of 0.4 kV. The PV inverter shall be selected with respect to local climatic and environmental conditions of each site.

All PV inverters supplied for the projects bid for shall be from the same manufacturer [AA1] .

The Proposer shall install the same series on all sites and preferably the same model (one model is defined by a product reference and a nominal rated power). The Proposer shall use only one model per site; only in exceptional cases, two different models can be installed on the same site.

The PV inverter manufacturer shall comply with the minimum qualification criteria as follows:

- a) More than 5 years of experience in manufacturing PV inverters of string-type
- b) More than 1000 MW annual manufacturing capacity (year before the tender publication)
- c) Manufacturing facilities certified according to ISO9001 and ISO14001

Evidence for each qualification criteria shall be provided in the bid.

The PV inverter model(s) proposed for the project shall have been deployed and in successful operation (ideally in similar environmental conditions) for at least 24 months in commercial financed non-recourse project with a size of at least 10 MWp. Evidence of successful operation of the proposed PV inverter models shall be provided in the bid.

PV inverters shall be equipped with communication capabilities with the Plant’s Programmable Logic Controller (PLC), as required. In particular, PV inverter shall be able to locally and remotely limit their power output to ensure the protection of the Power Conversion System (PCS) and the batteries (e.g. PV inverter output power shall be limited to the level accepted by the charger input of the PCS, especially in case there is no load consumption).

The Contractor shall submit calculations for ensuring electrical compatibility between the selected PV inverters and PV modules to confirm the extent of different losses at the inverter and to ensure that the string voltages lie within acceptable MPPT ranges across the range of operating conditions for the site and for the long-term operation of the project. This technical compatibility shall be also confirmed in written by the Contractor together with the bid.

PV inverters shall comply with the minimum specific technical requirements described in the following table.

PV Inverters - Minimum technical requirements

N°	Parameter	Requirement
1	Technical Characteristics	
1.1	Minimum AC rated power (25°C)	60 kW
1.2	Nominal AC output voltage	0.4 kV, Three phase + Neutral
1.3	Rated frequency	50 Hz
1.4	Maximum DC/AC ratio (ratio between the total DC PV capacity in Wp and the total AC rated power at 25°C of the inverters)	1.2 Technical compatibility between PV modules string configuration and PV inverters shall be confirmed in written along with loss and MPPT range

N°	Parameter	Requirement
		calculations (to be provided with the bid)
1.5	Degree of protection (according to IEC 60529)	IP65
1.6	Maximum Power Point (MPP) operating voltage range	<p>Maximum value: at least 10% higher than the string voltage at the lowest expected module temperature of 10°C</p> <p>Minimum value: at least 10% lower than the string voltage at the highest expected module temperature of 75°C</p>
1.7	Maximum input DC voltage	<p>1,000 V or 1,500 V as required based on inverter size</p> <p>The string voltage at the lowest expected module temperature of 10°C shall be below 1,000 VDC or 1,500 VDC based on inverter size</p>
1.8	Integrated protection functions on DC input	<p>Surge Protection Device</p> <p>Lockable on-load switch disconnecter to isolate PV sub-arrays</p> <p>DC reverse polarity protection</p>
1.9	Communication protocol and capability	Standard protocol (Modbus TCP/IP or IEC 61850 based) compliant with Plant PLC
1.10	Display function	<p>Instantaneous AC active and reactive powers</p> <p>Cumulative energy production</p> <p>Frequency and voltage output</p> <p>DC voltage and current</p>

N°	Parameter	Requirement
1.11	Islanding protection	Required with the possibility to adjust on site minimum and maximum disconnection values for voltage and frequency
1.12	Maximum Efficiency	Minimum 98%
1.13	Euro-efficiency	Minimum 97.5%
1.14	Maximal Total Harmonic Distortion (THD)	3%
1.15	Maximum standby consumption (at night)	3 W
1.16	Ambient operating range without AC power derating	10°C - 45°C or wider
1.17	Maximum permissible value for relative humidity	100%
1.18	Power factor range	Adjustable (e.g., 0.8 leading to 0.8 lagging) Set point can be provided via the PLC Dynamic regulation of the reactive power to be provided
1.19	Cooling system	Active or Passive Cooling system description shall be included in the bid
1.20	Permanent labelling	Serial number (or bar code) Model type and reference Technical data at STC (Rated power, Maximum input current and voltage, input voltage range)

N°	Parameter	Requirement
2	Warranty	
2.1	Product warranty against manufacturing defects	Minimum 10 years The Bidder shall indicate if a warranty extension beyond the minimum value is possible
3	Certification	
3.1	IEC 62109 - Safety of power converters for use in photovoltaic power systems	
3.2	IEC 62116 - Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures	
3.3	IEC 61000 - Electromagnetic compatibility (EMC)	
3.4	IEC 61727 - Photovoltaic (PV) systems - Characteristics of the utility interface	
3.5	Written confirmation from the inverter manufacturer with regard to the PV module/inverter compatibility at site conditions for each PV block. This written confirmation shall state the absence of overload losses	
3.6	PV inverter manufacturing facility certified according to ISO9001 et ISO14001	
3.7	EU declaration of conformity	

The quality of equipment supplied is controlled by the Proposer to meet the overall guidelines for engineering design and installation included in the standards and codes listed above.

All transportation, storage, handling and installation of the inverters shall be in accordance with the specifications from the manufacturer, as to not void the inverter manufacturer's warranty.

The Proposer shall provide the list of spare parts required for the operation of inverters over a 25 year-period according to the manufacturer's recommendations.

1. The number and rated capacity of the inverters must be such that Total PV Array DC capacity < 1.2 x Total Inverter AC output capacity. The sizing of the inverter shall

- determine the operable requirement on the Power Factor as per Nigerian codes.
2. Where available, the inverters are to include a display that allows operators to see how much power is being generated, grid voltage, and output current. The string level monitoring facility shall be made available.
 3. Inverters must be able to be monitored and controlled locally and remotely as per the requirements set out in Control System and SCADA.
 4. The inverter should have a 10-year warranty from the manufacturer (in addition to any contractor warranties). Standard warranties are often 5 years, so evidence of the extended warranty having been purchased will need to be provided when the inverter is ordered.
 5. Inverters must be certified to IEC 62548:2016, all the certifications are to be confirmed through the Factory Acceptance Test (FAT) by the consultant and employer's representatives. The cost for these FATs shall be borne by the proposer.
 6. The installation of the inverter is to be in accordance with IEC 62548:2016 and IEC 62109-1&2

2.1.7 Cables

2.1.7.1 DC Cables and Connectors

DC cables refer to those cables which provide the electrical connection between individual PV modules and PV inverter DC input.

All DC cables and connectors shall be sized, considering at least the following margin factors for current and voltage:

- a. Voltage: $V_{oc} (STC) \times 1.15$
- b. Current: $I_{sc} (STC) \times 1.25$

The Contractor shall design the cable sections in such a way that the cable loss on DC cable circuits from PV modules to PV inverters is **below 1.5%** (at STC conditions). Calculations shall consider ambient temperature or conduit derating factors. Evidence of a detailed wiring loss analysis and calculation shall be submitted during the detailed engineering phase.

DC cable strings and main DC cables shall be selected and installed in such a way to prevent the risk of leakage currents. Unipolar single-core conductors with double insulation specific for PV installation shall be used. Cable insulation type shall be weather resistant (UV, ozone) and shall comply with EN 50618. Two different colours are preferred to be used to easily distinguish the positive and negative poles.

DC cables and connectors shall comply with the minimum specific technical requirements described in the following table.

Table 5: DC Cables and Connectors - Minimum technical requirements

N°	Parameter	Requirement
1	Technical Characteristics	
1.1	DC rated voltage	1,000 V minimum
1.2	Insulation and jacket material	Cross-linked compound (e.g., XLPE) Halogen free Flame retardant Double insulated – Class II UV, ozone and weather resistant
1.3	Type of conductor	Copper Single core Flexible for outdoor installation
1.4	Operating temperature range	-20°C ... 90°C
1.5	Section	≥ 4 mm ² and to be defined according to the maximum acceptable DC cable loss of 1.5% (at STC conditions)
2	Certification	
2.1	EN 50618 - Electric cables for photovoltaic systems	
2.2	IEC 62852 - Connectors for DC-application in photovoltaic systems - Safety requirements and tests	

All cables shall be fastened adequately to avoid swinging and tension. Insulation and resistance measurements shall be carried out after every cable installation in order to locate any possible faults. DC cables shall be installed in such way to avoid direct exposure to the sunlight. The area inside DC cable loops shall be kept as small as possible to reduce the induction of unwanted voltages and currents, for example due to lightning strikes.

DC cabling between the PV array and the building shall be underground (or in closed metal cable ducts for rocky environment) and installed in compliance with local requirements for underground installations, with the use of adequate conduits for transitions “entering” and “exiting” the cable trenches. Mechanical

protections of the underground cables shall be provided according to industry-standard practices, with a special attention when they cross vehicle roads. For installations in building, DC cables shall be fixed in cable trays which shall be durably mounted and shall include mechanical protections from damage rodent attack, weathering and UV radiations.

DC connectors shall have protection against direct contact (class II), designed to avoid corrosion (type MC4 or equivalent) and be weather resistant (\geq IP65 rated). DC connectors shall be from the same manufacturer throughout the whole PV System and be compatible with the original PV module connectors (proof of this compatibility shall be provided by the Contractor during detailed engineering phase). DC connectors shall be certified by an independent laboratory to prove compliance with IEC 62852 - Connectors for DC-application in photovoltaic systems - Safety requirements and tests.

2.1.7.2 AC Cables

AC cables connect (in low voltage 0.4 kV) the AC output terminals of the PV inverters to the AC Combiner Cabinet and from the output of the AC Combiners to the LV side of the respective Transformers in the respective Power Stations.

The Contractor shall design the AC cable sections in such a way that the voltage loss between PV inverters output and the AC Combiner Cabinet is **below 0.5%** (calculated at nominal power of the PV inverters). Additionally, the cable loss between AC Combiners and LV input of respective transformers should be kept **below 1.5%**. The calculations shall consider any ambient temperature or conduit derating factors. Evidence of a detailed wiring loss analysis and calculation shall be submitted during the detailed engineering phase. The minimum cable sections should be 25mm² Aluminium between Inverter and AC Combiner and 70mm² Aluminium between AC combiner and Power Stations.

The Contractor designs, manufacturers, supplies and installs all cables for the required design life of 25 years under the prevailing site environmental conditions. Cable works is designed and installed in accordance with the latest edition of all applicable codes, standards and recommendations.

AC cables shall be fastened adequately in cable trays to avoid swinging and tension and durably mounted in such a way to have a mechanical protection against damage rodent attack, weathering and UV radiations. The cables shall be uniquely numbered to facilitate later traceability and fault location. Circuits and cables are planned and installed to ensure accessibility and ease of maintenance.

AC cable characteristics shall comply with requirements and recommendations of the PV inverter manufacturer.

1. No cabling is to be exposed to direct sunlight, even if sheathing is marked as being UV- stabilized. All cabling that may be exposed must be routed through UV-stabilized conduit.
2. All cables under modules shall be protected from inadvertent contact with passing maintenance personnel. This may be achieved by routing the cabling on the underside

of the mounting rails, or through a cable tray, trunking or conduit. Care must be taken to minimize direct exposure to sunlight when cables pass between modules.

3. Heavy-duty conduit must be used for any cabling installed below a height of 750 mm. This is to prevent damage while maintaining vegetation.
4. Plastic cable ties, where used, must be protected from both direct and reflected UV radiation. Any cable ties used in UV exposed locations must be stainless steel.
5. All cable terminations are to be crimped or use a solar connector (e.g., string inverter DC input).
6. Details of how the cable will be run (i.e. description and drawings) are to be provided.
7. Where flexible conduit is used, care must be taken to prevent tracking of water down cabling into the conduit. The preferred method is to have conduit entries facing downwards, as water will not be able to track upwards into the conduit. Plugging the conduit entry with silicone is not an acceptable long-term solution.
8. The communication and power cables will need to run in individual conduits that are physically separated by 300 mm for the entire cable run.
9. PV cabling at the array must be installed such that inductive loops are minimized in order to minimize voltage spikes caused by inter-cloud lightning strikes.
10. All cables must be colour coded to comply with the Nigerian regulatory provisions (Red, Yellow, Blue & Black for neutral for AC systems, Red and Black for DC systems, green/yellow for earthing/grounding)
11. Confirm whether additional lighting protection (e.g. lightning rods) is required at the array. The assessment is to be done in accordance with IEC 62305.
12. Outdoor isolator enclosures and junction boxes are to be rated IP65 and resistant to UV damage and UV transmission to the components inside. Isolator enclosures must also be sheltered from direct sun and rain by the array or an awning. Isolator enclosures must be of a robust material resistant to bending under pressure and designed for operation in hot environments.
13. Enclosure covers are to be capable of being easily installed and removed multiple times from the enclosure body without damage (e.g., damage caused by stripping mounting holes in the enclosure body with over tightening of the enclosure cover screws).
14. Isolator enclosures are to be fitted with a clear window, so operators can easily verify the on/off state of the isolators inside.
15. Enclosures are to be easily opened for switch access without the use of a key or other tool, as keys or tools may not be readily available in emergencies. Site access will be restricted to relevant staff.
16. All outdoor enclosure cable entries are to be done from the bottom, to prevent water ingress. Care is to be taken in preventing water entry into conduits.
17. Quality of switchgear, isolator enclosures and other balance of systems components will be considered in the design review, as poor-quality BOS components can jeopardize the long-term viability of a project.
18. Permanent labelling is required to identify all major components including circuit breakers, isolators, fuses, lightning arrestors, and inverters meeting requirements of IEC 61293
19. It is expected that Transformer Stations will be provided for the solar plant with the PV array located as near as possible to the transformer stations.

- 1) An earthing study will be required for the design and installation of the earthing grid at the array. This study is to be submitted to REA four weeks prior to installation of the transformer(s).
- 2) Where in doubt regarding equipment design, relevant Nigerian MV standards are to prevail. Lighting is required at the transformers, and a fence provided with danger signs at appropriate sections around the transformer farm.
- 3) Transformers are to be outdoor-pad mounts with LV protection. MV protection is to be provided by the substation RMU, as fault currents on the MV line will come from the outgoing feeders, not the PV system.
- 4) 11kV underground cabling is to be used for connection of the transformer stations, RMU's and the 11kV substation shall comply with relevant Nigerian codes and standards.

2.1.8 Metering

The Contractor shall install a power meter panel at the 11kV interconnection point. The energy meter shall store data onboard and must be capable of logging data on a per second basis. It will record at a minimum; voltage, frequency, current, real, and active power and power factor of the plant generated electricity.

2.1.9 Control System and SCADA

1. Using an inverter manager / inverter controller or Power Plant Controller (PPC) the PV plant shall be able to be monitored and controlled. The PV system must be capable of receiving and executing the following commands:
 - Connecting to the network.
 - Disconnecting from the network.
 - Limiting active power to a set point.
 - The ability to control the ramp up rate of active power generation will be considered an advantage.
 - The ability to inject and absorb reactive power will be considered an advantage.
2. The inverter controller shall have a data communication port of either serial ports or ethernet ports. Ethernet ports are the preferred but available serial ports should have provisions for port converters or network adapters which can easily connect with the data communication system at the substation, allowing remote control and remote monitoring of the PV systems using the SCADA system. Remotely monitored data must also be available via the internet.
3. A SCADA system shall be integrated in the plant to view data from the plant in real time and download at a minimum of 15-minute averages. Data shall be collected from:
 - Inverters (DC voltages, currents, AC voltages, currents and power factor, frequency)
 - Transformers (temperatures, levels, alarms, etc.)
 - Meters (KVar, KVAh, kWh)
 - Weather Monitoring sensors

4. The plant SCADA system shall comply with TCP/IP & DNP 3 & IEC 61850 & IEC 60870-5-101/104 protocols and compatibility with features of IoT & RIoT is considered a plus. The certifications shall be confirmed through Factory Acceptance Test (FAT) by the employer's representative; the cost for the FAT shall be borne by the proposer.

2.1.10 Weather Monitoring Systems

A weather station shall be installed on each site with the following sensors (minimum requirements):

- a) Two (2) high accuracy calibrated solar reference cells installed within the PV array on the module plane of array with the same technology and type as installed PV modules. The calibration of the reference cell shall be performed according to IEC 60904-2: Photovoltaic device – Part 2: Requirements for reference solar devices;
- b) Two (2) thermal sensors (Pt 100 class B according to IEC 60751) to measure module surface temperature with a measurement resolution up to $\pm 1^\circ\text{C}$ installed at the back sheet of two PV modules (not on the modules located at the extremity of a row);
- c) Two (2) horizontally mounted and completely unshaded calibrated pyranometers to measure the global horizontal irradiation according to Secondary Standard as stipulated in ISO 9060;
- d) One (1) shielded ventilated thermocouple to measure the ambient temperature with a measurement accuracy of $\pm 1^\circ\text{C}$ (Pt 100 class B according to IEC 60751);
- e) One (1) wind speed and wind direction sensor;
- f) One (1) relative humidity sensor; and
- g) One (1) rain gauge.

The weather station shall be able to store locally up to 2 GB of historical data. All cables of the weather station shall be shielded and UV resistant.

All components of the weather station, such as Datalogger, GSM modem, power supply, electrical protections, etc. shall be hosted in a cabinet rated IP65 designed to comply with environmental site conditions.

All signals measured by the weather station shall be transferred to the PLC and shall be synchronized and visualized on the main interface of the PLC. Interface shall be Mod bus TCP/IP, Profibus or IEC 61850. Before installation, the Contractor shall provide recent and valid calibration certificates of all meteorological sensors included in the weather station.

2.1.11 Earthing and Grounding

All metallic parts of the PV System (PV module frames, mounting structure, enclosures of PV inverters and boxes when applicable) shall be grounded and connected to the main earthing system of the Hybrid Power Plant. The earthing system aims to ensure the functionality of electrical protection equipment during electrical faults and to eliminate the risk to personnel or animals of electric shock under normal operating conditions as well as fault conditions. The contractor shall ensure that the measured earthing resistance and all protection schemes should be in accordance with IEC 62548:2016 and IEC TR 63227

respectively. The Contractor shall always ensure that the proper earthing of the PV System is in accordance with PV industry best practice and he shall take every step to keep the earthing resistance lower than the maximum threshold.

The PV modules shall have equipotential bond with the mounting structure. Several options enable the earthing of the PV module frame, in all the cases, the Contractor shall prove that it is done in respect to the recommendations of the PV module manufacturer and Inverter Manufacturer if it follows Earthing provisions in Chapter 11 of the NESIS Regulations 2015, as well as other relevant sections of the NESIS Regulations 2015, IEC 62548:2016 and IEC TR 63227.

Two adjacent parts or frames of the mounting structure of the same row shall be connected through equipotential bonds which shall be fixed by using existing holes or bolts on the metallic structures. In all cases, the anti-corrosion protection of the structure shall not be damaged. Attention shall be paid to avoid electrolytic coupling. Marginal lengths of wires used in equipotential bonds shall be left to allow for expansion/retraction of structures with temperature changes.

Two adjacent rows of mounting structures shall be also connected using buried copper cable of at least 35 mm² section (section to be confirmed during detailed engineering phase) which shall be laid at the bottom of all the trenches in order to be in direct contact with the soil. Table 11.6.4 of the NESIS Regulations guides in the sizing of earth conductors, see Nigerian Electricity Supply and Installation Standards Regulations 2015 (nems.gov.ng).

The main earthing conductors installed within the PV array shall be connected to the main earthing system of the building where all electrical equipment is installed. The main earthing conductor coming from the trenches shall enter directly in the electrical buildings to be connected to the earthing electrodes. The perimeter fence shall also be connected to the earthing system (intervals to be defined during detailed engineering phase).

Before construction, the Contractor shall submit the overall earthing system design at the hybrid power plant level and associated calculation notes, including minimum sections of the main earthing conductors to be installed within the PV System (type and quantity of earthing rods, earthing conductor sections, etc.).

It shall be noted that the mounting structures cannot be considered as earthing electrodes.

2.1.12 Lightning Protection System (LPS)

The Contractor shall carry out a risk assessment according to IEC 62305-2 for lightning and install an adequate LPS to protect the PV System against direct and indirect (overvoltage) potential damages caused by lightning strikes.

The LPS shall be of the enhanced type which is designed to protect equipment from the damaging effects of lightning strikes and safely convey the lightning energy to ground with minimal risk of side flashing via a pre-determined route. The complete lightning protection system will comprise the following key components:

- a) Air-termination rods: intended to intercept lightning flashes within the PV array and on the building(s) to be constructed, if needed.
 - The material of the air-termination rod shall be Aluminium. The minimum thickness of the 1-meter arrester rod shall be 10 mm
 - The air-termination system shall have as few joints in it as possible. Where joints are necessary, they shall be mechanically and electrically effective and shall be so made as to exclude moisture completely
 - The upper extremity of the air-termination rod shall be pointed for better capture of lightning.
 - All accessories of the air-termination system shall be made of stainless steel
- b) Down conductor system: bare copper conductor intended to conduct lightning current from the air-termination system to the earth-termination system. Section shall be determined during detailed engineering.
- c) Earth-termination system: intended to conduct and disperse lightning current into the earth with the use of earthing electrodes. The earth-termination system shall be designed according to the requirements specified for the overall earthing system, especially regarding the length, diameter and material of the electrodes as well as regarding the requirements for the pit inspection.
- d) Surge Protection Devices (SPD): intended to limit transient overvoltage and divert surge current. SPD are to be compliant with IEC 60099-4 provisions on Surge Arresters. SPD are to be installed in Inverter DC Boxes and in the AC Combiner Cabinet. SPD types (type I or II), voltage protection level, discharge current capacities and short circuit ratings shall be defined according to the whole PV System and LPS design and results from the risk assessment to be conducted by the Contractor at the plant level.

The proposed LPS shall not cast any shadow on the PV modules.

Together with the earthing system design, the Contractor shall submit during detailed engineering phase, calculation notes and technical justifications on the proposed LPS design and selected components to ensure compliance with IEC 62305.

2.1.13 Tools and Spares

The following table provides a breakdown of the minimum stock of spare parts and special tools to be provided by the Contractor and be made available for the PV System before the final handover of the project (Final Acceptance Test).

Notes:

- a) The list of spares is presented prior to Operational Acceptance and spares are available all time on site during the Defects Liability Period (if applicable, to check).
- b) The Contractor is responsible for compiling and maintaining the spare part inventory during the Defects Liability Period at its own cost.

- c) The list of spares is transferred to the Employer prior to the issue of a Final Acceptance Certificate.
- d) % unit in table below represents the % of total installed quantity of such items in the PV System.
 - If % of required value is lower than 1, then the minimum number of such item/equipment in the inventory shall be 1
 - % of required value shall be rounded up

2.1.13.1 Spare Parts for PV System

No.	Spare Part	Proposed Quantity	Remarks
1	PV modules	1% of installed modules, with min. 10 units per model	
2	PV Inverter	2% of installed capacity, with min 1 unit for each inverter model	Additionally, recommended list of spare components from the inverter manufacturer (to be detailed within the bid)
3	DC SPD	5% of each type With a minimum of 2 pieces of each type installed	
4	DC Fuse holder	5% of each type	
5	DC Fuse	10% of each type	
6	DC switch	2% of each type With a minimum of 2 pieces of each type installed	

No.	Spare Part	Proposed Quantity	Remarks
9	DC cable	50 meters of each type	
10	Pair of DC connectors (male + female)	20 pieces of each type	
11	AC circuit breakers (AC Combiner Cabinet)	1 piece of each type	
12	AC SPD	5% of each type with a minimum of 2 pieces of each type installed	
13	Bi-metal washers	20 of each type	
14	PV Modules clamps and screws and bolts	12 of each type	
15	AC cables	10m of each type	
16	Communication cable	50m of each type	
17	Bare copper cable	10m of each type	
18	Other connectors	5% of each type	
19	Cable tray	5m	
20	One calibrated reference cell	1 pc	
22	Module temperature sensors	2 pieces	

2.1.13.2 Tools for PV System

No.	Tools
1	Set of electrical tools as required for inverter maintenance and replacement
2	Set of mechanical tools including any for maintenance of mounting structures
3	Set of electrical tools including special tools for repair and replacement of cables and connectors
4	Digital multimeter (incl. clamp meter), suitable for DC voltage and current measurements (1000 VDC)
5	Set of tools required to clean the PV modules
6	Portable Flashlight + headlamp

2.1.14 Perimeter Fence System

Post:

1. Post shall be, 3.8m long Taper Locking Post.
2. Post width shall be 85mm - tapering to 45mm with a depth of 85mm.
3. Post shall include a 'Locking Recess Mechanism' to secure the panel edge
4. Post shall be sealed with a UV stabilized polymer cap.
5. Post finish shall be galvanized.

Panel (including Concertina coil):

1. Panel shall be of 3.305m width and 2.4m in height with spikes.
2. Panel aperture size (centres) shall be 76.2mm x 12.7mm.
3. Wire diameter will be 3mm.
4. Every second vertical line wire is replaced by a 12mm reinforced flat bar. This is to prevent penetration with sophisticated tools.
5. The panel shall be reinforced with 4 x 50mm deep 'V' formation horizontal recessed bands

(rigidity)

6. Panel shall have 2 x 70° flanges along sides (internal fixtures- all fixtures shall be on the inside of fence line)
7. Panel shall have 1 x 90° flange along top and 1 x 30° flange along toe (integrated rigid angle, anti-scale locking device).
8. Panel posts shall have a flush panel post finish with no climbing aid.
9. Panel shall be affixed to post over 48-line wires using 8 x Double bolt comb clamps and 8 x Single bolt comb clamps using 24 x Anti vandal bolts.
10. Panel and fixtures shall be galvanized.
11. Panel Post connection minimum break force.

Additions

Toppings: Ø730mm RIPPER CONCERTINA COIL: NATO 5660-99-371-1515

FEATURES

1. **Visibility:** Highly transparent/ unobtrusive
2. **Finish:** Flush Post-Panel Finish
3. **Posts:** 48mm x 85mm Taper Locking Post (TLP)
4. **Apertures:** 76.2mm x 12.7mm which makes it too narrow for fingers or foot holds- “Anti-cut & Anti-climb”. Every second vertical line wire is replaced by 12mm reinforced flat-bar. This is to prevent penetration/breach with sophisticated tools.
5. **Internal fixtures (Anti-Vandal):** All locking fixtures are internal, hidden from view and protected from attack.
6. **Coating Technology:** Galvanized, to offers a 25-years maintenance-free lifespan of the fence system (Under normal conditions).
7. **CNI Compliant:** 48-line wire panel to post connection, Critical National Infrastructure (CNI) complaint.

2.1.15 Advanced Metering Infrastructure (AMI)

This specification outlines the requirements for the advanced metering infrastructure (“AMI”) software that shall operate with compatible single- phase and three-phase electricity meters with telemetry and data logging capabilities to support an electricity supply service. The total number of meters estimated per site including buildings and substations is presented in table 6 below.

The AMI software shall be provided as Software-as-a-Service (SaaS) and be operated on a cloud-based computing platform.

The compatible meters shall contain the measuring element, relay switch, and comply with the requirements of the relevant standards. The relay switch shall be used to disconnect or reconnect customers based on the status of their available prepaid account credit balance or as the utility requires as part of

managing the electricity distribution network. The relay switch shall be capable of operating over the life of the meter. The meter shall be capable of being remotely operated by, and communicate with, the AMI.

Table 6: Total Number of Meters per Site

	MAU Yola	FUDMA	FU Lafia	FU Lokoja	FUTA	FU Uyo	FUTO	UNIPORT + TH
Approx. no of meters	873	186	220	170	328	276	2195	3510
Approx. no of bulk meters in Sub station	1	1	1	1	1	1	1	2

The complete AMI infrastructure shall undergo a Factory Acceptance Test by the employer’s representative, the cost of which shall be borne by the proposer.

1. For deployment in EEP Programme, the AMI shall provide for monitoring of energy use by:
 - consumers who must pay for the energy they use, as well as for
 - energy used by consumers who do not need to pay for the energy they use.
 - The AMI must also be able to provide a free power allocation to certain consumers, who then must pay for additional power they use above the allocation.

Communications between the meter and the AMI shall take place either via a local data concentrator unit (“DCU”) or a similar device, or directly to the AMI, and shall make use of radio frequency and/or power line carrier communication (“PLC”) and GSM wireless technologies and the internet.

The product shall conform in all respects to high standards of engineering, design and workmanship and shall be performing in continuous commercial operation in a manner acceptable to the Employer. The offered material shall be complete with all components necessary for their intended purpose.

2. Applicable Standards for Communication between the AMI and the compatible meters

- IEC 60256 - Electricity metering data exchange - The DLMS/COSEM suite

3. Requirements for the AMI

The Employer requires the EPC Contractor to key into the existing smart metering⁴ platform to ensure protocol compatibility and a unified AMI platform across all the EEP Projects. The platform follows the AMI Specifications as defined in this section.

EPC Contractors are required to provide any hardware for integration of the meters with the platform, ensure all metering equipment is fully interoperable with the metering platform and provide all the functionality required by the Employer as outlined in these Technical Specifications. EPC Contractor will also be responsible for all costs and fees associated with the deployment and operation of this platform for a minimum period of one (1) year.

Proposers are advised to engage with the AMI platform service provider.

⁴ Website: www.steama.com (Email: eep@steama.co)

2.1.15.1 Software-as-a-Service

The AMI shall be cloud-based software, provided as a service (SaaS). The associated cost of software purchase and maintenance cost shall be borne by the proposer for the contracting period.

The AMI shall be accessible through a secure web browser interface.

The vendor shall maintain service uptime to >99.5% and provide advance notifications to the utility of scheduled downtime (for maintenance and/or implementing upgrades and/or improvements).

2.1.15.2 Remote Operations

The AMI shall provide for the remote monitoring of energy use and power quality metrics, both for metered consumers and for monitored consumers.

The AMI shall provide for the remote switching of meters (both bulk and individual switching of meters) and to set power limits.

It shall be possible for the utility to configure data logging and reporting intervals through the AMI.

Logging intervals for meter readings and power quality metrics shall be capable of being set to different intervals.

The AMI shall allow for the remote configuration of equipment (DCUs and meters).

2.1.15.3 Reporting

The AMI shall provide downloadable reports covering:

[Section VII: Employer's Requirements](#) _____ Page

1. Anomalous and suspicious readings
2. Equipment uptime
3. Alerts

Reports shall be available to download in Comma Separated Values (“CSV”) format, and/or viewed in charts. The AMI shall provide the means to create and edit charts as needed.

Alerts shall be possible to be sent also by email and SMS, configurable by the utility.

2.1.15.4 Tariffs and Billing (Tariffs in this sense means a collection needed to run the plant sustainably)

The AMI shall support a variety of tariffs, including, but not limited to:

1. Flat rate
2. Free power allowance
3. Credit bundles
4. Minimum top-up
5. Time-of-use
6. Hybrid tariff
7. Connection fee
8. On-bill financing
9. Dynamic power limits

The AMI shall be capable of adding additional tariffs as may be needed in the future.

The AMI shall support the following methods of billing for energy use, configurable per consumer:

1. Prepaid billing
2. Postpaid billing
3. [Free power allocation (the allocation is configurable by the utility per consumer per month), once the allocation is used, the consumer will automatically switch to prepaid billing during the remainder of the term (i.e., they must purchase credit to use additional power).
4. No billing (only monitoring of energy use).

The AMI shall record all energy use charges in an indelible ledger.

Add End User Smart Meters here or in a separate section.

2.1.15.5 Payments

The AMI shall record payments made by customers by cash, electronic cash transfers such as payments by USSD, Point of Sales (POS), payments by fintech and/or other vending systems that are interfaced with the AMI.

The utility is to provide details to the vendor of other vending systems that they wish to interface with the AMI. The vendor is to include the interface within their proposal.

The AMI shall record all payments by each consumer in an indelible ledger.

2.1.15.6 Loss Protection

The AMI shall provide for methods to detect and locate incidences of technical and non-technical losses and provide alerts to when a loss is identified. The AMI shall provide a method of directing maintenance technicians to investigate the identified loss and to record the successful resolution of the cause of the loss.

The AMI shall provide methods to prevent fraudulent activities related to billing, payments, loss detection and loss resolution.

2.1.15.7 Metrics

The metering hardware under operations shall have immunity against current harmonics, undervoltage and over voltages as well as surge and interruptions. It shall have protection against mechanical, electrical, thermal, fire and external radiations. This shall generally comply with the following standards: IEC 61000, IEC 63053, EN 60755 and other industry codes and standards for low voltage instrumentation equipment and devices.

2.1.15.8 User Interfaces

The AMI shall provide a user interface.

The user interface shall be by means of a web browser on any computer or laptop with internet access and interface. The browser should be open-source system with support for Graphical User Interface (GUI)

User access to the AMI user interface shall be by password authentication. In addition, access to both user interface functions and privileged functions shall be granted by the system administrator.

2.1.15.9 System Interfaces

It shall be possible for the AMI to interface with other systems by means of a RESTful Application Programming Interface (“API”), with full documentation for the API provided.

All data held by the AMI shall be securely accessible by other systems via the API.

Other systems shall be able to send commands to the equipment through the AMI via the API (e.g., meter switching commands).

Other systems shall be able to update equivalent AMI records via the API:

1. CRM systems can update customer information in the AMI
2. Vending systems or mobile money systems, USSD payments can provide payment information to the AMI, which will then update the customer’s account balance.

2.1.15.10 Site Management

The AMI shall allow for the management of sites, including:

- Configuration of site name, location, and time zone.
- Settings applicable site-wide, including tariffs, time of use pricing, usage tiers and messaging preferences.
- Registration of DCUs and meters installed on site.
- Linking consumer accounts to one or more meters on site.
- Locations of equipment on site, providing a map view of equipment and operational metrics obtained from each device.

2.1.15.11 Consumer Management

The AMI shall allow for the management of consumer accounts, including:

- Configuration of customer name, location, and time zone.
- Configuration of customer mobile phone number (or unique reference number if no mobile phone).
- Preferred language for communications

- Account configurations
 3. Type of account (configurable by utility)
 4. Tariff applied
 5. Account balance credit
 6. Time of Use pricing
 7. Assigned or linked meters

2.1.15.12 Equipment Management

The AMI shall be capable of recording all equipment (meters and DCUs) installed on site(s). Information recorded per piece of equipment shall be, at minimum:

1. Name of equipment.
2. Make/model and serial or unique reference number.
3. Location coordinates.
4. Uptime statistics.
5. Configurable parameters.
6. Utility notes and/or labels
7. For meters, also:
8. Line status (On/Off)
9. Power limits
10. Time of use power limit policy
11. Last meter reading date/time stamp
12. Parent (bulk) meter

Configuration of equipment shall be possible by the AMI, including, but not limited to:

1. Time synchronization
2. Data receiving and transmission schedules

2.1.15.13 Data and Data traffic management

The AMI should support the efficient management and storage of data.

The AMI should support traffic prioritization, filtering, shaping etc. and efficiently handle the volumes of data that will potentially be transmitted or received by the AMI.

2.1.15.14 Privacy standards

The AMI must comply with the Nigerian Data Protection. Regulations 2019. It shall also comply with radio frequency use regulations as provided by the National Frequency Management Council (NFMC), Nigerian Communications Commission (NCC), Nigerian Information Technology Development Agency and other related National Regulatory Agencies.

It shall not be possible for a user or consumer to access metrology firmware on a meter via the AMI.

Access to consumer data held by the AMI must be restricted to authorized users only.

2.1.15.15 Data Receiving and Transmission

The DCU or meter shall send data to the AMI according to a configurable schedule. The DCU or meter will respond to configurable schedule requests or on-demand requests from the central system.

2.1.15.16 Meter fault conditions

Meter fault occurrences shall be automatically uploaded to the AMI for notification to the Utility's engineers.

Meter fault conditions to be reported and alerted on, are:

1. Incorrect meter calibration values.
2. Meter is not metering due to incorrect configuration.
3. Corrupt data on the storage device had to be recovered.
4. Meter tamper switch activation.
5. Other fault conditions, as are available to be reported by the meter.

2.1.16 Data Concentrator Unit (DCU)

2.1.16.1 General Requirements of the DCU

The DCU shall send and receive communication from the meter using a Long Range (LoRa) low power radio transceiver or an equivalent free-to-use, unlicensed, long range, wireless communications method. Alternative methods of communication to/from the meter, such as PLC or RF Mesh Network, are acceptable, and provide details of the method proposed to be used.

The DCU shall be capable of communicating with the cloud-based meter management software by means of the GSM mobile telephone network via GPRS data and/or SMS and shall incorporate a GSM sim card for this purpose. All the cost associated with this provision shall be borne by the proposer for the contracting period.

The DCU must be capable of obtaining data from meters multiple times per day, preferably once per hour. The frequency of data collection from the meters should be configurable by the utility.

The DCU must be capable of uploading metering data to the cloud-based meter management software once per hour preferably, and, at minimum, once per day. The frequency of data upload should be configurable by the utility.

The DCU must be capable of securely storing all meter data from multiple meters for a period not less than 30 days, in the event of a GSM communications outage that prevents the DCU from uploading the metering data to the cloud-based meter management software.

2.1.16.2 Applicable Standards for Compatible Meters

- IEC 60256 - Electricity metering data exchange - The DLMS/COSEM suite
- Certified as approved meters as per the Nigerian Metering Code
- IEC 62052-11:2003 Electricity metering equipment (AC) - General requirements, tests, and test conditions - Part 11: Metering equipment
- IEC 62052-11:2003 Electricity metering equipment (AC) - General requirements, tests, and test conditions - Part 11: Metering equipment
- IEC 62053-21:2003 Electricity metering equipment (AC) - Requirements - Part 21: Static meters for active energy classes 1 and 2
- IEC 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use – General requirements
- EN 50665:2017 Generic standard for the assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0Hz - 300GHz)
- IEC 61326-1:2012 Electrical equipment for measurement, control & laboratory use – EMC requirements.
- ETSI EN 301-489-1, -3 EMC standard for radio equipment and services.

01.Part 1 Common technical requirements

02.Part 3 Specific conditions for short range devices operating in the range 9kHz to 40GHz

03.Part 17 Specific conditions for broadband data transmission

systems

04. Related tests include:

05. EN 61000-4-11 (IEC 61000-4-11) Voltage Dips - AC Mains

06. EN 61000-4-6 (IEC 61000-4-6) Conducted RF Immunity - AC Mains

07. EN 61000-4-5 (IEC 61000-4-5) Voltage Surges - AC Mains

08. EN 61000-4-4 (IEC 61000-4-4) Fast transient bursts – AC Mains

09. EN 61000-4-3 (IEC 61000-4-3) Radiated RF Immunity - Enclosure port

10. EN 61000-4-2 (IEC 61000-4-2) Electrostatic Discharge - Enclosure port

11. EN 61000-3-3 (IEC 61000-3-3) Limitation of voltage changes and voltage fluctuations and flicker impressed onto public low voltage supply system

12. EN 61000-3-2 (IEC 61000-3-2) Limits for harmonic current emissions injected into the public supply system (AC power port)

- ETSI EN 300 220-2 V3.1.1 (2017-02) RF testing of the LoRa device. Frequency range 865 to 869.5MHz, single channel operation.

The meter reliability prediction must conform to the following standard:

- IEC 62059-41:2006 Electricity metering equipment - Dependability – part 41: Reliability prediction

2.1.16.3 General Requirements for the Meter

The meter must be a class 1, active and reactive static electricity meter for 2 wire single phase electricity or 4 wire three phase electricity with energy flow in the positive direction only. It must be type tested to the International Electrotechnical Commission (IEC) metering standards IEC 62052-11 and IEC 62053-21. The vendor must confirm that each subsequent meter is manufactured according to the same procedures and standards as the devices submitted for type testing.

Functional capability of the meter must include load limiting and energy dispensing through pay-as-you-go credit control. In the event of cover and/or terminal cover removal, an anti-tamper device on the enclosure cover must alert the utility.

The meter should send and receive data through:

1. a long-range low power Radio Frequency (RF) transceiver that communicates with a data concentrator unit (DCU)
2. or through power line communication (PLC) with a DCU
3. or through a low power radio frequency (RF) mesh network transceiver that communicates with a data concentrator unit (DCU)
4. or directly with the AMI via GPRS using a GSM modem and SIM card.

The meter must minimize the amount of data that will be sent via GSM mobile networks to avoid excessive communication charges.

The meter casing shall be a polycarbonate case and the terminal cover has a V0 flammability rating (non-ignitable and fire retardant) providing protection against electric shock, the spread of fire, mechanical hazards, and stresses.

The device shall provide double insulation, protection class 2, avoiding the need for an earth.

The case shall be able to withstand mechanical shock, vibrations, and impact according to IEC 62052-11

To prevent the removal of power supply wiring, the terminal cover shall be fitted with a terminal cover screw containing an aperture for a wire seal, and an anti-tamper switch.

The enclosure cover shall be fitted with non-removable anti-tamper plugs, a warning label, and an anti-tamper switch.

2.2 Energy Storage System (ESS)

2.2.1 General

1. The system shall conform to the following specification.

ESS shall consist of:

- i. A power conversion system (PCS) suitable for outdoor installation on a concrete pad or the box pad.
- ii. An energy storage unit of suitable capacity for the site in question.
- iii. Lithium-ion battery or other newer technologies with life expectancy rating of above 10 years under normal operating conditions, suitable for outdoor installation, and a battery management system (BMS/ESMS).
- iv. Specification requirements of the PCS are further discussed in PCS section below. Specification requirements of the energy storage unit and BMS/ESMS are further discussed in the sections below, respectively.

2. Electrical grid connection

The ESS shall be connected to the medium voltage distribution line at a frequency of 50Hz. A step-up transformer shall be provided to allow connection between the ESS and the distribution line compliant with NEMSA regulations. The proposer shall provide and make a connection power cable between ESS and the substation. Rating of a step-up transformer and the winding type of transformer can be specified by the proposer.

3. Operation

In normal operation, ESS shall operate in current-source mode, providing such functionality as voltage regulation, power factor correction, peak shaving and load following (for PV output smoothing). It shall have the ability to perform four- quadrant control.

4. Communications

- i. The ESS shall be capable of communicating over a standard protocol, such as DNP 3.0 over IP or IEC61850 protocol, furnished and installed by the system manufacturer. This will allow monitoring and control of such parameters as battery voltage, current, temperature, state of charge and state of health at the cell/module/tray and rack levels; as well as allow control charging, discharging and other functions of ESS, as necessary.

- ii. The PCS shall communicate with the energy storage unit controller via a standard protocol defined by the vendor, e.g., Modbus RTU or Modbus TCP, etc. In case of Modbus communication, all Modbus details shall be provided.
- iii. The ESS shall have a maintenance port (serial, Wi-Fi, Bluetooth, etc.) to allow monitoring and control of the ESS at local level via a PC.
- iv. The ESS shall have security access for maintenance of battery containers.

2.2.2 Design Report

The Contractor shall submit as part of its bid a detailed report to justify that the proposed design for each BESS complies with the minimum performance level specified in the present specification.

2.2.3 Manufacturer Qualification Requirements

2.2.3.1 PCS Manufacturer

The PCS manufacturer shall comply with the minimum qualification criteria as follows:

- a) More than 5 years of experience in manufacturing PCS for similar applications
- b) Manufacturing facilities certified according to ISO9001 and ISO14001

Evidence for each qualification criteria shall be provided in the bid.

The proposed PCS shall have been deployed and in successful operation (ideally in similar environmental conditions) for at least 24 months months in 3 different projects of 2000 kWh or more in the past 3 years. Evidence of successful operation of this PCS shall be provided in the bid together with the list of references.

2.2.3.2 Battery Manufacturer

The battery manufacturer shall comply with the minimum qualification criteria as follows:

- a) More than 5 years of experience in manufacturing battery
- b) More than 2 GWh annual manufacturing capacity (year before the tender publication)
- c) Manufacturing facilities certified according to ISO9001 and ISO14001
- d) The batteries must have been used in at least 3 different projects of 2000 kWh or more in the past 3 years, which have received non-recourse debt financing by 3 different banks

- e) Manufacturers need to own production facilities and the brand name

Evidence for each qualification criteria shall be provided in the bid.

The proposed battery model shall have been deployed and in successful operation (ideally in similar environmental conditions) in one of the above 3 projects for at least 24 months. Evidence of successful operation of this battery model shall be provided in the bid together with the list of references.

2.2.4 Standards and Codes

Equipment furnished shall meet the guidelines defined in the applicable sections of the standards and codes listed below.

- ANSI/IEEE Standard C2-2007: National Electrical Safety Code
- ANSI C57.12.28-2005: Pad-mounted Equipment Enclosure Integrity
- ANSI Z535.4-2002: Product Safety Signs and Labels
- ANSI C62.41.2-2002: IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000V and Less) AC Power Circuits
- IEC 61000: Electromagnetic compatibility (EMC)
 - EN 61000-6-2 EMC immunity
 - EN 61000-6-4 EMC emission
 - Reference - FCC Sections 15.109&15.209: FCC Code of Federal Regulations Radiation Emission Limits
- IEEE Standard 519-2014: IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems
- IEEE Standard 1547.1-2005: IEEE Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems· IEEE Standard 1547.3-2007: Guide for Monitoring, Information Exchange, and Control of Distributed Resources with Electric Power Systems
- IEEE C37.90.2-2004: IEEE Standard Withstand Capability of Relay Systems to Radiated Electromagnetic Interference from Transceivers
- IEEE Standard C37.90.1-2002: IEEE Standard for Surge Withstand Capability (SWC) Tests for Protective Relays and Relay Systems (ANSI)
- International Building Code: Applicable to seismic rating, requirements, location and design of mounting pad (designed by others).
- NISTIR 7628: Guidelines for Smart Grid Cyber Security
- IEC 62619 or UL 1973 - Safety Requirements for Secondary Lithium Cells and Batteries or Standard for Stationary Batteries
- IEC 62897: Stationary Energy Storage Systems with Lithium Batteries – Safety

Requirements

- IEC 63056: Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for secondary lithium cells and batteries for use in electrical energy storage systems
- IEC 62109 or UL 1741: Safety of power converters for use in photovoltaic power systems or Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources
- IEC 62485-2: Safety requirements for secondary batteries and battery installations – Part 2: Stationary batteries
- IEC 62485-5: Safety requirements for secondary batteries and battery installations - Part 5: Safe operation of stationary lithium-ion batteries
- IEC 61427-1: Secondary cells and batteries for renewable energy storage – General requirements and methods of test – Part 1: Photovoltaic off-grid applications

2.2.5 Environmental Requirements

The system shall be designed for use in the following environment

- Operating temperature 0°C - 50°C without derating
- Humidity 0 – 95% Non-condensing
- Maximum altitude 1,000 m without derating
- Seismic Rating Uniform Building Code Zone 4.
- Audible Noise Less than 50 dBA at 10 meters from the ESS

Proposers must provide sufficient information specific to their product to facilitate utility personnel training and communications with emergency response and environmental agencies. Material Safety Datasheet (MSDS) shall be provided as applicable.

2.2.6 Power Conversion System (PCS)

2.2.6.1 General

Energy storage units are predominantly DC in nature. To utilize the energy storage capability on the AC bus, the energy from batteries must be converted to a standard 50 Hz 230/415V AC level and regulated through a converter, generally known as the Power Conversion System (PCS). The PCS serves as the interface between the DC battery system and the AC system, providing

bi-directional conversion from DC to AC (for discharging batteries) and AC to DC (for charging batteries). The PCS may consist of one or more parallel units. The PCS is a bi-directional converter that can be operated in inverting mode for battery discharging and rectifying mode for battery charging.

The PCS shall be cooled, with final rejection of waste heat to the ambient air. The air-handling systems shall include filtering that is adequate to keep dust from the interior of the PCS system. Replacement of filters shall not require special tools or involve more than two hours of labor at the site.

The PCS shall consist of a converter area, user-accessible AC termination area, user-accessible DC termination area, and user-accessible control area.

1. Converter area:

The converter area shall contain an AC circuit breaker, converter, and DC circuit breaker.

- AC circuit breaker – The AC circuit breaker shall isolate the power unit from the utility source if needed.
- Converter – Upon opening of the AC circuit breaker in response to interruption of the utility source, the three-phase converter shall power the island's load until utility service is resumed or energy in the battery pack is depleted.
- DC circuit breaker – The DC circuit breaker shall provide isolation of the battery pack, permitting routine maintenance to be performed on PCS.

2. AC termination area

The user-accessible AC termination area shall include bus terminal pads for connection of utility source and the customer load cables.

3. DC termination area

The user-accessible DC termination area shall include terminations for cables from the battery pack.

4. Controls area

The user-accessible controls area shall contain the master controls and associated circuitry to support operation. Within the control area shall be the following:

- Control panel – The control panel shall include a three-position rotary switch for selecting the control mode of the power unit (MGC or ADDC-enabled, MGC or ADDC-

disabled, and Remove from Service).

- Master control board – The master control board shall provide the main processing and control functions of the converter.
- Power supply – The power supply shall provide the necessary DC control power for the system controls.

2.2.6.2 Standards

The PCS shall be of high-quality product, preferably produced by a manufacturer certified with ISO 9001 or equivalent.

The PCS shall comply with:

IEC62109 or UL 1741: Standard for Inverters, Converters, Controllers, and Interconnection System Equipment for Use with Distributed Energy Resources.
IEC 62477-1: Safety requirements for power electronic converter systems **OR** IEC 62109 and other relevant standards

2.2.6.3 PCS Electrical Protection

The PCS shall be protected against thermal overload, over-current and over-voltage. Insulating and monitoring ground fault detection shall be provided. The following protective function shall be provided:

- DC over-voltage
- DC under-voltage
- DC over-current
- AC over-voltage
- AC under-voltage
- AC over-current
- Battery protection
- Internal fault (over temperature, logic failure, etc).

The electrical shield cable shall be adopted for the signal and control cable. The surge absorber shall be connected on both sides.

The EMC requirement shall meet IEC 61000 or equivalent standard.

Neutral point high resistance grounding type (DC side) for ground fault alarm shall be provided.

2.2.6.4 PCS Minimum Electrical Requirements

The proposed PCS must satisfy the following minimum requirements:

N°	Parameter	Minimum Requirement
1	AC Voltage	400 V
2	Maximum continuous AC Voltage	1.1 p.u.
3	Maximum continuous current	1.1 p.u.
4	10 sec maximum overcurrent	1.25 p.u.
5	Voltage THD	<3%

As a minimum, the power converter shall be capable of continuous operation at the minimum required active power specified for each site with a power factor of 0.8 leading and lagging.

The power converter shall be designed to prevent failures, power limitations or reductions of the lifetime due to the environmental conditions on site.

2.2.7 Energy Storage Systems

2.2.7.1 Energy Storage Type

Energy Storage shall be of Lithium-Ion type suitable for utility scale ESS.

Different chemistry of Lithium-Ion batteries, such as Lithium Manganese (LMO), Lithium Ferro-Phosphate (LFP), Lithium Nickel Manganese Cobalt Oxide (NMC), Lithium Nickel Cobalt Aluminum Oxide (NCA), can be proposed.

2.2.7.2 Standard

Energy Storage System preferably produced by a manufacturer certified with ISO 9001 or equivalent.

2.2.7.3 Battery Module/Tray

Battery modules shall consist of many battery cells connected in series/parallel.

Module/tray battery management system (BMS/ESMS) shall be provided.
Automatic module balancing shall be provided.

Module/tray cooling system shall be provided.

2.2.7.4 Battery Rack

Battery modules shall be connected in series/parallel in the battery rack so that the nominal voltage of the DC is more than 480V, suitable for PCS DC voltage.

Rack BMS/ESMS with battery fuse, DC current measurement devices and Proposers shall be provided.

Electrical connection shall be at rack front side.

Many racks shall be connected in parallel to the total capacity required for the project.

2.2.7.5 Battery Protection

The following protections shall be provided:

- Over-charge protection
- Over-discharge protection
- Over-temperature protection
- Over-current protection
- Ground-fault detection
- Internal battery fault detection
- Cell balancing

Protective devices should include DC-side protection:

- Battery fuse for each battery cell and module (preferred)
- DC contactor for each battery rack
- Grounding over current (76G)

2.2.7.6 Cycle Life

If the product is sensitive to depth of discharge, the manufacturer must state the limitations and the product should be sized such that the depth of discharge corresponds to the required cycle life.

For purposes of estimating and demonstrating cycle life, cycles are defined in the same manner as system efficiency.

For lifetime assessment the supplier should provide a graph that displays the relationship between depth of discharge and the corresponding number of cycles available within the system's life.

Results of charging and discharging are tested at 1C. However, additional test results for 0.5C may also be provided.

2.2.7.6.1 Li-ion minimum requirements

The proposed li-ion batteries must satisfy the following requirements:

N°	Parameter	Minimum Requirement
1	Calendar lifetime (@25°C)	20 years
2	DC/DC efficiency(@25°C)	95%
3	Number of Cycles to Failure (EoL 80% 1C/1C)	>4500 cycles
4	Percentage of available capacity (25°C) @ 0.5C @ 1C	101% 100%
5	Minimum Discharge rate	0.5C
6	Minimum Charge Rate	0.5C
7	Fire Protection Type	Active Suppression

The following technical information must be provided with its bid:

- Cell type and chemistry
- Medical Safety and Data Sheets

- Module capacity (in Ah)
- Overall and usable energy (in kWh)
- Calendar life
- Continuous and temporary discharge current rating (C-rate)
- Continuous and temporary charge current ratings (C-rate)
- Module weight
- Round trip DC-DC efficiency curve at different temperatures
- Operating DC voltage range
- Operating temperature range
- Self-discharge rate [% energy loss/day]
- Number of Cycles curve for different DoDs @ 80%EOL, 25°C and 0.5C (dis)charge rate.
- (Dis)charge curve @ 0.5C
- Temperature degradation curves of the capacity and the lifetime.
- Fire protection and response concept for the Energy Storage System

The batteries shall accept short-term charge and discharge currents corresponding to their 1C ratings.

The safety solution for avoiding thermal runaway must be clearly presented. In addition, proper firefighting precautions shall be indicated.

The battery cooling system shall keep the batteries at max. 25°C for optimal operation. This system shall have a redundant design (at least 120% redundancy) with failure alarms. In case of failure in the cooling system, the current flow to and from the batteries shall be limited.

To increase safety, Li-ion modules shall include dividers to protect the failing cell from spreading to the neighbouring ones in case of thermal runaway.

2.2.7.7 End of Life and Warranties

The End of Life (EoL) of the batteries is defined as when the useful energy is at 80% of the installed energy capacity.

After the Defect Liability Period, the Contractor shall pass over all Original Equipment Manufacturer (OEM) warranties to the Employer including the performance warranties of the batteries.

The batteries are expected to have capacity performance warranties with the specified duration and minimum requirements for the number of cycles specified below, for each of the battery capacities defined for the respective sites:

Minimum requirements for warranties

No	Parameter	Minimum Requirement
1	Product warranty of PCS	5 years
2	Product warranty of Li-ion battery system	5 years
3	Capacity performance warranty of Li-ion batteries	10 years or 4500 cycles at 80% DoD and 1C (or equivalent at 0.5C)

2.2.8 Battery Management System (BMS/ESMS)

BMS/ESMS is used to monitor, protect, maintain safety and optimal operation of each battery cell, module and rack. BMS/ESMS consist of: Module/tray BEMS, rack BMS/ESMS and system BMS/ESMS.

2.2.8.1 Minimum Functions of Module/Tray BMS/ESMS

- Metering and monitoring
 1. Battery cell voltage (all cells)
 2. Battery module voltage
 3. Battery cell temperature
 4. Battery module current
- Cell balancing
 1. Module/tray BMS/ESMS should balance voltage of cells
- Safety protection: Module/tray BMS/ESMS should protect the battery cells and module/tray from:
 1. Over and under voltage
 2. Over current
 3. Short circuit current
 4. Over and under temperature
- Data communication: all metering items and contactor status shall be provided for rack BMS/ESMS control and monitoring systems.
- Accurate calculation of the State of Health (SoH) and the State of Charge (SoC),
- Communication with the inverter (power limits, voltage, current, SoC, SoH, warnings, faults, etc.),
- Logging of faults and warning

2.2.8.2 Minimum Functions of Rack BMS/ESMS

- Metering and monitoring
 1. Battery rack voltage
 2. Battery rack current
 3. Battery rack temperature (one or several locations in battery rack)
 4. Battery SOC of battery modules
- Module/tray balancing
- Balancing battery modules/trays scheme
- Safety protection
- Rack BMS/ESMS should protect the battery rack from:
 1. Over and under voltage
 2. Over current
 3. Short circuit current
 4. Over and under temperature
- Data communication: all metering items and contactor status shall be provided for system BMS/ESMS control and monitoring system.

2.2.8.3 Minimum Functions of System BMS/ESMS

- Metering and monitoring
 1. Battery system voltage
 2. Battery system current
 3. Battery rack voltage
 4. Battery rack current
 5. Battery rack temperature (one or several locations in battery rack)
 6. Battery SOC each rack and battery system
 7. Battery SOH (state of health) of each rack
- Safety protection
- System BMS/ESMS should protect the battery system from:
 1. Over and under voltage
 2. Over current
 3. Short circuit current
 4. Over and under temperature
- Data communication: all metering items and contactor status shall be provided for the PCS control and monitoring system by a standard protocol, e.g., Modbus RTU or Modbus TCP protocol. Data sampling rate should be configured based on process

requirement but not more than 2 seconds.

- Preferred functions of system BMS/ESMS: Controlling individual battery rack
- BMS/ESMS data communication: All metering items and contactor status shall be provided for the PCS control and monitoring system by a standard protocol, e.g., Modbus RTU or Modbus TCP protocol.

2.2.8.4 Functional Requirements

2.2.8.4.1 Voltage Regulation

Voltage deviation should be controlled within +/- 1% for a specified sec sampling rate.

2.2.8.4.2 Reactive Power Regulation

The system shall maintain a defined VAR flow level within +/- 5%.

2.2.8.4.3 Frequency Regulation

Frequency deviation should be controlled within a plus/minus ½ cycle per second.

2.2.8.4.4 Round-trip Efficiency

Roundtrip AC-AC energy efficiency shall be provided and include parasitic and auxiliary losses under worst-case conditions.

2.2.8.4.5 Self-Discharge

Proposers shall provide self-discharge characteristics.

2.2.8.4.6 Basic Insulation Level

The ESS AC system equipment shall have a Basic Insulation Level in accordance with IEC62109/UL1741 and ANSI C62.41.2-2002 standards.

2.2.8.4.7 Uninterruptible Power Supply Feature

The system shall be capable of performing as an uninterruptible power supply to Nighttime Loads. The switch-over time between the main-grid and the battery inverter + diesel generator system shall be a maximum 10ms or half a sinus wave in a 50 Hz system. Switch over shall happen in case of brown outs (voltage or frequency supplied by the main-grid deviate more than +/-10% from nominal values) or black outs, where the electricity supplied by the main-grid cuts off. Implementation can be through a fast thyristor-based transfer switch or other means.

2.2.8.5 ALARMS AND RESETS

2.2.8.5.1 Alarms

The ESS shall provide the following alarms:

- Informational Notification—indicates the status of the unit.
- Warning Alarm—indicates a problem with the converter requiring attention (not affecting proper operation).
- Converter Inhibit—indicates a problem with the converter affecting proper operation.
The converter will stop working.
- Trip Offline Alarm—indicates a severe problem with the converter. The system will not operate.
- Isolate Alarm—indicates a problem affecting proper operation of the system. The system will operate with limited functionality.
- Fire detection remote alarm status for main fire alarm control panel, and control and monitoring system.

2.2.8.5.2 Resets

Energy storage unit alarms shall be reset by any of the following means.

- Manual Reset—via the reset button located on the control panel, or via a personal computer connected to the control panel Ethernet port.
- Auto Reset—automatically performed until reaching a predetermined reset count.
- Self-Reset—automatically performed whenever required.

2.2.8.6 Enclosure Construction

2.2.8.6.1 Modular Replacement

The ESS PCS control, energy storage system and current sensors shall be modularized and connected in a manner that enables field replacement of each module. It is expected that most maintenance will be accomplished while maintaining service.

2.2.8.6.2 Enclosure

The PCS shall be contained within a weatherproof, moisture-sealed, tamper-resistant, metal enclosure with a minimum IP54 or equivalent rating suitable for outdoor installation on a concrete pad or cover of a fiberglass box pad, in accordance with the following requirements.

- The enclosure shall not utilize replaceable filters, dehumidifiers, or similar features requiring periodic maintenance. Air intakes are designed so that any entrance of water or dust is directed away from internal components and does not affect operation of the unit.
- The enclosures shall be equipped with a complete and failsafe fire detection/extinguishing system.
- The enclosure shall comply with security requirements of IEEE C57.12.28 Section 4. The enclosure shall limit access to the controls and physical network connections.
- The enclosure shall comply with coating system requirements of IEEE C57.12.28 Section 5.
- Enclosure grounding shall be provided.
- The enclosure shall have access control.
- If applicable, wiring and weather-tight enclosure egress to an external antenna shall be provided.
- A nameplate shall be provided specifying the following:
 - Manufacturer name
 - Connection diagram
 - Unit ratings: Power, energy, voltage,
 - Specimen data: serial number, date of manufacture
 - Signage shall indicate Source and Load-Side AC Buses, Neutral Bus, DC Bus, Isolation, Contactor, and Module names. Custom signage will be in accordance with specific utility requirements.
- All necessary safety signs and warnings as described in ANSI Z535-2002 shall be included on the unit.
- All necessary signs and warnings for identification of hazardous materials as described in NFPA704 shall be included on the unit.

2.2.8.7 Earthing and Lightning Protection

The Contractor shall design, install and test the earthing and lightning protection systems for the BESS.

2.2.8.7.1 Earthing System

The earthing design of the BESS shall be such that the effect of ground potential rise and maximum fault current levels will not endanger the safety of people or equipment under normal and fault conditions, while ensuring continuity of service.

All metallic parts of the BESS and the materials including the battery racks and inverter box shall be connected to the integrated earthing system in accordance with IEC60364-5-54.

2.2.8.7.2 Lightning Protection System

The lightning protection system shall be designed to protect the BESS equipment against direct or indirect lightning / thunderbolts and shall comply with lightning protection Class IV defined in IEC 62305.

The Contractor shall provide a lightning protection report for direct and indirect effects as per IEC 62305 to demonstrate the lightning protection design.

The BESS building roof shall receive a lightning protection system composed of lightning rod and down conductors, sufficiently sized and spaced connected to the earthing electrode. The distance crossed by lightning protection conductors to the earthing electrode shall be as short as possible. The distance between down conductors shall meet the requirement of IEC standard.

The lightning protection system shall include surge protection devices. These surge protection devices shall protect the BESS equipment by limiting the transient over-voltage and diverting surge currents.

2.2.8.8 Safety

2.2.8.8.1 General

- The ESS must be compliant with IEEE 1547, IEC 62619, and UL 1973 as appropriate. In addition, it shall comply to the newer NFPA 855 standard. Systems must be able to protect themselves from internal failures, thermal runaway and utility grid disturbances.
- For all ESS equipment, the Supplier shall provide information on specific safety issues related to the equipment, including appropriate responses on how to handle the energy storage system in case of an emergency, such as fires or module ruptures.

2.2.8.8.2 Fire Mitigation

- Provisions shall be included to extinguish internal container fires without the need to open container doors.
- Active fire protection and suppression systems must be included in the ESS. The Fire prevention and response concept must be provided along with the bid.
- Limiting thermal runaway is a requirement of the UL1973/9540 and IEC 62619 standards which is standard practice. The NFPA 855 is the newer standard which is also required for compliance of these projects.

- Large-scale fire testing of Li-Ion systems is done for battery manufacturer's energy storage system on a case-by-case basis. It is typically tested according to the methodology laid out in UL9540A. Evidence of such testing should be made available from the manufacturer.

2.2.8.9 System Testing, Documentation and Training Course

2.2.8.9.1 Testing

The following test procedures shall be conducted on the unit prior to shipment.

- Battery connection and configuration check
- Circuit boards and subassembly functionality
- Mechanical inspection
- Wiring continuity
- Alarm functionality
- The user shall witness the factory acceptance testing at the
- manufacturer's production facility.

2.2.8.9.2 Quality Assurance

- Factory Testing—Prior to shipment, the proposer shall complete a documented test procedure to test all required functions of the ESS and guarantee compliance with the specifications. These are, but not limited to, the following:
 - The ability to perform PV output smoothing
 - The ability to perform 4-quadrant control
 - The ability to perform black start
 - The ability to deliver zero-voltage ride through
 - The ability to operate in an islanded operation
 - The ability to perform parallel operation with the grid, PV and diesel generator
 - The ability to communicate with MGC via DNP 3.0 over IP or IEC61850
 - The ability to communicate with ADDC via DNP 3.0 over IP or IEC61850
 - The stakeholders shall witness the factory acceptance testing at the
 - manufacturer's production facility as outlined above.
- Assemblies and Materials—All materials and parts shall be new, of current manufacture, and shall not have been used in a prior service, except as required during factory testing. The system manufacturer shall conduct inspections on incoming parts, assemblies, and final products.

2.2.8.9.3 Approval Drawings and Documentation

The Proposer shall meet the general requirements for the project documentation supplemented as per applicable standards. Drawings shall be provided for each energy storage system, which clearly indicate the physical parameters, electrical characteristics, and auxiliary equipment. Documents required are including but not limited to the following list:

- The documents and drawings requirements applicable for prefabricated / containerized buildings
- The documents and drawings requirements applicable for transformers (if applicable)
- Specifications and Descriptions
 - Functional description
 - Hardware description
 - HMI Description
 - I/O Lists grouped according to plant components
 - Equipment list
 - Inverter PQ charts (as a function of outdoor temperature, voltage level)
- Single Line and Schematic diagrams
 - Overall schematic diagrams - system architecture
 - Single line diagram
 - Communication architecture
 - System logic diagrams
 - System block diagrams
 - Interlocking and inter-tripping scheme
- Technical Datasheets for all main equipment and components including (Medical Safety and Data Sheets (MSDS)
- Type test certificates
- Calculation report
 - Battery selection and sizing report
 - HVAC sizing report
 - Component selection and sizing report
- Layout / Arrangement Drawings
 - Arrangement and Dimensional drawings for entire BESS package including required clearances for installation, operation and maintenance
 - Civil Guide drawings with floor cut out dimensions and approximate static loads
 - Detailed Assembly/Equipment Drawings of each main component and/or panels

- Wiring/circuit diagrams
- Terminal diagrams
- Factory and site Testing documents (as described in the present specification)
- Installation Manual & Method Statements
- Engineering and Configuration Manual
- Fire Protection and Response Description
- Recommended spare parts (with list) – If applicable, the instruction book will list the required spare parts to be furnished with the energy storage system.
- Special tools - The proposer shall furnish a complete set of any special tools, lifting devices, templates and jigs, which are specifically necessary for installation and/or maintenance of the energy storage system.
- Additionally, special tools for PCS configuration and system parameter setting including link cable and software licenses shall be provided.
- Nameplate system drawing to be located on the doors of the container or cabinets.
- Outline drawing including the following:
 - Assembly of principal components, converter, control cabinet, parts and accessories.
 - Power requirements for all control and auxiliary equipment.
 - Shipping Center of Gravity – shown on two (2) views
 - Installed Center of Gravity – shown on two (2) views
 - Centerlines for external conduit and grounding cable connections.
 - Projected floor space for container systems if applicable, including air conditioning units mounted on the side.
 - Weight of the components and container.
 - Kilowatt & Kilowatt-Hour rating.
- Control Elementary Wiring Diagrams, with cross references for checking and verifying all of the control circuit and wiring diagrams, along with the terminal designations for termination of field wiring of all equipment.

2.2.8.10 Information Security

The Supplier shall design the ESS to be hardened against willful attack or human negligence as per NISTIR 7628 and relevant Nigerian data protection regulations. The Supplier shall contract information/cyber security scans and penetration tests by a 3rd party security company.

2.2.8.11 Spare Parts

The following BESS spare parts shall be included in the proposal by the bidder:

Spare Parts for BESS

	Spare Part	Quantity	Remarks
1	Set of rectifier spares as relays, fuses, bulbs, switches, mini circuit breakers, diodes, control elements, etc	1	For each type of rectifier
2	Set of battery fuses	2	One set for each type
3	Set of battery circuit-breaker	1	One set for each type
4	Set of DC/DC inverter spares as relays, fuses, bulbs, switches, mini circuit breakers, power components, control elements, etc.	1	One set for each type of inverter
5	DC/AC inverter spares as relays, fuses, bulbs, switches, mini circuit breakers, power components, control elements, etc.	2	One set for each type of inverter
6	Battery module (for Li-Ion)	Min. 1% of installed capacity or 1 module whichever is higher	Increase battery module quantity to 2 if power converter module not replaceable
8	Power converter module	Min. 2% of installed power	If replaceable. Else, increase battery module quantity to 2

2.3 Diesel Generators

2.3.1 General Requirements

The scope of works includes the supply of complete enclosed diesel generators of various capacities including spare parts, tools, controls and all accessories as outlined in this specification. The diesel generator sets are foreseen to operate either alone, in a modular combination with other diesel gen sets or in a hybrid set-up with gen sets using renewable energy sources (PV & battery modules).

Each Generator shall be supplied complete with the following items:

- Supply of all installation drawings and documentation, Operation and Maintenance manuals.
- Design, supply and warranty of:
 - a. Diesel generator sets with the given minimum kVA/kW rating comprising a diesel fueled, reciprocating, inter-cooled, prime power rated engine which is directly coupled to a three-phase synchronous generator;
 - b. The gen set shall be able to provide prime power on variable loads for an unlimited number of hours per year, in island operation mode, providing 110% of prime power during a minimum of 1 hour per 12 hours cycle.
 - c. Completely enclosed diesel generators fully suitable for the given environment complete with sufficient space for all engine fluids, base fuel tank, noise abatement, water-air radiator, exhaust systems and all necessary controls, remote monitoring and ancillary components.
 - d. General access and protection structures.
 - e. Diesel generator earthing system.
 - f. Synchronization unit for load sharing across multiple interconnected generators (kW, kVAr), see the table 7 below
 - g. Diesel generator control system and enhanced power management.
 - h. Fuels transfer system inclusive manual fuel transfer system from external tanks.
- Factory Acceptance Testing (FAT) complete with all documentation, certificates, test reports.
- Remedy all defects.
- Provision of training for Operations and Maintenance staff.

- Provision of Operation and Maintenance manuals.
- Provision of spare parts, and special tools.
- Provision of all signed certifications (HSNO, Electrical Certification etc.) for the plant
- Warranty during the warranty period.

Generating Set Control System

AC/DC control panel consisting of:

- Emergency Stop button
- Controller with selection for auto-start, AMF monitoring and with following (and not restricted to) features:
 - Start/Stop button
 - Hour run meter
 - Monitor engine temperature and provides shutdown protection
 - Monitor engine speed and provides shutdown protection
 - Monitor oil pressure and provides shutdown protection
 - Alarm output for abnormal operation

Control System shall have and operate in the following mode:

- Manual transfer panel,
- Automatic transfer Panel,
- Fully Automatic Synchronizing and load Sharing system
- Manual Synchronizing Panel.
- Controller Protections 46 unbalance
- 50/51 phase overcurrent

Fuel System shall have and operate in the following mode

- Fuel filter
- 8 hours base fame fuel tank
- Fuel level shut down sensor
- Dual Wall Integral Fuel Tanks
- Dual Wall Sub-Base Fuel Tanks

- Automatic Fuel Fill Option

Starting / Charging system

- Battery charging alternator
- 24 volt starting motor(s)
- Maintain free battery with rack and cables
- Battery charger

Cooling system shall have the following:

- Radiator with guard sized for 50°C
- Coolant drain line with valve
- Fan and belt guards
- Radiator duct flange
- Low Coolant Level shut down sensor

The proposer shall provide separate prices for generator sets including the synchronization control system, all necessary converters, controls, etc., where these are available for the given kVA ratings.

The proposer shall provide details of the manufacturing process and all materials used, including quality assurance standards and any environmental certifications. Full technical specifications for each item shall be included. It is also preferred that the proposer details the recyclability of product components and packaging.

The proposer shall provide a list of their authorized maintenance services providers, indicating the locations in which such services could be provided.

Table 7

INDICATIVE GENERATOR CAPACITIES FOR THE UNIVERSITIES								
Parameters	MAU YOLA	FUDMA	FU LAFIA	FU LOKOJA	FUTA	FU UYO	FUTO	UNIPOR T

DG Total Capacity (kW)	1,700	960	630	790	1,900	1,300	3,000	4,400
After considering 70% loading factor (kVA)	3,036	1,714	1,126	1,411	2,500	2,321	5,357	7,857
DG individual units (kW)	500 x 6	500 x 4	400 x 3	400 x 4	500 x 5	500 x 4 400 x 1	500 x 10 400 x 1	500 x 15 400 x 1

2.3.1.1 General Specification

The following specifications shall be met by the proposers:

- Genset Model number: Please indicate
- Engine Make: Please indicate
- Installation Conditions: Outdoors @ 0-40 deg C, 95% humidity
- Protection Degree: Within Canopy
- AC Output Power range (kVA): 300-625 (Prime Rated Power)
- Nominal AC Output Voltage range (V): 415±5%
- Number of Phases: 3+N
- Insulation class: H
- Genest Type: Canopy type @ 75dB (A)
- Noise Level: Canopy/Soundproof engine shall have noise level of 75dB (A) at 1meter distance
- Nominal Frequency (Hz): 50±5%
- Rated Speed (Rpm) 1500
- Aspiration: Turbocharged & Charge air cooled
- Governing type: Electronic
- Cooling method: Water
- Excitation: Brushless, Self-excited
- Rated Power factor: 0.8
- Protection class: IP23
- Fuel Filter Type: Replaceable Element
- Cycle: 4 STROKE, Direct injection
- No. of Cylinders: 6

- Steady State Voltage Regulation: $\pm 1\%$ AVR
- Steady State Frequency Regulation: $\pm 0,5\%$
- Total harmonic Distortion withstands: At least 3%
- Communication Protocol Modbus TCP/IP
- Controller Protections: 46 unbalance, 50/51 phase overcurrent

2.3.1.2 Climatological Conditions

The generators, and associated panels shall be able to operate under various climatic (i.e., tropical, semi tropical and arid) conditions and must therefore be constructed to work in the indicated locations.

2.3.1.3 Operating Concept

To provide optimal fuel efficiency and maximum machine life, the proposer shall provide several generators in series to match the load profile provided in each location, (instead of one large generator which would run at high inefficiency). Additionally, should load grow beyond the capacity of the installed diesel generator(s), it shall be possible to increase load capacity following a modular concept, adding multiple units to form a single combined source of electricity or mini grid.

The proposer shall price separately for manual switchover control panel, automatic switchover control panel for single machine control, and also, panels for full synchronization control. The synchronization control in each case shall be designed for the following modes of operation:

- Diesel only: The first diesel unit takes over all loads. In case load is approaching a certain threshold (preset on site, e.g., 70% of nominal capacity) the second unit will be automatically switched on and synchronized. Switching off and disconnecting the second unit from the grid will take place when load is below a certain threshold (e.g., 60% of unit capacity). The diesel gen sets run in isochronous or base load control mode and are adjusted to an internal speed droop.
- PV-diesel Hybrid: (Controls to manage PV system supplied by others). In the case of PV-diesel hybrid generation, the diesel units operate as stand-by systems on the main AC bus together with the PV modules. Diesel gen sets are operated if load exceeds a certain threshold (e.g., 70% of module or battery capacity) or DOD of the battery is below a preset threshold (e.g. 50%).
- Off: The diesel generators will not start from local or remote control.

- Automatic: In this mode the diesel generator control will respond only to a single start/stop command from the control system.

Once an automatic start is initiated, the diesel generator will start, run up to speed, synchronise (if required), run to pre-set warm upload output until a pre-set time period has expired or the engine is up to normal operating temperature then ramp to load levels for automatic load sharing with other diesel generators online.

On automatic shutdown, the diesel generator will ramp unload, open the main breaker at pre- set load, go into a cooldown for pre-set time and then shutdown.

- Semi-Automatic: In this mode the diesel generator control will respond only to an operator-initiated single start/stop command.

Once a semi-automatic start is initiated, the diesel generator will start, run up to speed, synchronize, run to pre-set warm upload output until a pre-set time period has expired or the engine is up to normal operating temperature, then ramp to load levels for automatic load sharing with other diesel generators online.

On semi-automatic shutdown, the diesel generator will ramp unload, open the main breaker at pre-set load, go into cooldown for pre-set time and then shutdown.

- Manual: In this mode the diesel generator control responds only to an operator-initiated single start/stop and synchronize command.

Once a manual start is initiated, the diesel generator will start, run up to speed, and then wait for the operator to initiate the synchronize command. Once synchronized, run to pre-set warm upload output until a pre-set time period has expired or the engine is up to normal operating temperature, then ramp to load levels for automatic load sharing with other diesel generators.

On manual shutdown, the diesel generator will ramp unload to a pre-set load, and then open the main breaker on an operator command, go into cool down for pre-set time and then shutdown.

- Base Load / Isochronous Load Control

In all operation modes (automatic, semi-automatic and manual) it is possible to select between Base Load / Isochronous Load Control.

1. Base load control is by operator set point for fixed kW and power factor output.
2. Isochronous Load Control is an automatic load sharing control.

- Local Test

In Local Test mode only (initiated only at the diesel generator control panel), the diesel generator and ancillaries will run to speed for mechanical and electrical excitation checking. They will not synchronize to the load.

The proposer shall submit with its bid detailed operational instructions for the intended operating concept.

2.3.1.4 Design Life

The proposer shall indicate with their offer the life of the mechanical and electrical equipment at rated efficiencies under preset operating conditions. The proposer shall submit with its bid charts of life expectancy in hours and assumed efficiencies.

The proposer shall also submit with their offer a generator sizing guide and respective maintenance recommendations. (See below for additional details)

2.3.1.4.1 Design Requirements

As general requirement, the following specifications shall be followed:

- Support Off grid mode
- Different mode of operation
- Synchronization Features
- Parallel operation
- Motorized Circuit Breaker

- Rapid start-up response upon command
- Canopy Housing

Applicable Codes and Standards

The Diesel generator Sets shall meet the following Standards: GB/T2820, GB1105, YD/T502, ISO3046, ISO8525, ISO8525-3-5-6.

2.3.1.5 Manuals, Catalogues and Electrical Drawings

Manuals, catalogues and drawings and any other documentation supplied shall be available in English.

2.3.1.5.1 Operating Instructions:

The Instruction Manual shall include detailed Operating Instructions and, as a minimum, should cover starting, synchronizing, stopping, protection of circuits, automatic controls, battery charging, safety considerations, method of adjustment of speed, output voltage, control timers, etc.

Performance parameters of the generator set shall be detailed for the operator's guidance and as a minimum should cover output voltage, frequency, load, engine temperature and oil pressure nominal values and acceptable limits. Circuit drawings with component identifications shall be included for reference purposes.

2.3.1.5.2 Maintenance Recommendations:

The proposer shall provide complete maintenance procedures for all the equipment supplied. Schedules for maintenance to be effected on a daily, weekly, monthly, etc. or on hourly run basis should be included. Guidelines for the selection of fuel oil, lubricating oil, use of water treatment additives and anti-freeze if applicable.

2.3.1.5.3 Troubleshooting:

Troubleshooting procedures shall be available to enable the timely diagnosis of a defect considered likely to occur in service. Reference outputs and conditions shall be quoted to facilitate diagnosis.

2.3.1.5.4 End of life recycling/disposal

The proposer shall explain its concept of end-of-life recycling and/or disposal for the supplied equipment.

Note: It is mandatory that one set of above manuals, catalogues, and electrical drawing/diagram for each category of the offered generating sets is supplied with the bid (electronic versions). Bids shall not be acceptable unless the offer includes these items.

2.3.1.5.5 Factory Acceptance Tests (FAT)

During the FAT, the proposer shall provide the respective reports including test results and certifications of factory tests on all systems and subsystems of the complete supply. This shall include but not limited to:

- Operation of all alarms, trip safety protection devices and confirmation of operation, and their indication on the diesel generator controllers (local / remote).
- Operation of all status indications and their indication on the diesel generator controllers (local / remote).
- Operation of the diesel generator in all operating modes where possible.
- Drop and recovery load tests to an agreed regime.
- Over speed tests.
- Acoustic level measurement is provided to the appropriate standard at each of the load test ratings.
- Each generating set shall be subjected through 1-hour load test for running 0%, 25%, 50%, 75%, 100% and 110% load before dispatch, all protective devices, control functions are simulated and its system checked, proved and then passed for dispatch. A test certificate shall be provided upon request.

2.3.1.6 Packing, Documentation

2.3.1.6.1 Packing

All Generator sets including spare parts in special weatherproof materials shall be packed and securely clamped against movement in either Sea container or in wooden secured crates suitable for export shipment, such that the crates can be stack on top of each other and stable for export shipment by surface, sea and rough handling during transportation.

Similarly, spare parts shall be packed separately in waterproof and rainproof packing in wooden crates suitable for export shipment by surface, sea & rough handling.

All electronic parts shall be carefully protected from damage by dust, moisture, heat or humid atmospheric conditions. Where parts may be affected by vibration, they shall be carefully protected and packed to ensure that no damage will occur while they are being transported and handled.

All wood and other materials used in packing cases shall be insect free. Adequate protection and precaution are to be taken to exclude termites and other vermin, noxious insects, larvae or fungus from the packing materials. The proposer shall protect all steelworks before shipment, to prevent corrosion and/or damage. Bundles of steel sections shall be properly tied together by an approved method and care shall be taken to ensure that they are robust and that they can be handled easily during shipment. Packing cases where used shall be strongly constructed and in no case shall timber less than 25 mm in thickness be used. Cross battens supporting weight in any direction shall not rely on nails or screws driven lengthwise into the grain of the wood but shall be supported by cleats secured from the inside. Waterproof papers and felt linings shall overlap at seams and the seams secured together in an adequate manner, but the enclosure shall be provided with screened openings to obtain ventilation. All cases, packages, bundles, etc., shall bear at least the identification mark relating to the appropriate shipping documents, the contents and total weight. The identification marks on the outside manufacturer's name, type of equipment shall be waterproof and permanent.

The proposer shall be entirely responsible for ensuring that the packing is suitable for transit and the proposer shall bear in mind that it will be shipped, stored in a harsh environment during a long period.

The markings shall be of non-removable and permanent material, fixed on each individual item clearly identifying the production batch and the proposer. The markings on the packing are fixed outside of the to be as per the purchase order, minimum height of letters 200 mm including dimensions/weight/capacity clearly marked on the crate.

2.3.1.7 Training and Technical Support

2.3.1.7.1 Training

The proposer shall detail their capacity for delivering training courses in installation, commissioning, operation, and maintenance of all equipment across their regional service centers and/or requested locations. (The provision of these training courses is not to be included in this offer)

The proposer shall also outline the content, and various levels, of their training courses.

2.3.1.7.2 Technical Support

The proposer shall detail the technical support available, both globally and regionally, for troubleshooting, spare parts, installation, operation and maintenance queries.

2.3.1.7.3 Regional Service Centres

The proposer shall provide a detailed list of Regional/country Service Centres, highlighting centres across Africa and the Middle east. The Service Centres shall have the capacity to respond to emergency queries, providing immediate technical support on a 24/7 basis. Each Regional Service and Call Centre must have technical experts that are fully familiar with equipment provided.

The proposer shall provide detailed information on the capabilities of the individual Regional Service Centres. It should be clearly indicated in the proposal, which Regional Service Centres have the capacity to enter contracts to provide full maintenance and repair services and for which equipment falls under the scope of this RFP. The proposer shall also indicate from which regional/country centres, if any stocks are kept at those locations, generator sets, and controls can be delivered. It is preferred that the proposer has one central operation through which orders would be placed, and that this central operation would coordinate delivery of generators from the regional centre.

2.3.1.7.4 Spare parts

It is imperative that the proposer has a robust arrangement for the provision of spare parts across global locations. All spare parts must be readily available at any time for emergency requirements and the supply of spare parts for scheduled maintenance must be timely and accurate in order to avoid any service delays, equipment failure and prolonged power supply interruption. The proposer shall demonstrate that a well-organized network and supply chain structure for any given spare parts is in place. It shall be illustrated by the proposer on how Regional Service Centres are facilitated with spare parts and how spare parts can be ordered and subsequently supplied in the shortest possible time.

It is important that the proposed spare parts ordering and management system is safe against mixing-up of similar parts for different generator models. Parts must be clearly marked and can be easily identified during visual inspection by non- technical personnel upon arrival at the destination. This can be either achieved by a clearly visible engraved part number; packing/wrapping with a clearly visible part number; tagged-on part number or similar.

Spare parts shall be packed suitable for long-term storage, with suitable preservative coatings. Clear marking on the outside of packaging materials shall identify each part so that the parts need not be unpacked for identification.

With the Technical Proposal the proposer shall supply the following:

- Complete list of spare parts for all generator parts and equipment for each model
- Itemized price schedule for a spare parts kit recommended for 2,000 hours of continuous generator operation and maintenance, to be supplied with each generator. This shall include all tools and associated items necessary to carry out maintenance and install these spare parts.
- List of required spare parts for each scheduled maintenance service for each model
- List of available spare parts and stock levels at each Regional Service Centre for each model.

The list shall also include standardized part numbers as per manufacturer’s database for ease of ordering. All spare parts shall be numbered to ease identification and stock keeping.

The spare parts proposed should carry a warranty of twelve (12) months from the date of installation.

The proposer shall guarantee the availability of spare parts for the engines for 10 years.

2.3.1.7.4.1 First Fills

The proposer shall supply the first fills for all oil and coolant and all fuel and oil filters for the diesel generators. This shall include start-up filters and the like for the initial pre-commissioning of the Solar Hybrid Power Plant. The proposer is to confirm as part of the tender submission if the start-up filters are different to normal operation filters to account for possible construction debris.

2.3.1.7.4.2 Special Software

All diesel generator controllers, governor, and AVR software and programs, communication leads, and software dongles required for general maintenance and overhauling of offered generators shall be supplied as part of the diesel generator supply.

2.3.1.7.5 Warranty

The generator sets and associated equipment proposed should carry a warranty of twenty-four (24) months from the date of delivery to the site, with the exception of the control panel containing microprocessor Chip(s) which shall carry a minimum warranty of three years for its smooth & trouble-free operation. The warranty shall cover faulty parts due to manufacturer poor workmanship during and after the assembly, and the warranty shall remain in full force from the date of delivery to the site and entities as per Incoterms 2010. The proposer agrees to carry all costs related to fulfil warranty obligations.

The proposer shall extend third party manufacturer warranties in full with the minimum warranty as stated. The proposer shall provide certification attesting covering the above warranties in the bid.

All costs for travel and upkeep of proposer's personnel to undertake repairs and replacement of Generator sets and associated equipment supplied and found to be defective or not to conform to technical specifications contained in this document during the warranty period shall be borne in full by the proposer. Repairs or replacements of equipment made during the warranty period or thereafter shall be warranted for the remainder of the original warranty. The proposer shall begin the remedial work within 24 hours of being notified of the failure.

The proposer shall extend third party manufacturer warranties in full with the minimum warranty as stated. The proposer shall provide certification attesting covering the above warranties in the bid.

All costs for travel and upkeep of proposer's personnel to undertake repairs and replacement of Generator sets and associated equipment supplied and found to be defective or not to conform to technical specifications contained in this document during the warranty period shall be borne in full by the proposer. Repairs or replacements of equipment made during the warranty period or thereafter shall be warranted for the remainder of the original warranty. The proposer shall begin the remedial work within 24 hours of being notified of the failure.

2.3.1.7.6 Guarantee

The proposer shall state and guarantee:

- Fuel usage rates at 110%, 100%, 75% and 50% prime rated output (g/kWe) and corrected values as noted.
- Maximum net output (kWe) of each diesel generator.
- Continuous net output (kWe) of each diesel generator.

2.3.2 Standards

The diesel engine, alternator, generator control panel, fuel delivery system and fuel storage system shall comply with the current versions of the following applicable standards or equivalent standards. The proposer shall list any deviation from these standards in its bid.

- IEEE 762:1987 Standard Definitions for Reporting Electric Generating Unit

test methods -Additional requirements for engines for general use,

- ISO 3046-3: 2006: Part 3 Test measurements
- ISO 15550: 2002 Internal combustion engines --Determination and method for the measurement of engine power --General requirements.
- The Diesel generator Sets shall meet the following Standards: GB/T2820, GB1105, YD/T502, ISO3046, ISO8525, ISO8525-3-5-6.

2.3.3 Drawings and Documentation

2.3.3.1 General

2.3.3.1.1 Documentation Formats

All documentation shall be supplied by the proposer as PDF and native formats as detailed below:

- Documents – MS Word.
- Specifications – MS Word.
- Schedules – MS Excel.
- Program – MS Project.
- Drawings – AutoCAD.

2.3.3.1.2 Units of Measurement

Metric units of measurement (System International) shall be used on all contract documentation. Angular measurement shall be in degrees with 90° degrees comprising one right angle.

2.3.3.1.3 Language

All manuals and drawings shall be available in **English**. This language shall be used on all drawings and in all documents and wherever anything is required to be written, marked, printed or engraved.

2.3.3.2 Manuals

The proposer shall provide the following manuals:

- a. Quality Assurance Manual.
- b. Safety Manual.
- c. Operation and Maintenance Manuals.

2.3.4 Particular Specifications

2.3.4.1 General Arrangements

The generating set shall be powered by a water-cooled, heavy-duty, industrial type diesel engine that is directly coupled via a SAE flexible disk/flange coupling to a brush-less, synchronous, self-regulated alternator. The fuel system shall be capable of governing to ISO 8528-2 G2 specifications.

The engine/alternator/radiator shall be mounted on a skid-type steel base frame with rounded and slanted rail ends. The engines/alternators shall be insulated from the frame by suitably rated and oil resistant anti-vibration mounts. A "tropical" class radiator, and belt-driven fan, capable of cooling the engine on full load, at site conditions, shall be included. A diesel day- fuel tank shall be incorporated between base-frame rails, with a minimum capacity of eight (8) hours continuous running for air-cooled units and 12 hours continuous running for water-cooled units at 75% load. Generating set shall be mounted inside a purpose built and sound attenuated weatherproof enclosure fitted on a high-speed trailer for easy towing on rough terrain. A safety shutdown system for low oil pressure, high temperature, over-speed and low fuel level shall be provided with LED, resettable indicators. The generator sets should be in serviceable and full operational condition on delivery.

All Generator sets should be manufactured and fitted with a "Common Rail " or "HEUI or MEUI System operated by ECM (valid for Generator capacities above 20 kVA). It is crucial to make Generators fuel efficient and reduce permissible fuel (Diesel) emissions to Euro Stage II G & D standards for non-road diesel constant speed engines measured under ISO 8178-4 C1.

The engine shall be capable of operating at light loads for extended periods of time and shall provide a means to reduce carbonization. (With good design, periodic cleaning of exhaust parts should not be required).

An oil evacuation hand pump shall be mounted and connected for draining/filling the engine oil sump.

Battery cables, vibration-free battery racks/trays and charge alternator are also included. The engine shall be supplied with vertically mounted spin-on oil and fuel filter(s), a fill of suitable lubricating oil, and antifreeze for cooling system [separately packed] for protection down to minus 20°C. The radiator drain shall be piped to the edge of the /skid base frame/enclosure.

During each initial start of the engine, a system shall be provided to pre- lube at low idle speed. When the internal oil pressure reaches a predetermined safe value, the engine speed will then increase to the alternator set operating speed.

The engine shall be equipped with fuel filter, tube oil filters, heavy-duty tube oil cooler and the temperature controlled by a thermostat valve, fuel transfer pump, fuel priming pump and duplex filters (primary and secondary filters), charge- cooler and heavy-duty type air filters made to withstand dusty tropical conditions, service meter, engine driven water pump, and unit mounted instruments. Supply and spill fuel-lines, fittings shall be included and fitted to the day-tank.

Unit-mounted instruments shall include a water temperature gauge, and lubrication oil pressure gauge. The engine shall be provided with low oil pressure, high water temperature, and low coolant level and over-speed safety shutdowns of the manual reset type. Additional instruments and safety shutdowns shall be provided as noted herein.

Injection pumps and injection valves shall be a type not requiring adjustment in service and shall be of a design allowing quick replacement by mechanics without special diesel engine experience. The engines shall have an individual electronically controlled injection pump and injection valve for each cylinder, any one of which may be removed and replaced from parts stock. Fuel injection pumps are positive action, constant-stroke pumps, activated by a cam driven by gears from the engine crankshaft. Fuel lines between injection pumps and valves shall be of heavy seamless tubing.

Where applicable, air filters including pre-filters and dust traps shall be mounted behind the engine, over the alternator so as not to restrict the access to rocker covers and fuel injection pumps.

2.3.4.2 Guaranteed Output and Conditions

Generator sets shall have the rated Voltage, Phase, Frequency and Speed on load.

Calculation of net power output based on prime rated variable load operation, with makes, models, kW(e), kW(m), radiator fan power requirement, efficiencies, derating factors, etc., as per original technical brochures must be furnished along with the bid.

All Generator sets must be manufactured and rated according to continuous power output as outlined in ISO-8528-1, overload power in accordance with ISO- 3046/1, BS 5514, AS 2789 and DIN 6271. The net power outputs of the desired generator capacities will have been derived not only from the mechanical, electrical losses and efficiency, but also considering the derating factors caused by high altitude operation.

2.3.4.2.1 Rating

The diesel generators shall be prime rated with an electrical output from each diesel generator as given below

2.3.4.2.2 Maximum Voltage and Frequency Excursions

The set shall also be capable of operating under the following situations:

- a. The full capacity loading of the set shall be possible within 20 seconds.
- b. At 30% load steps the speed shall not change by more than 1% of nominal (depression) after not more than 5 seconds from load changes.

- c. At 30% load steps the voltage shall not change by more than 20% of nominal (depression) after not more than 5 seconds from load changes.
- d. Removal of 30% of rated load shall not result in transient speed change exceeding 10%, and voltage change exceeding 15%, recovering to 1% within 10 seconds.

2.3.4.2.3 Technical Schedule Guarantees

The Specific fuel consumption (g/kWe) and power output (kWe) must be quoted at standard (ISO) ambient conditions and at 45°C (although it's not the highest possible ambient this temperature will be used for assessment of the equipment performance in hot conditions). The proposer shall advise the de-rating curves or correction curves or formulars or calculations applicable to the particular diesel generator for the power deration or fuel consumption for the contract ambient conditions, this must be advised with the bid submission.

2.3.4.2.4 Noise

Noise levels shall be within the specified range. The weatherproof and sound attenuated enclosure construction will limit the noise level to 70 dbA at 7 meter or 80 dbA at 1 m distance at full continuous load.

Diesel generators shall be placed as far away from buildings as reasonably possible to minimize noise emissions.

2.3.5 Requirements

2.3.5.1 General

The diesel generator shall, as a minimum include:

- Diesel engine directly coupled to a synchronous electrical alternator.
- Tropicalised, single/dual bearing (depending on size) alternator.
- Air-water heat exchanger cooling for jacket, lube oil and intercooler cooling.
- Fabricated structural steel base skid for mounting inclusive of all protection systems, control systems to be mounted inside tropicalised containers for permanent mounting on a concrete foundation.
- Diesel generator tropicalised container.
- Dual electric starting system (battery and starter motors).
- Dual fuel filters (fuel and fuel / water).
- Fuel meters to measure the net consumption of fuel by the engine in grams and litres.

The meters shall have temperature correcting capability with analogue output (4-20 mA), and pulse output.

- Diesel fuel engine supply system.
- Lubrication system with engine lube oil pumps, oil filter.
- Exhaust system (stainless steel outlet, with rain cap).
- Local diesel generator control panel controlling a common rail or unit injection system type and ECM operated The ECM system shall be able to record hourly and total fuel consumption through the ECM data history for future download. In the absence of electronic controlled engines for the generators with capacities below 25 kVA, mechanical governors will apply provided that they meet the desired fuel efficiencies and emission levels. Generators with a capacity of 25 kVA and above shall be fitted with ECM (Electronic Control Management).
- Synchronization unit for manual, semi-automatic and automatic synchronization.
- Local service 415 V / 240 V diesel generator auxiliary switchboard.
- The diesel engine shall be an intercooled, turbocharged (if applicable), water-cooled, four-stroke cycle design which is capable of accepting load immediately after starting.
- The engine unit shall be capable of driving an alternator mounted on a common base skid at the specified output.

2.3.5.2 Starting System

Each engine shall be provided with an on-skid dual 12/24 V DC electric starting system. The proposer shall provide the electric starting motors, low maintenance starting batteries together with ventilated battery housing, interconnection cables and 240 V AC battery charger(s).

The independent battery charger(s) must be fully automatic and allow boost, charge and float charging conditions with monitoring by the diesel generator control system.

The batteries and starters shall be capable of ten (10) starts per hour. The battery charger(s) shall be capable of recharging the batteries to full potential within one hour after a cranking cycle and shall be adjustable to compensate for the battery self-discharge rate during standby periods. All battery system components shall be monitored and alarmed by the control system.

The control system provided shall include a cycle cranking system, which allows for user-selected crank time, rest time, and number of cycles. Initial settings shall be for 3 cranking periods of 15 seconds each, with 15 second rest periods between cranking periods.

The control system shall include time delay start (adjustable 0~3 00 seconds) and time delay stop (adjustable 0 ~ 6 0 0 seconds) functions.

Generating Set Control System

- AC/DC control panel consisting of:
- Emergency Stop button
- Controller with selection for auto-start, AMF monitoring and with following (and not restricted to) features:
 - Start/Stop button
 - Hour run meter
 - Monitor engine temperature and provides shutdown protection
 - Monitor engine speed and provides shutdown protection
 - Monitor oil pressure and provides shutdown protection
 - Alarm output for abnormal operation

Control System shall have and operate in the following mode:

- Manual transfer panel,
- Automatic transfer Panel,
- Fully Automatic Synchronizing and load Sharing system
- Manual Synchronizing Panel.
- Controller Protections 46 unbalance
- 50/51 phase overcurrent

Fuel System shall have and operate in the following mode

- Fuel filter
- 8 hours base fame fuel tank
- Fuel level shut down sensor
- Dual Wall Integral Fuel Tanks
- Dual Wall Sub-Base Fuel Tanks
- Automatic Fuel Fill Option

Starting / Charging system

- Battery charging alternator
- 24 volt starting motor(s)
- Maintain free battery with rack and cables
- Battery charger

Cooling system shall have the following;

- Radiator with guard sized for 50oC
- Coolant drain line with valve
- Fan and belt guards
- Radiator duct flange
- Low Coolant Level shut down sensor

2.3.5.3 Lubrication

The lubrication system shall comprise an engine driven pump to circulate lubricating oil under pressure. Full flow filters shall be provided together with replaceable elements. Lube oil make-up shall be automatically monitored and alarmed by the control system. The lubrication system shall be provided with alarms and trip sensors for high/low oil levels and temperatures and fitted with a crankcase heater if required.

2.3.5.4 Engine Cooling

The engine cooling system shall be capable of adequately cooling the diesel generator engine when the diesel generator is delivering full load at the specified maximum outdoor ambient air temperature. The on-skid radiator cooling system shall be provided with the following:

- Water pumps for jacket water and turbocharger intercooler cooling complete with thermostatic bypasses.
- Water-air heat exchanger(s) for jacket water and turbocharger intercooler cooling complete with all necessary interconnection(s) to the on-board radiator.
- Automatic control of radiator fans, including automatic cycling for even running hours
- Alarms and trip sensors for high/low coolant levels and temperatures.
- The diesel generator sets are to be installed in a complex climatological environment. The cooling and aspiration air system shall be fully suitable for this arrangement.
- All cooling system components to be monitored and alarmed by the control system.

The cooling system shall include a heavy-duty, tropical-type radiator, constructed for high ambient/engine temperatures, and prevailing conditions in tropical and arid dusty climates. The radiator shall be capable of cooling the engine when the diesel generator set is delivering a full rated load in an ambient temperature not to exceed 55°C.

The engine shall be provided with a thermostatic valve placed in the jacket water outlet between the engine and the cooling source. This valve shall maintain the proper jacket water temperature under all load conditions. A flexible connecting section shall be provided between the radiator and the discharge louver frame. The radiator shall be mounted in front of the engine, onto the skid base with oil resistant anti-vibration mountings.

2.3.5.5 Exhaust System

The diesel engine exhaust system shall comprise the exhaust silencer, discharge pipe work and stack, and support structures. The engine exhaust system includes but is not limited to the following:

- Flanged flexible stainless steel thermal expansion bellows at the diesel engine exhaust outlet
- Exhaust silencer of a non-spark type capable of the following:
 - Low-pressure drop;

- Damping engine pulsations, backfiring and preventing any engine resonance.
- Sound attenuation as required to meet the noise levels specified.
- Drainage facilities.
- The exhaust shall be stainless steel insulated as required and fitted with a rain flap. The discharge stack, and exhaust systems shall be supplied complete with roof, wall and ground mounts as required, complete with anti-vibration supports as required.

The exhaust shall discharge from the top of the diesel generator enclosure.
- All 316 stainless steel bolts are mated with 304 stainless nuts together with an anti-seize compound.
- Other noise control measures including splitter attenuators and acoustic linings shall be considered with regard to reducing the noise levels. The proposer shall state any additional options for noise reduction and associated costs.

2.3.5.6 Insulation

The proposer shall provide and install thermal insulation on the diesel generator and supplied auxiliaries where required for the efficiency of the works, to meet statutory and local regulatory requirements and safety of personnel.

No part of the works that can be touched during normal operation shall have a surface temperature in excess of 50°C. All insulation materials shall not contain any asbestos or asbestos based products.

All insulation applied to pipe work, machinery, works, and ducting shall be clad with aluminium or stainless-steel cladding of appropriate thickness not less than that conforming to BS 5970. Cladding design, application and fixing shall be in accordance with BS 5970 or as otherwise approved.

All insulation exposed to the weather shall be sufficiently clad to be completely weatherproof. Insulation and cladding shall be designed and applied with proper allowance for expansion and contraction.

2.3.5.7 Governor

An electronic governor system shall be provided to maintain automatic isochronous frequency regulation. The governing system dynamic capabilities shall be controlled as a function of engine coolant temperature to provide fast, stable operation at varying engine operating temperature conditions. The fuel rate shall be

regulated as a function of starting, accelerating to start, disconnecting speed, accelerating to rated speed, and operating in various isochronous or parallel states. The control system shall interface directly with the governor. All software, programming leads, software dongles and the like shall be included if a PC programmable system is offered.

2.3.5.8 Alternator

2.3.5.8.1 General

The alternator shall be a synchronous, air-cooled, single or dual bearing (depending on size), drip-proof industrial type. It shall be of a rotating field brushless design and have an integral rotating exciter with an excitation supply from a permanent magnet alternator or other approved method of supply. The synchronous alternator shall be rated for a nominal continuous output and overload capacity at the specified environmental and operating conditions and shall be capable of delivering rated output (kVA) at rated frequency and power factor, at any voltage not more than 5 percent above or below rated voltage. The sub-transient reactance of the alternator shall not exceed 15% and the alternator shall be able to operate up to 15% reverse kVA.

The instantaneous voltage dip shall not exceed 20% of rated voltage when full load, at rated power factor, is suddenly applied. Recovery of stable operation shall occur within 5 seconds. Steady state modulation shall not exceed +0.5%.

The deviation of the waveform of voltage output from a pure sine wave shall not exceed the limits specified in BS 5000 Part 99: 1981 within a range of $\pm 2.5\%$. Telephone, Radio/Television radiated interference should be suppressed to the limits in accordance with BS: 800 1983 Part 99, BS 833: 1985 & BS EN: 6100-6 (1, 2, 3, 4).

2.3.5.8.2 Design

The stator core is built up of high-grade silicon steel laminations, precision punched, and individually insulated. Armature lamination followers and frame ribs shall be welded integral with the frames for support of the stator core. A directional blower shall be mounted on the unit to draw cooling air from the exciter and over the rotor poles and through louvered openings on the opposite end.

The rotor poles shall be built up of individually insulated silicon steel punching. Poles shall be wound and bonded with high strength epoxy resin. Cage connections to the amortisseur rings shall be brazed for strong construction and permanent electrical characteristics. Each pole shall be securely bolted to the rotor shaft with bolts sized for the centrifugal forces on the rotor. Alternator windings shall be braced for full line ground fault currents, with a solidly grounded neutral system.

The alternator housing shall be weatherproof and rated to minimum IP23. The alternator output is wired to heavy-duty terminations, via an appropriately rated, moulded case circuit breaker, with overload and short circuit protection.

The alternator stator and exciter winding shall conform to BS 2757: 1984 excluding Classes Y and A standard, with 100% rated load temperature rise, protection against aggressive atmosphere, and severe environmental conditions. This should be acceptable to RH >95%, not less than Class H limitation.

The insulation to windings shall have an oil, moisture, salt air, fungus proof finish and epoxy coated surface which will not retain dust or condensation; it shall be possible to put the set-in service after long periods in unheated storage without the necessity for drying up insulation.

2.3.5.8.3 Temperature Rises

The winding insulation shall be Class 'H' to BS 2757 or equivalent. At rated output under the specified operating conditions the temperature rises for Class 'H' insulated windings shall not exceed those specified in BS 4999 Part 32 for Class 'H' insulation.

2.3.5.8.4 Excitation System

The exciter shall be a fast response type, with a rotating 3-phase full-wave bridge. The exciter has a low time constant and large capacity to minimize voltage transients under severe load changes. The voltage regulation class of accuracy and performance shall be in accordance with regulation grade VR 1 of Clause 40.3.4 of BS 4999 Part 40.

The alternator shall be AVR (Automatic Voltage Regulator) controlled (digital type). The alternator manufacturer/proposer shall furnish a hermetically sealed, silicon-controlled rectifier type voltage regulator employing a zener diode reference with $\pm 1\%$ regulation for the generator. The regulator shall include 1-phase/3-phase voltage sensing, automatic short circuit protection and shall include automatic under frequency protection to allow the generator to operate at no load at less than synchronous speed for engine start-up and shutdown procedures.

For sustaining short circuit current of up to 300% for 3 seconds when under control of the automatic voltage regulator, a permanent magnetic exciter shall be provided to the units with capacities which can

meet the 300% short circuit current for 3 seconds, permitting the breaker to trip on overload. To prevent possible overheating of the armature windings, appropriate relaying shall be supplied to limit the fault to ten seconds.

The excitation system shall incorporate the following features and facilities:

- Voltage setting control.
- Reactive power (VAR) or power factor control.
- Protection against AVR failures (e.g. over/under excitation combined with over/under voltage).
- Supervised fault detection.
- Capability to operate with automatic synchronising equipment.
- Start excitation under black start conditions.
- An excitation system which will withstand short circuits and synchronising of the machine up to 90° out of phase without failure of the components.
- Fault current boosting as required for discrimination of the system electrical protection with the alternator running isolated.
- A brushless excitation system.

2.3.5.8.5 Automatic Voltage regulation (AVR)

The AVR shall be capable of maintaining voltage at $\pm 1.0\%$ of any value within 10% of the nominal voltage throughout the full range of rated load and power factor conditions. Droop stability and voltage set point adjustments shall be by operator interface or programmable via laptop.

The AVR shall be capable of preventing sustained over-voltage during over-speed conditions following the loss of load. After a sudden load rejection at a rated power factor, rated voltage shall be restored within 2 seconds.

Torque matching characteristics shall be adjustable for roll-off frequency and rate and be capable of being curve-matched to the engine torque curve adjustable in the field. The voltage regulator shall include adjustments for gain, damping, and frequency roll-off. Adjustments should be broad range, and made via rheostat, with LED readouts to indicate setting level. Controls shall be provided to monitor the output current of the generator set and initiate an alarm (over current warning) when load current exceeds 110% of the rated current of the generator set on any phase for more than 60 seconds. The controls shall shut down and lock out the generator set when the output current level approaches the thermal damage point of the alternator (over-current shutdown).

Controls shall be provided to individually monitor all three phases of the output for short circuit conditions. The control/protection system shall monitor the current level and voltage. The controls shall shut down and lock out the generator set when the output current level approaches the thermal damage point of the alternator (short circuit shutdown).

Controls shall be provided to monitor the kW load on the generator set and initiate an alarm condition (overload) when total load on the generator set exceeds the generator set rating for in excess of 5 seconds. Controls shall include a load-shed control; to operate a set of dry contacts (for use in shedding customer load devices) when the generator set is overloaded.

All software, programming leads and software dongles and the like shall be included if a PC a programmable system is offered.

2.3.5.8.6 Synchronizer

Each generator set supplied under this contract shall be capable of synchronization with other diesel gen sets and RE sources.

A fully featured synchroniser shall be included either as part of the AVR or as a separate unit. The synchroniser shall be controlled by the alternator start-up system and interface directly to the governor and AVR. Clean contacts for close/open of the main breaker are included as well as an interface to any other indications required.

2.3.5.9 Diesel Generator Control System

2.3.5.9.1 Diesel Generator Control

The main diesel generator control panel shall be a sturdy, self-supporting, of suitably treated and painted sheet steel (conforming to IP 54 protection and in accordance with industry standards. It shall comprise all equipment necessary to support the function, controls and modes of operation described in this specification, including but not limited to (the equipment may be adjusted for units with smaller capacities):

- Automatic controls including operator interface capable of communication for transmission of status and alarms.
- Isochronous load control and base load control modes.

- Dedicated 12/24 V DC supply system.
- Comprehensive indication including but not limited to:
 - Diesel generator voltage (LL & LN)/current per phase.
 - Battery voltage.
 - Power meters for diesel generator kW, kWh, kVAr
 - Power factor.
 - Frequency.
 - Lube oil pressure/temperature
 - Fuel system monitoring.
 - Engine/Alternator speed.
 - Coolant temperatures.
 - Start fails.
- Panel controls for circuit breaker.
- Panel controls and status of diesel generator test, manual and automatic operations.
- Emergency stop – lock down / twist to release mushroom style.

2.3.5.9.2 Control Switches

2.3.5.9.2.1 Mode Select Switch

The mode select switch initiates the following control modes. When in the RUN or Manual position the generator set shall start and accelerate to rated speed and voltage as directed by the operator. In the OFF position the generator set shall immediately stop, bypassing all time delays. In the AUTO position, the generator set shall be ready to accept a signal from a remote device to start and accelerate to rated speed and voltage. In the LOAD TEST mode position the generator set shall be ready to be tested under varying-load conditions.

2.3.5.9.2.2 Emergency Stop Switch

The emergency stop switch shall be a Red "mushroom-head" push-button. Depressing the emergency stop switch shall cause the generator set to immediately shut down and be locked out from automatic restarting.

2.3.5.9.2.3 Reset Switch

The RESET switch shall be used to clear a fault and allow restarting the generator set after it has shut down for any fault condition.

2.3.5.9.2.4 Panel Lamp switch

Depressing the panel lamp switch shall cause the entire panel to be lighted with DC control power. The panel lamps shall automatically be switched off 10 minutes after the switch is depressed, or after the switch is depressed a second time.

2.3.5.10 Generator Set AC Output Metering

The generator set shall be provided with a metering set including the following features and functions:

- a) Digital Controller working in parallel with an analog metering set with 0.5% accuracy, to indicate generator RMS voltage and frequency, output current (3 ammeters), output kW, kWh, and power factor (pf). Generator output voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three-phase voltages (line to line and line to neutral) simultaneously.
- b) The control system shall log the total number of operating hours and total kWhrs.
- c) The control system shall log total fuel consumed given a certain number of operating hours and or total kWhrs.

2.3.5.11 Engine Status Monitoring

The following information shall be available from an analogy display status panel on the generator set control:

- a) Engine oil pressure (psi or kPa)
- b) Engine coolant temperature (degrees C)
- c) Engine oil temperature (degrees C)
- d) Engine speed (rpm)
- e) Number of hours of operation (hours)
- f) Number of start attempts
- g) Battery voltage (DC volts).

2.3.5.12 Control Interfaces for Remote Monitoring

The control system shall provide four programmable output relays. These relay outputs shall be configured for any alarm, shutdown, or status condition monitored by the control. The relays shall be configured to indicate:

- a) generator set operating at rated voltage and frequency,
- b) common warning,
- c) common shutdown,
- d) load shed command.

A fused 10 amp switched 12/24VDC power supply circuit shall be provided for customer use. DC power shall be available from this circuit whenever the generator set is running.

A fused 10 amp 12/24V DC power supply circuit shall be provided for customer use. DC power shall be always available from this circuit from the engine starting/control batteries.

The electronic and electrical controls and wiring shall be able to withstand the ambient temperature and vibrations inside the enclosure. The panel itself shall also be vibration insulated. Line diagram of the integrated control panel clearly showing all components shall be submitted with the bid.

2.3.5.13 Battery Monitoring System

A battery monitoring system shall be provided which initiates alarms when the DC control and starting voltage is less than 13.5 V DC or more than 15 V DC. During engine cranking (starter engaged), the low voltage limit shall be disabled, and DC voltage shall be monitored as load is applied to the battery, to detect impending battery failure or deteriorated battery condition.

2.3.5.14 Diesel Generator and Engine Protection System

The diesel generator shall be equipped with a dedicated engine protection system that acts to minimize damage in the event that the unit malfunctions or is exposed to an external fault. This shall include:

- An engine protection system including coolant temperature, oil pressure etc.
- An emergency stop operator push button system, with emergency stops.

The electrical protection system shall operate on the main breaker. The diesel generator protection shall include warnings and trips including but not limited to:

- Over voltage.
- Under voltage.
- Over speed/frequency.
- Under speed/frequency.
- Over current and earth faults.

- Differential.
- Reverse power
- Turbocharger over speed (if applicable).
- High oil temperature.
- High jacket water temperature.
- Low oil pressure.
- Low fuel tank level and alarms.
- AVR alarms.
- Exciter alarms.
- Temperature alarms.

The proposer shall provide any additional recommendations for protection elements, recommended settings for the diesel generators provided, and provide all base data including capability curves, negative sequence withstand curves and the like to assist with the settings of the above protection elements.

2.3.5.14.1 Voltage Monitoring System

An AC over/under voltage monitoring system that responds only to true RMS voltage conditions shall be provided. The system shall initiate shutdowns of the generator set when alternator output voltage exceeds 100% of the operator-set voltage level for more than 10 seconds, or with no intentional delay when voltage exceeds 130%. Under voltage shutdown shall occur when the output voltage of the alternator is less than 85% for more than 10 seconds.

2.3.5.15 Main line Circuit Breaker

Main line, moulded case circuit breaker mounted upon and sized to the output of the generator at 50 Hz shall be installed as a load circuit interrupting and protection device. It shall operate both manually for normal switching functions and automatically during the above-mentioned failure events. The breaker shall also include ground fault sensing that will trip the breaker on ground fault conditions.

The circuit breakers on the Generator power supply outlet shall be covered by flex glass internally/externally for protection against electrical hazards. Each circuit breaker shall be equipped with

auxiliary contacts for connecting the required number of indicators and protection devices as stated above and to connect remote annunciation of the breaker position.

The circuit breaker enclosure, together with all specified circuit breakers, shall be designed for the specified and be equipped with an isolated neutral conductor bus, rear copper stabs, or load cable lugs and be finished painted to match the generator set. The rating of each circuit breaker shall allow the starting of the full generator kVA.

The trip unit for each pole shall have elements providing inverse time delay during overload conditions and instantaneous magnetic tripping for short circuit protection. The circuit breaker shall meet standards according to IEC 947-2 and/or BS EN 60947-2.

2.3.5.15.1 Starting Battery and Charger

The stationary maintenance-free storage battery set shall be of heavy-duty diesel starting type. It shall be of maintenance-free, sealed type e.g., AGM, VRLA, OPzV or OPsV. The battery voltage shall be rated 12/24 V DC, and the battery set shall be of sufficient capacity for six starts in succession once in an eight-hour period at a minimum. Requisite quantity for initial fill of batteries will be supplied with generating sets.

An automatic 12/24 V DC battery Charger with current limiting capabilities shall be furnished to automatically charge the batteries. The Charger shall float at 2.17 volts per cell and equalize at 2.33 volts per cell. It shall include overload protection, silicon diode full wave rectifiers, voltage surge suppressors, DC ammeter, DC voltmeter and fused AC input.

2.3.5.16 Earthing/Grounding

The alternator star point is solidly earthed. The earthing system may consist of copper plates and minimum 35 mm² copper stranded wire. Maximum permissible resistance will be 5 Ω.

All metal parts including doors, windows, rails, metal boxes, engines and alternators bodies, etc. shall be connected via insulated stranded copper cable of minimum 35mm², marked yellow-green through suitable cable lugs and ready to be connected to the earthing system

2.3.5.17 Weatherproof and Sound Attenuated Enclosure

The generator set shall be manufactured and housed completely in a weatherproof and sound attenuated enclosure, with standard forklift slots and two standard load locking /lifting fittings. The arrangement inside the enclosure shall allow for the generating set to be pulled out in either direction after unbolting the sound attenuation enclosure, anti-vibration mounts, day- tank, etc.

The engine and alternator (including integrated fuel tank) shall be mounted and aligned on a rigid skid, fabricated from cross-braced structural steel members. The skid shall be complete with all necessary fixings and floor strengthening as required and be provided with vibration mounts and seismic restraint holding down bolts.

All sheet metal shall be primed for corrosion protection and finished painted with the manufacturer's standard colour using a two-step electro-coating paint process, or equal to the performance requirements specified below. All surfaces of all metal parts shall be primed and painted. The painting process shall result in a coating that meets the following minimum requirements and shall be suitable for a minimum of 20 years' life in a tropical atmosphere:

- a) Primer thickness, 0.5-2.0 mm
- b) Topcoat thickness, 0.8-1.2 mm
- c) Gloss, per ASTM D523-89, 80% plus or minus 5%. Gloss retention after one year shall exceed 50%.

The enclosure shall be outfitted with all necessary louvered openings to provide sufficient ventilation and allow the generating set to operate as per site conditions. The enclosure shall be outfitted with:

- a) Ceiling mounted Light bulb (12/24 V DC), providing sufficient light on both sides of the generator.
- b) Outside, flush –mounted, easily accessible (for re-fueling), lockable fuel-tank filler. The Enclosure fitted with a day fuel-tank shall also be supplied along with a manual hand-priming pump to fill the day fuel-tank (in case of AC power outage) from the external main storage tank.
- c) Suitable outlet for distribution cable, that when not in use is covered by a bolt-on cover accessible from inside only.
- d) The generating set is earth-connected to the enclosure, and two (2) heavy-duty earth connections are provided (one on each side).

Minor differences in the construction of the weatherproof enclosure are acceptable, provided that the main requirements are met i.e.

- a) Generating set can operate continuously at site conditions
- b) Generating set can be pulled out of the enclosure from either end.
- c) Outside mounted exhaust silencer
- d) Provision of internal day-tank
- e) Mounting of main circuit breaker.

Sound proofing materials shall be highly fire protective (material manufacturer's certificate should be provided)

2.3.5.18 Data sheets

The proposer shall provide a complete set of data sheets as described below with his bid. Missing data sheets and/or information may lead to the rejection of the bid.

2.3.5.18.1 Installation Drawings

Installation drawings showing plan and elevations of the complete generator unit:

- foundation plan;
- exhaust silencer;
- starting battery;
- battery charger;
- weatherproof enclosure and trailer and
- base mounted fuel tank.

2.3.5.18.2 Engine Data:

- a) Manufacturer
- b) Model
- c) Number of Cylinders
- d) RPM
- e) Bore x stroke
- f) BMEP at full rated load
- g) Piston speed, FPM
- h) Make and model and descriptive literature of electric governor (where required)
- i) Fuel consumption rate curves at various loads
- j) Engine continuous pump drive duty rating (without fan) HP

- k) Gross engine horsepower to produce generator continuous rating (including fan and all parasitic loads) HP

2.3.5.18.3 Alternator Data

- a) Manufacturer
- b) Model
- c) Rated kVA
- d) Rated kW
- e) Voltage
- f) Temperature rise above 40°C ambient:
 - i) Stator by thermometer
 - ii) Field by resistance
 - iii) Class of insulation
- g) Generator efficiency including excitation losses and at 0.8 power factor:
 - i. Full load ii) ¾ load iii) ½ load

2.3.5.18.4 Generator Unit Control Data:

- a) Actual electrical diagrams including schematic diagrams, and interconnection wiring diagrams for all equipment to be provided. Standard pre-printed sheets are not acceptable.
- b) Legends for all devices on all diagrams.
- c) Sequence of operation explanations for all portions of all schematic wiring diagrams.

2.3.5.18.5 Engine/Alternator Unit and weatherproof enclosure

Dimensional data shall be given for the Engine/Alternator set and for the weatherproof enclosure:

- a) Weight of skid mounted unit
- b) Overall length
- c) Overall width
- d) Overall height
- e) Exhaust pipe size
- f) CFM of air required for combustion and ventilation
- g) Heat is rejected to jacket water and lubricating oil BTU/hr.
- h) Heat is rejected to room by engine and alternator set BTU/hr.

- i) Weatherproof enclosure and trailer details and certification of manufacturing method per specification.
- j) Base fuel tank (capacity to be stated for each size), venting, fuel connection points and fill cap location.
- k) Data on all miscellaneous items supplied.

2.3.5.18.6 Test Reports

Furnish several copies of certified shop test records of the complete engine-driven generator unit.

2.3.5.18.7 Warranty information

- Submit the operating and maintenance data.
- Submit the equipment manufacturer's certificate of installation, testing, and instruction.

2.3.6 *Operations and Maintenance Manuals*

A comprehensive plant O&M manual together with the manpower requirements will be provided to the Owners Engineer prior to Practical Completion and training with two hard copies and one soft copy. It shall include at a minimum.

- Project information: Names, addresses, email, phone of responsible people within REA, Contractor, and subcontractors (where applicable)
- Safety Instructions
- Equipment information: Contact information of manufacturers and proposers of Main Equipment including datasheets of the equipment.
- Tools and consumables supplied by the contractors
- Equipment description: This part shall describe the location of the equipment, the performance figures and equipment specific information such as manufacture date and flash test results for PV modules
- All Software, Manuals and Project Documentation required to operate, maintain, service, repair and restore the inverters, protection systems, switchgear, monitoring, control systems and other systems that form part of the Plant
- Operation Procedures: Appropriate manufacturer's technical literature.
- Maintenance Procedures: Appropriate manufacturers technical literature including detailed recommendations for preventative maintenance, frequency, and procedures
- Detailed and thorough self-troubleshooting providing logical step-by-step procedures where possible, including dis-assembly, repair and re-assembly, cleaning, and alignment
- Accurate records of outputs, inputs such as fuel and measured data such as irradiation, ambient temperatures and other performance indicators
- Schedule of periodic checks to identify any deviation in the conditions of the PVs and Energy Storage system.
- User Guide for SCADA system, data monitoring and data communication

- Schedule of Spares
- General maintenance of the site
- Applicable Certificates
- All test documentation and As-Built Drawings shall be added after Practical Completion.

2.3.7 Management and Safety of Hazardous Materials

The proposer shall develop an e-waste management plan for safe end-of-life disposal of equipment from the solar plant with the University in line with the Environmental and Social Management Framework (ESMF) and the approved ESIA.

2.4 Building Specifications and Requirements for Workshop & Training Centre

2.4.1 Concrete Work

2.4.1.1 General Requirements

All concrete work shall be carried out in accordance with these specifications except that in the case of reinforced concrete the provisions of B.S 8110-1: 1997: Structural Use of Concrete - Part 1: Code of Practice for Design and Construction shall apply in so far as they override, modify or supplement the clauses contained herein. The Contractor shall submit to the Project Manager full details of all materials which he proposes to use for making concrete.

MINIMUM RECOMMENDED STRUCTURE FOUNDATION TYPE

S/No	Structure	Location of Institution	Foundation Type	Remarks
1	Workshop & Training Center	Port Harcourt, Uyo, Owerri	Raft	Weak soil with very low Bearing Capacity envisaged
		Other Areas	Isolated Pad	
2	Control Building	Port Harcourt, Uyo, Owerri	Strip/Wide Strip	Building must be framed
		Other Area	Strip	
3	Containerized Battery Room	Port Harcourt, Uyo, Owerri	Slab at Grade (Raft)	
		Other Area	Isolated Pad footing	

Note following as guide in your soil test to obtain required Soil Bearing Capacity for your design of above foundations:

- Standard Penetration Test, Static Dutch Cone Penetrometer Test and where necessary Undrained Triaxial Test shall be conducted to determine the least Soil Bearing Capacity among the 3 methods for design purposes with due consideration of adequate Safety Factor
- Each exploratory borehole shall be a minimum of 10 metres deep.
- The ground water condition within the depth of exploration must be stated
- Elaborate mention of sample collection and preservation methods is required
- Exploratory Borehole must be located at the load centre of transformer foundation(s) for the Substation, WTC and any other heavy structure of note
- 3 exploratory boreholes must be sunk to determine the subsoil characteristics
- Every test parameter as required in Geotechnical Engineering shall be carried out.
- Expected foundation settlement must be stated
- Laboratories for the testing of samples including the Subcontractor for Soil Test shall be approved by the Project Manager

2.4.1.2 Cement

The cement shall, unless specifically stated to the contrary, be Ordinary Portland cement complying with the requirements of BS EN 197-1:2000. Where other cements are specified, they shall comply with the requirements of the relevant Nigerian and International Standards.

All cement shall be obtained from manufacturers in Nigeria. Where cement is to be imported, prior approval shall have to be obtained.

The Contractor shall supply, when requested by the Project Manager, test certificates relating to each type of cement used certifying that it complies with the appropriate Standards.

Unless approval is given for bulk handling, all cement shall be transported and delivered in sound and properly secured bags and stored in a dry, weatherproof, well ventilated shed with a raised floor and free from walla or in such a building as approved.

Each delivery of cement in bags shall be stacked in one place. The bags shall be closely stacked to reduce air circulation but shall not be stacked against an outside wall. Where pallets are used, they shall be constructed so that the bags are not damaged during handling and stacking. No

stack of cement bags shall exceed 3 m in height. Different types of cement in bags shall be clearly distinguished by visible markings and shall be stored in separate stacks. Cement in bags shall be used in the order in which it is delivered.

Bulk cement shall be stored in weatherproof silos, which shall bear a clear indication of the type of cement contained in them. Different types of cement shall not be mixed in the same silo.

Cement shall be delivered or stored on site in such quantities to ensure that the concrete work on any section of the Works can be carried out without interruption. Each consignment shall be kept separate and distinct.

Any cement that has been injured by dampness or any other cause shall not be used and shall immediately be removed from the site. Cement which has become hardened and lumpy shall be removed from site.

Cement which has been stored on site for longer than one month shall be tested at Approved Laboratories. In any case no cement which has been stored for more than 90 days is considered fit for use on the job.

2.4.1.3 Aggregate for Concrete

Aggregates for concrete shall consist of clean natural sands, gravel, crushed stone or other material which have been approved for use and shall apply in respect of quality with the requirement of BS EN 12620 "Coarse and Fine Aggregates from Natural Sources for Concrete".

Tests shall be made at frequent intervals or when called for to determine the amount of impurities in the aggregates and if deemed required, the fine aggregates shall be washed at the Contractor's own expense.

BS EN 12620 requires that aggregates shall be hard, durable, clean and free from adherent coatings such as clay.

They shall not contain harmful materials such as iron pyrites, iron oxide, mica, shale or similar laminar materials, or flaky or elongated particles, in such a form or in sufficient quantity as to adversely affect the strength or durability of the concrete or any materials which might attach reinforcement where this is required.

The various sizes of particles of which an aggregate is composed shall be uniformly distributed throughout the mass. The quantities of clay, silt and fine dust shall not exceed:

- (i) Sand or crushed gravel sand, 3% by weight when using the test given in BS 812 Clause 13.
- (ii) Crushed stone sand, 5% by weight when using the test given in BS 812 Clause 12.
- (iii) Coarse aggregate, 1% by weight when using the test given in BS 812 Clause 13.
- (iv) All in aggregate, 2% by weight when using the test given in BS 812 Clause 13.

A guide to the silt and clay content of sand and crushed gravel sand can be obtained by the field settling test described in B.S. 812 Clause 14 when the silt and clay content should not exceed 65 by volume.

2.4.1.4 Sand

All sands for making mortar shall be clean well graded siliceous sand of good, sharp, hard quality equal to samples which shall be deposited and approved being free of earth, loam, dust, salt, organic matter and any other deleterious substances.

2.4.1.5 Maximum Sizes of Coarse Aggregates

The maximum size of the largest coarse aggregate shall not be larger than a quarter of the smallest size of the member in which it is being used and at least 6 mm less than the smallest space between reinforcing bars where the member is reinforced.

2.4.1.6 Storage of Aggregates

Aggregates of different sizes shall be stored in separate bins on hard clean floors free from contamination of any kind. Samples shall be supplied for testing prior to the Works being commenced.

Aggregates shall be kept in sufficient quantities to enable the work on any section to be completed without interruption.

All aggregates shall be tested regularly, and any material which is below standard, or which has become contaminated or adulterated in any way shall be immediately removed from the site.

2.4.1.7 Water

Water for concrete mixing shall be from an approved source and shall be clean and free from acids, vegetable matter and any other deleterious material in solution or suspension. Potable water shall be suitable for concrete preparation.

2.4.1.8 Concrete Mixes by Volume or Weight

The proportion for concrete mix sizes shall be specified either by:

- a) Volume
- b) Weight

Concrete mixes by volume will be permitted in the case of mass concrete work, unreinforced foundations and beds and for small isolated structural members such as lintels and isolated beams providing that in all cases the Project Manager is satisfied that the required strengths are being obtained.

Weight batching shall be used for all other concrete work in reinforced concrete ground beams, column bases, structural frames, floors, roofs, staircases, retaining walls and the like.

2.4.1.9 Concrete Mixes

Concrete mixes shall be designed to satisfy the specified characteristic strengths. The mean strength of the designed mix shall exceed the specified values by twice the expected standard deviation to take into account the inevitable variation.

Both fine and coarse aggregates shall be from natural sources and shall be graded such as to produce a concrete of specified proportions which will work readily into position without segregation and without excessive water content.

2.4.1.10 Trial Mixes

When directed, the Contractor shall make trial mixes for approval, before general manufacture of concrete commences.

Trial mixes shall be made using the identical plant and compaction methods which will be used in the works and deposited in suitable representative formwork.

Careful measurements of the cement, aggregate and water: cement ratios, slump and workability shall be made and the time of mixing noted for each mix.

Six "preliminary" test cubes shall also be made for each mix. Three cubes from each batch shall be tested for compressive strength at seven (7) days and the remaining three at twenty-eight (28) days. The density of all the cubes shall be determined before the strength tests are carried out.

Mixes shall be made in such numbers as directed until the desired qualities are obtained.

Every precaution shall be observed to ensure that the manufacture and placing of concrete in the works is carried out in the same fashion as that used in the manufacture of the selected trial mix.

Fresh trial mixes may be directed to be made should there be any change in the source or grading of the aggregate, manner of making and compacting, or other changes from the trial mix adopted originally.

The crushing strength of "preliminary" test cubes taken from trial mixes, shall at 28 days be not less than 25% more than that specified for the minimum crushing strength of "Works" test cubes as later described, for the same quality of concrete.

Concrete cubes shall be submitted for "Preliminary" and "Work" Cube Tests. The Contractor shall equip himself with accurately made metal moulds for casting 100mm square concrete cubes.

The moulds and method of preparing such cubes shall be in accordance with B.S 1881 "Method of Testing Concrete".

Batches of six "Preliminary" cubes shall be taken from the trial mixes as previously described. Six "Work" cubes each measuring 150mmx150mmx150mm shall be taken for testing from any batch or class of concrete in use on the works as directed.

Three cubes shall be tested at 7 days and three at 28 days.

Concrete test cubes shall be submitted to approved Materials Laboratory for testing and the Contractor shall carefully identify each cube and provide all information relative thereto, e.g., contract number, mix proportions, date cast, where the rest of the batch has been incorporated in the works and the Contractor's name and test cube reference number.

If any cubes representative of concrete which has already been incorporated in the work fail to give the required compressive strength, the Project Manager reserves the right to instruct the contractor to cut out and remove all work affected by these cubes and replace it entirely at his own expense.

2.4.1.11 Mixing of Concrete

Concrete shall be thoroughly mixed to a uniform consistency in measured batches in a mechanical mixer of capacity proportional to the amount of concrete required in any section of the works under construction. Mixing shall continue for not less than two minutes after all the materials including water, which shall be added last of all, have been passed into the drum and before any portion of the batch is discharged but in all cases the actual shall conform to that required for the selected trial mix.

The water content shall be carefully controlled and shall be added in sufficient quantity to make up the amount found to be necessary in the trial mix under no circumstances will the water; cement ratio be exceeded and any batch which is mixed too wet shall be rejected. The entire contents of the mixer drum shall be discharged before the succeeding batch is introduced into the drum.

Mixers and or batching plants shall be properly maintained throughout the contract and any mixer of plant which is faulty in any respect shall not be used. Drums of all mixers shall revolve at a constant speed recommended by the manufacturers. A mixer which has been standing idle for twenty minutes after mixing the last batch shall be thoroughly washed and cleaned before any fresh mix is made. Mixers shall be thoroughly cleaned at the finish of each run of concrete mixing or at the end of each day. All mixing plants shall be thoroughly cleaned if used for High Aluminium or other specialized cement concrete after Common Cement concrete and vice-versa.

2.4.1.12 Hand Mixing

Hand mixing shall only be allowed with express permission. The mixing shall be done on a clean, watertight, non-absorbent platform. The cement and fine aggregate shall be mixed dry until the mixture is thoroughly blended and uniform in colour. The coarse aggregate shall then be added and mixed in until it is uniformly distributed throughout the batch. The correct quantity of water shall be added using a can with a rose nozzle and the mixing continued until the entire batch of concrete appears to be homogenous and has the desired consistency. Each batch of concrete shall be turned over at least three times dry and three times wet. The platform shall be emptied before a subsequent batch is mixed and thoroughly cleaned if not in use for more than 20 minutes before the next batch is prepared or if a different type of cement is used as previously described.

For hand mixing the cement content of each mix shall be increased by 10% over that required for machine mixing and this shall be done at the Contractor's own expense.

2.4.1.13 Transporting and Placing Concrete

Concrete shall be transported in a manner which will avoid any segregation, loss, consolidation or drying out of the consistent materials and placing in the forms shall be completed before the initial set takes place. Concrete shall not be dropped through a height greater than 1.5 m.

Chutes and pumps may be used provided they shall be so arranged as to avoid segregation.

All equipment for the transporting and placing of concrete shall be constantly cleaned and kept free of all coatings of hardened concrete or other obstructions.

Concreting of any unit or section of the work shall be carried out in one continuous operation and no interruption of the concrete will be allowed without the approval of the Project Manager.

In no case shall more than 20 minutes elapse between mixing and placing of any concrete in its final position.

2.4.1.14 Ready Mix Concrete

The term "Ready Mix" concrete is applied in cases where concrete is obtained from a firm which specializes in the manufacture of concrete in bulk at a central plant where it is transported to the site in transit mixers which keep it agitated until it is delivered. This term also applies to concrete in which the aggregate and cement are batched dry at a central plant and fed into the drum of a mixer mounted on a lorry in which it is transported to the site. Water is carried in a special container and is measured and fed into the drum and wet mixing is started, either during the journey or when the mixer lorry reaches the site.

This type of concrete will only be allowed on the specific instructions of the Project Manager who will require a certificate with every batch of concrete delivered giving the actual weights of aggregate, cement and water used so that a guarantee is provided that the concrete is in accordance with the Specifications.

2.4.1.15 Compaction of Concrete

After concrete has been placed in the forms it shall be compacted with approved tools and in such a manner as to produce a dense homogenous mass, free from segregation of honeycombs and entrained air, filling all spaces between and around forms and reinforcement without voids of any kind.

Where vibrators are used they shall be of the immersion type, approved by the Project Manager and have a frequency of not less than 5000 hertz (HZ). Vibrators shall not be attached to or allowed to come into contact with reinforcement or used in such a manner as to damage concrete in other parts of the structure, which has taken its initial set. Care is also to be taken so that concrete is not over-vibrated or compacted and segregation takes place.

Partially set concrete shall not be disturbed in any way and the Contractor shall ensure that it is not subjected to unnecessary loads, shocks or vibrations from adjacent plant or vibrators in the vicinity nor allow his workmen to walk on it or disturb it in any other way.

2.4.1.16 Construction Joints

Construction joints shall be made where shown on the drawings or as directed by the Project Manager, but in either case they shall be so arranged that their number is kept to the minimum.

Construction joints shall be formed at right angles to the axis of the member concerned by the insertion of rigid stopping-off forms.

Construction joints in slabs shall be vertical and in general, parallel to the main reinforcement, but, when required at right angles to the main reinforcement, they shall be constructed in the middle of the span.

The upper surface of lifts of concrete in walls and columns shall be horizontal and in the case of exposed finished work shall be so constructed so that they cannot be seen.

Lifts in walls and columns shall not exceed a height of 1m unless approved otherwise by the Project Manager.

Forms at construction joints shall be so made that they shall produce within the thickness of the joint a suitably grooved or keyed surface to act as a bond for the subsequent concrete.

As soon as the concrete is sufficiently set, stop boards shall be removed and the face hacked and wire brushed to form a key and washed. Before

placing the adjacent concrete, the surface of the joint is to be coated with a neat cement grout and left ready to receive the new adjacent concrete which is to be tightly packed up against its face.

2.4.1.17 Protection of Concrete

Freshly placed concrete shall be protected from the sun, drying winds and rain until it has properly set and shall be kept damp with hessian, sand, polythene or other waterproof sheeting for not less than seven days after laying. In the case of rapid hardening cements being employed, this shall be reduced to three days.

Concrete which has not been properly protected and is damaged or adversely affected in any way whatsoever shall be carefully cut out and replaced at the Contractor's own expense.

2.4.1.18 Concrete Surface Finishes

The surface of all concrete foundation beds shall be finished to an even surface to receive the walling.

The upper surface of floors, roofs, landings etc. shall either be trowelled smooth or where they are to be covered with screeds for other finishes shall be floated while onset to a smooth even finish free of all projection and irregularities either level or to falls as shown on the drawings.

The trowelling and floating shall be done in such a manner that the surface is free of laitance or cement slurry. After the removal of formwork, all surfaces in contact with the same shall be drenched with water, and carefully rubbed down with a carborundum block to remove fins and other irregularities. Any honeycombing or other damaged surface shall be carefully filled up with neat cement slurry and rubbed down to finish flush with the surrounding work. Such work shall be prevented from drying too rapidly by the use of damp sacking or similar means to ensure a good key between the concrete and the grout.

When the concrete surfaces are to be left exposed, the required surface finish shall be specifically stated in either the Particular Specification or the Bills of Quantities.

No rubbing down, repairing or patching of concrete shall be carried out until the surfaces have been inspected by the Project Manager.

2.4.1.19 Fair Face and Fine Face Finishes of Concrete

When exposed concrete is required to have a “Fair Faced Finish” it means that it is to be finished to a perfectly plain smooth surface free from all blemishes, irregularities, honeycombing, joint or grain marks.

The manner of obtaining this type of finish will be left to the discretion of the Contractor but the Project Manager reserves the right to instruct the Contractor to adopt an alternative method where he thinks the method in use is unsatisfactory.

Where “Fine Face” concrete finish is specified, the exposed surfaces produced by formwork shall have all fins and other small protuberances rubbed down but no pittings nor large fins or other protuberances will be allowed. The face of the concrete shall be finished perfectly smooth and even.

2.4.1.20 Form Hole Chases

Form all holes, pockets, chases, etc. required for services and other fittings as indicated on the drawings or otherwise using liners, sleeves, cardboard tubes, temporary boxings and timber filets attached to the framework.

Holes and chases shall not be cut in structural concrete after it has been set except on the specific instructions of the Project Manager.

2.4.1.21 Steel Reinforcement

Steel reinforcement shall conform to BS 4449, BS 4492 or BS 4483.

Mild steel reinforcement shall consist of plain round mild steel rods as specified in BS 6722.

Twisted mild steel reinforcement shall be cold twisted mild steel reinforcement as specified in BS 449.

Fabric reinforcement shall be hard drawn steel fabric reinforcement in accordance with BS 4483.

All steel reinforcement shall be of approved manufacture and shall be free from loose rust, mill scale, oil and grease or any other material which may impair the proper adhesion of the reinforcement and the concrete or cause corrosion of the reinforcement and subsequent disintegration of the concrete cover. If directed by the Project Manager, all the reinforcement shall be wire brushed to remove such imperfections before concrete is poured around it.

The Contractor shall produce Certificates of Manufacture indicating that the material complies with the requirement of the appropriate B.S. Random samples from any consignment may be taken for testing by approved Laboratories and any material found to be brittle, cracked or unsatisfactory in any way whatsoever shall be rejected and removed from the site at once.

Reinforcement shall be stored on site in level tiers raised above the ground.

2.4.1.22 Bending Reinforcement

All steel reinforcement shall be bent cold and shaped as shown on the drawings before placing in position and shall comply with the bending dimensions and tolerance laid down in BS 8666 or BS 4466.

An approved former shall be used to produce gradual and even bending and no steel shall, once bent, be straightened and rebent.

Bends made whilst the reinforcement is hot or welding either by gas or electricity shall not be carried out without the prior approval of the Project Manager.

2.4.1.23 Spacing of RC bars

The spacing of bars, amount of reinforcement and the type of fabric, mesh size, disposition, etc. shall be in accordance with structural design calculations, drawings and bending schedules.

2.4.1.24 Fixing and Assembly of Reinforcement

All reinforcement shall be accurately placed, fixed and maintained in the positions shown on the drawings. Intersecting bars shall be securely wired together with No. 16 gauge (1.626 mm) soft iron tying, with the ends twisted and turned into the body of the concrete. Binders, links and the like shall make close contact with the main reinforcement and shall be securely wired to the same.

When reinforcement is placed in horizontal or sloping layers whether in beams, slabs or staircases, etc., the distance between each layer shall be carefully maintained by the insertion of sufficient spacer bars to prevent either movement or sagging of the main reinforcement in each layer.

2.4.1.25 Cover to Concrete

The concrete cover to all reinforcements shall be carefully maintained as shown on the drawings and bending schedules within a tolerance of 3 mm under or over.

Cover to the underside of soffits may be obtained using accurately made cement mortar blocks.

2.4.1.26 Inspection of Reinforcement

No concrete shall be poured until the Project Manager has inspected and approved the reinforcement.

All reinforcement shall be properly fixed in position and every precaution shall be taken to ensure that no movement takes place whilst the concrete is being poured and compacted and that it is properly surrounded by concrete.

Any rods which have worked loose during fixing shall be securely retied and any small pieces of rod or fabric shall be removed from the forms before pouring is commenced.

2.4.1.27 Formwork

The term formwork shall include for any material or mould required for forming the concrete into the desired shape and upholding it until it is set, together with all necessary temporary supports, stagings, bolts, nuts, wedges, clamps, and other fixing, all cutting and waste and the cost of all labour and material in the construction, erection and removal of such formwork.

Formwork shall be of timber or other approved material and shall be of such strength as will ensure complete rigidity throughout the placing, compaction, vibration and setting of the concrete and so designed and constructed that it can be easily removed without shock, vibration or damage to the finished concrete.

All joints in forms shall be sufficiently tight to prevent leakage of grout and in timber forms, unless otherwise specified, they shall be tongued and grooved.

Timber boards for formwork shall be seasoned to 20% moisture content and shall be in widths not exceeding 150 mm or narrower if the Project Manager so directs.

The use of internal ties shall be avoided as far as possible, but, if used they shall be reduced to the minimum, of metal and capable of easy removal without damage to the face of the concrete. No part of any metal tie or spacer remaining permanently embedded in the concrete shall be nearer the finished surface of the concrete than the thickness of the general cover dimension as shown on the drawings.

When vibrators are used, special care shall be taken to see that all bolts, wedges, clamps, etc. are kept tight so that no distortion of the forms takes place.

2.4.1.28 Formwork Non-Exposed Concrete

When the surface of the concrete is to be covered with some other finishing material, the forms may be constructed of plain, but jointed sawn timber, unless otherwise instructed by the Project Manager. The boards

shall be sufficiently thick to withstand the loading of the concreting operations without deflection so that the finished surface cover specified is maintained.

2.4.1.29 Formwork for Exposed Concrete

When a particular type of finish is required to be produced by formwork on exposed concrete surfaces this will be fully described in the Particular Specifications or Bills of Quantities, and the material to be used to achieve it will be specified, i.e., plywood, hardboard, hessian, polythene paper, strips, panels, etc.

When wrot formwork is required the boards shall be tongued and grooved and wrot free from all cracks and irregularities on the face in contact with the concrete.

2.4.1.30 Preparation of Formwork before Concreting

Unless otherwise directed, the inside faces of all formworks shall be coated with lime wash or approved non-retarding mould oil. Care shall be taken to keep reinforcement free of any coating material.

Temporary windows shall be cut in the sides of vertical surfaces of forms to ensure that concrete is not poured from a height exceeding 1.5 m.

Forms shall be thoroughly scraped and cleaned between each and before subsequent uses.

Prior to depositing concrete, the forms shall be thoroughly cleaned and freed from all sawdust shavings, mud, dust or other debris by hosing with clean water and draining through temporary openings left for this purpose.

2.4.1.31 Approval of Formwork

All formworks shall be inspected and approved by the Project Manager before pouring of concrete. Forms are commenced, but such approval will not relieve the contractor of his overall responsibility for the safety and efficiency of the works. Details of special forms and systems of formwork i.e. self-lifting or sliding forms etc. shall be submitted to the Project Manager for his approval before they are put into use.

2.4.1.32 Removal of Formwork

The removal or striking of formwork shall be carried out in such a manner that the concrete will not be subjected to sudden shock or injury, nor shall it be removed before the concrete is sufficiently set and hardened.

The foregoing figures are given as a guide for normal cement concrete for average conditions of setting and hardening. For vibrated concrete or extreme climatic conditions or for special surface finishes the above times may be varied on the instructions of the Project Manager.

Compliance with the requirements of the foregoing shall not relieve the Contractor of his obligations and overall responsibility. Should the removal of the formwork be found to have been carried out prematurely, any damage caused thereby shall be made good entirely at the contractor's own expense.

2.4.1.33 Composite Concrete/Hollow Clay Block Structures

Composite concrete/hollow clay block construction when specified for floors and roofs shall consist of 305 x 305 mm hollow clay filler blocks placed end to end in rows on formwork as described with an in-situ reinforced concrete rib between each row and a concrete topping or cover over the blocks. The overall thickness of the composite slab, thickness of the filler blocks and the width of the ribs and details of reinforcement and concrete mixes in the ribs and topping will be described in the Particular specification or bills of Quantities.

All hollow clay filler blocks shall be well burnt, of even colour, uniform density free from cracks, distortion and conform in every respect with the requirements of BS 3921 Part 2.

The hollow clay blocks shall be laid end to end in rows, care being taken that the joints are close and that the specified width between rows is maintained. Ends of rows of blocks shall be plugged with a stiff mixture of cement and sand 1:3 before the inset concrete is placed.

The ribs and transverse reinforcement as specified are then to be fixed in position, care being taken to ensure that the filler blocks in each row are not displaced.

Concrete as specified is to be placed in the ribs and topping and compacted as described, care being taken to see that the reinforcement and filler blocks are not displaced. The topping is to be leveled and smoothed over to receive the finish as specified and carefully covered up and protected as before described for solid reinforced concrete slabs.

Before the placing of the concrete ribs and topping is commenced the spaces between the rows of blocks shall be thoroughly cleaned of any rubbish and the clay blocks and formwork sprayed with clean water.

The contractor shall provide this construction only to the extent indicated on the drawings, any other areas from where this work stops up to the outer edges of the construction being made out with thickness equal to the thickness of the composite slab.

2.4.1.34 “Freespan” and “Maxspan” Suspended Structures

The burnt clay beam, rib and filler tiles for “Free span” and “Maxspan” construction or their equivalent shall be by approved manufacturers.

“Freespan” is a system of clay blocks, concrete and reinforcement assembled into precast beams whilst “Maxspan” uses a system of clay ribs, and reinforcement assembled into precast ribs with hollow filler blocks between and inset concrete rib filling and topping.

All clay blocks shall be as previously specified and any which are cracked, chipped, broken or distorted shall be rejected.

Concrete for filling beams, ribs and topping is to be Mix “C” 12 mm aggregate as described.

Steel reinforcement shall be as previously specified, bent or hooked at ends as required and accurately and securely positioned in the units.

All units shall bear on perimeter walls or support a minimum of 115 mm.

The units shall be assembled for pre-casting on an even, clean concrete bed or timber form provided with a camber of approximately 1/300 of the span.

The pre-casting of beams and ribs is to be carried out under cover. The units shall be kept covered with wet hessian or other approved means and left to cure for a minimum period of 14 days during which time the hessian etc. shall be kept wet.

When the units are cured and ready for handling they shall be carefully removed from the place where they were cast without undue shock or jarring and transported and hoisted into position where required. Each unit must be handled at each end to ensure that cracking does not take place. When fixed in position the joints between adjacent beams shall not exceed 3 mm.

After placing in position, the ends of all hollow blocks and beams shall be sealed with a stiff mixture of cement and sand (1:3).

Carefully cover up and protect the finished surfaces of all “Freespan” and Maxspan” slabs as previously described for concrete work.

2.4.1.35 “Freespan” Units or Beams

The “Freespan” burnt clay blocks 305 mm wide and 30mm long shall be closely assembled end to end in straight lines on the casting bed to form beams of the required length. The required amount of reinforcement is then placed in the channel, after which the blocks are soaked thoroughly with water and filled with concrete, properly compacted as described.

After curing as before described the units shall be hoisted and fixed in position side by side, the recessed side joints flushed up with cement and sand (1:3) and the whole covered with a layer of fine concrete or cement and sand (1:3) not less than 20 mm thick or as otherwise specified, finished to a level even surface.

2.4.1.36 “Maxspan” Precast Rib and Filler Block Structures

The “Maxspan” clay rib channel blocks either 75 or 100 mm wide as specified shall be assembled to form rib units as described for “Freespan” beams.

The rib channels shall then be thoroughly soaked with clean water and four 6 mm diameter mild steel rods inserted into the prepared grooves in the blocks and grouted in place with a stiff mixture of cement and sand (1:3). These units can be precast one on top of the other up to a maximum of 10 in height.

After curing, the ribs shall be hoisted and fixed in position at the appropriate centers and propped on the underside every 2 m. The hollow filler blocks of the specified size shall be laid end to end between the rib units.

Reinforcement of the specified size is then laid in the rib channel and the transverse distribution reinforcement placed in the topping. The whole of the ribs and filler blocks shall be thoroughly soaked with clean water and the ribs and topping filled up to the specified thickness with well compacted concrete Mix “C” 12 mm aggregate, all as previously described. Finish surface level and even ready to receive screeds.

2.4.1.37 Concrete Lintels

Concrete lintels to be (1:2:4) as previously described, well tamped around reinforcing rods. The reinforcement and sizes of lintels shall be in accordance with drawings for standard Lintels, copies of which can be obtained from the Project Manager unless otherwise directed by the Project Manager.

Lintels may be cast in-situ or precast. When cast in-situ the general concrete specifications already described shall apply except that the lintel may be built upon after 7 days providing the soffit boards and propping are not removed.

Precast lintels shall be cast in accordance with the clauses governing precast concrete as later described but they shall not be built on for a minimum of 14 days after casting or such other longer period as the Project Manager may direct.

Provide to all buildings where shown on the drawings as an in-situ concrete (1:2:3) ring beam 225 mm deep for the full thickness of the wall, cast in alternate 6 m lengths, with suitable construction joints and reinforced with 4 No. 12 mm diameter twisted steel reinforcing rods with 6 mm diameter stirrups at 300 mm centers.

All reinforcement in lintels shall be embedded in the concrete to have not more than 40 mm cover on the soffit and ends of bars shall be hooked.

Where shown, cills shall be of rebated, splayed and throated precast concrete to the sizes required and having an outer projection of not less than 40 mm from the finished wall face. They shall be cast in suitable moulds and finished fine on all exposed faces, free from all cracks, crazing, chipped or broken surfaces, discolouration or other defects.

Reinforcement shall be provided where necessary for handling with a 25 mm minimum cover.

Cills over 1.4 m Long shall be divided into even sections, and butt jointed with joints not more than 1/8" thick grouted up with cement mortar and neatly flush pointed.

Clean-cut throatings 12 mm deep shall be formed 25 mm back from the finished outer edge of the cill.

Stoolings not less than 50 mm wide shall be formed on cills required to be built in.

Cills to take metal windows shall have holes for fixing lugs formed during casting to the required size, depth and positions.

All concrete not plastered shall be finished with a fair face unless otherwise stated. Unless otherwise stated, precast concrete ventilators to be 300 mm or 225 mm wide x 225 mm x 40 mm thick of approved pattern. The ventilators shall be fixed double, one fixed flush with outer face of wall and having approved copper mosquito gauze cut to size and fixed by tucking over top and bottom edges of ventilator before building in, the other ventilator fixed flush with inner face of wall and include for rendering around sides, top and bottom of ventilator opening in cement and sand (1:4).

All concrete floors shall be in concrete (1:3:6) and have a minimum thickness of 150 mm unless otherwise shown on drawings.

Entrance steps as required to suit ground and floor levels shall be formed in concrete (1:3:6), with suitable foundations as directed by the Project Manager. Treads shall be not less than 300 mm wide and risers not more than 175 mm high. All exposed surfaces shall be finished in cement and sand (1:4) trowelled smooth with a wood float 20 mm thick on treads and 12 mm thick on risers or finished with carborundum dust.

All suspended precast or in situ concrete shelves, pot slabs, etc., shall be reinforced with B.R.C. Weld mesh No. 28 or 210 as ordered by the Project Manager or other equal and approved fabric reinforcement. Where required, these shall be size 600 mm x 600 mm x 50 mm thick of vibrated (1:2:4) concrete finished on top with a wood float, clean cut edges and free from all cracks, chips or broken corners. The slabs shall be laid on a

a 75 mm consolidated bed of sand or stone dust, laid to falls where necessary and joined and pointed in cement mortar (1:4). The jointing mortar to be worked well down into the joints and the pointing to be key-drawn and all excess mortar cleaned off.

2.4.1.38 Precast Concrete

All precast concrete work shall be carried out in accordance with the instructions of the Project Manager and as recommended by the Code of Practice BS 8110 except that, where the Code differs with these specifications, these specifications shall take precedence.

The concrete and reinforcement shall be as described elsewhere or as indicated on the drawings.

The moulds for precast work shall be of stout timber or steel, strong, properly made true to shape to produce the sections shown on the drawings, finished perfectly true, without twist or deformation of any kind and having clean sharp arches, grooves, sinkings, etc., as required.

When concrete is specified as "Fair Face Finish", the moulds shall be lined with a smooth surface free from all blemishes, irregularities, honeycombing, joint or gain marks.

Where the concrete is described as "Finished Fine" the moulds shall be made of metal or are to have linings which will produce a smooth dense fine face to the finished concrete free from all shutter marks, protuberances and pinnacles and suitable to receive a painted surface directly.

Concrete shall be thoroughly tamped in the moulds and if required by the Project Manager shall be vibrated as described.

The pre-casting shall be carried out under an approved shade and shall remain under the same for a minimum period of seven days after which the moulds may be removed and the units stored under shade for a further seven days.

After this the units may be stacked in the open for not less than seven days before fixing. Unless otherwise described, faces shall be left rough from the sawn moulds.

For the whole of the period from casting of the units until the time they are put into use, they shall be covered with sacking or approved material which is to be kept wet constantly.

All units shall be cast in convenient lengths for handling and the contractor shall provide all necessary handling reinforcement whether specifically shown on the drawings or not.

2.4.1.39 Concrete Apron

To all houses of Category D and above and, where directed by the Project Manager, the contractor shall provide a 50 mm C15 concrete apron, 1 m wide around the perimeter of the building, laid on a 100 mm bed of hardcore.

2.4.1.40 Attendance

Particular care shall be exercised by the contractor to ensure that all pipes, ducts, drains, conduit, junction boxes, anti-static installations, etc are laid before the concrete for the floor and roof slabs is poured, and the Contractor will be held responsible for the cost of any additional cutting etc. and making good which

becomes necessary through his failure to make proper arrangements for all sub-contractors work to be done in close cooperation with his own.

2.4.2 Walling

2.4.2.1 General Requirements

2.4.2.1.1 Cement

The cement used shall be as described in “Concrete Work”.

2.4.2.1.2 Lime

The lime shall be best quality hydrated lime from an approved source and shall conform to BS EN 459-1:2001 or the equivalent UNBS Standard.

2.4.2.1.3 Sand

Sand for mortars shall be as described in “Concrete Works” except that it shall be fine sand.

2.4.2.1.4 Mortars

The cement mortar shall consist of one part of cement to four parts of sand by volume (1:4). The sand shall be measured in specifically prepared gauge boxes and thoroughly mixed in an approved mechanical mixer or mixed dry on clean and approved mixing platforms, with water added afterwards until all parts are completely incorporated and brought to a proper consistency. The use of retempering of wholly or partially set mortar will not be allowed.

The gauged mortar shall consist of one part of cement to two parts of lime to nine parts of sand by volume (1: 2: 9).

In the case of gauged mortar, the sand and lime shall first be mixed into a coarse mix before the addition of cement. All mortar is to be thoroughly mixed to a uniform consistency with only sufficient water to obtain a plastic condition suitable for troweling. No mortar that has commenced to set is to be used or knocked up again for reuse.

2.4.2.1.5 Protection

All walling shall be properly protected while the mortar is set as the Project Manager shall direct.

2.4.2.1.6 Setting Out

The Contractor shall provide proper setting out rods and set out on the same all work showing opening, heights, cills and lintels and shall build the various walls and piers to the thickness, widths and heights

shown upon the drawings. No part of the walling shall be carried up more than 900 mm higher at one time than any other part and in such cases the joining shall be made in long stops to prevent cracks arising and all walls shall be leveled round at each floor and roof level.

2.4.2.2 Brick Walling

2.4.2.2.1 Bricks

Bricks shall be kiln-burnt bricks from a local source, and samples shall be submitted for the Project Manager's approval. Bricks are to comply with BS EN 772 and BS 6750 as regards size and tolerances, and shall be of good shape, well burnt, of even colour, free from flaws, stones and unburnt lumps and are to emit a clear ringing sound when struck one another. Brittle or badly burnt bricks must not be used and broken bricks or bats may only be used where required for bond. No brick shall absorb more than 20% of its dry weight during 24 hours immersion in water.

Load bearing brickwork shall be constructed in solid bricks and internal non-load bearing walls where specified may be built in bricks having perforations.

2.4.2.2.2 Facing Bricks

The facing bricks unless otherwise described shall be bricks specially selected from the common stack for evenness of size, shape and colour.

Care is to be taken when selecting and stacking facing bricks to see that all bricks with chipped or damaged face or faces are rejected.

Facing bricks shall be obtained from an approved manufacturer and conform with BS EN 772 and samples shall be submitted for the Project Manager's approval. Purpose-made corner blocks and half blocks shall be used as necessary at angles etc., and for purposes of bonding.

2.4.2.2.3 Concrete Blocks

Concrete blocks shall be machine made, solid or hollow as specified, and comply with BS 6073, work other than internal non-load bearing partitions which may be of blocks in accordance with Type C.

Blocks shall be made with naturally occurring aggregates complying with BS EN 1260 with a binder as listed in BS 4887 except that lime as a sole bind agent will not be allowed.

The density of Type „A“ blocks shall be not less than 1500 kg/m³ and the density of type C may be less than this providing it meets the due requirements regarding strength.

As a guide a mix consisting of one part cement, two parts of fine aggregate grade 9mm down but free of fines and dust and seven parts of coarse sand by volume (1:2:7) will produce a block of the required strength but this must not be regarded as infallible and the contractor will be entirely responsible for finding the most suitable mix consistent with the available aggregates which will produce blocks of the requisite properties and strengths.

If suitable materials are not obtainable locally the Contractor shall obtain them from such other sources as he carried out under shelter and after casting the blocks shall be stacked under shelter to protect them from

sun and adverse weather. The blocks shall be properly cured by covering them with sand or sacks and spraying daily for not less than 14 days.

All blocks must be left with good sharp edges. The standard face size of blocks for use in the Works shall be 450 x 225 mm and these size blocks shall be used wherever practicable. Proper bonding shall be formed at corners, round openings, cills, lintels, beams, etc., and similar positions and the Contractor must make or cut blocks to all varying sizes required for these purposes.

Should the Contractor obtain blocks from local manufacturers or proposers he shall be responsible for ensuring that the blocks are of such quality as to meet the above loading requirements. In any case blocks for use on this project shall be tested for their compressive strength and water absorption values which values must meet standard requirement.

2.4.2.2.4 Fair-faced Blocks

Concrete blocks for fair faced walls shall have a perfectly smooth exposed face free of all honeycombing, blemish or other irregularity.

2.4.2.2.5 Stone

Stone shall be obtained from a local source and samples shall be submitted for the Project Manager's approval.

It is to be free from cracks, fissures, sand and clay holes and is to be dressed to shape the beds and faces as described in the Particular Specification or as indicated on the Drawings.

2.4.2.2.6 Bond and Joints

All brickwork shall be built in English bond except that half brick walls shall be built in Stretcher bond.

All block work shall be properly bonded together and in such a manner that no vertical joint in any one course shall be within 225 mm of a similar joint in the courses immediately above and below. Alternate courses of walling at all angles and intersections shall be carried through the full thickness of the adjoining walls.

All prebends, reveals, quoins and other angles of the walls shall be built strictly true and square.

2.4.2.2.7 Cleaning Facework

All bricks and blocks shall be well wetted before use and tops of walls where left off shall be well wetted before commencing building. All joints shall be flushed and grouted in solid as the work proceeds.

2.4.2.2.8 Plaster Key

Joints shall not exceed 9 mm or as otherwise indicated on the Drawings.

All faced brickwork and block work is to be kept clean and free of all mortar droppings, splashes, smears, stains etc.

Included for hacking and raking out joints of all walls as required to receive plaster, screeds, or other finishes.

2.4.2.2.9 Ant and Damp Proof Courses

Unless otherwise indicated on the drawings the ant proof course shall consist of a bed of cement and sand composed of one part cement to three parts (1:3) by volume and not less than 30 mm thickness laid over the whole area of walls and piers, finished to a smooth level surface with the edges pointed flush with the faces of the walls. Before laying the ant proof course the top of all walls shall be cleaned and well wetted, and after it is laid it shall be carefully protected until firm and covered with damp soaking.

When the ant proof course is hard it shall be covered with a damp proof course of Hessian based bituminous felt in accordance with BS 743 Part 2 unless otherwise described in the Particular Specification or Bills of Quantities.

Before laying the damp proof course the ant proof course shall be cleaned and brushed and any projections in the surface leveled off. The damp- proof course shall then be laid and bedded on a thin bed of cement mortar and neatly pointed on the exposed edges. Joints in the running length shall

be made in the damp proof course by horizontal laps of not less than 225mm and at intersections of walls the lap shall be equal to the thickness of the interacting wall or partition.

Damp proof course as described shall be laid under all internal walls where these are built off the ground floor slab.

2.4.2.2.10 Provisions, Allocations for Other Works

The Contractor shall:

- a) Do all necessary cutting and bonding up to other work and perform all rough and fair cutting required. Leave or form all chases for edges of concrete floors, roofs, staircases, landings, etc., and provide chases for pipes, conduit and the likes, and make good.
- b) Rake out joint or form grooves for flashings, turn-ups etc., and the like as required and point in cement mortar as described.
- c) Where shown on the drawing, all walls shall be carried up to the underside of the roof sheets and shall be splayed out on top edge to suit roof slope and the corrugations or tiling flushed up solid in gauged mortar as described.
- d) Level all wall plates, bed in gauged mortar and secure with 25 mm x 16 S.W.G. (1.63mm) galvanized hoop iron straps 900 mm long and 1250 mm apart bedded in walls and bent around, drilled and spiked to plates.

- e) Build in or cut and pin in cement mortar ends of cills, thresholds, steps, lintels and the like and make good.
- f) Leave or form holes for all pipes, conduit and services and make good.
- g) Sills shall be bedded in cement mortar and jambs and heads bedded in gauged mortar and pointed in cement mortar unless otherwise described or indicated on the drawings.
- h) Concrete lintels shall be provided with suitable plugs for the fixing of heads of wood frames.
- i) Flues shall be formed as shown on the drawings and parged with gauged mortar not less than 20 mm thick and core on completion.
- j) Rough render in gauged mortar not less than 12 mm thick to the faces of all flues where passing through timber roof or floor spaces or where passing less than 150 mm from the face of any timber.
- k) Carefully fill up all putlog holes as scaffolding is dismantled and where required face up to match adjoining work.
- l) Cut away for and attend to as required and make good after all trades.
- m) Screeds shall be brushed with a stiff bass broom to remove any surface dust or debris before felt laying commences.

2.4.3 Roofing

2.4.3.1 General

Roofing sheets shall generally be fixed in accordance with BS EN 501 except where the contract drawings or documents expressly override or modify this specification.

2.4.3.2 Steel Sheet

The galvanized corrugated steel roof sheets shall be generally in accordance with BS 3083 having a steel sheet not less than 0.559 mm (24 S.W.G) thick with a coating of zinc on both sides with a total weight of not less than 610 and not more than 763 grams per square meter of steel surface area.

Sheets shall be laid with 150 mm end laps and side laps of one and half corrugations on the side away from the prevailing wind; otherwise lapping shall be to the full extent indicated on the contract drawings or documents. Laps shall be not less than 150 mm long.

When timber purlins are employed sheets shall be securely fixed to same on the crown of the corrugations at not less than 300 mm centers with 6mm diameter galvanized drive screws each not less than 62 mm long with head and galvanized embossed curved washer under.

Sheets shall be fixed to steel purlins with 8 mm diameter galvanized mild steel hook bolts 50 mm longer in the shank than the depth of the steel purlin to which they are fixed, each with a nut and galvanized embossed curved washer. The sheets shall be fixed at not less than 300 mm centers on the crown of the corrugations.

Where sheets are required to be stitched together, they shall be joined at not less than 300 mm centers with 6 mm diameter and finished clean without rags, burrs or damage to the surrounding zinc coating.

Ridges shall have a roll top and plain wings not less than 450 mm girth, all in galvanized steel sheet not less than 0.559 mm (24 S.W.G) thick and fixed in similar manner to the sheeting.

At square abutments the last two corrugations of the corrugated iron sheets next to walls shall be flattened and turned up against the wall and covered with 24 S.W.G galvanised iron apron flashing.

Holes for bolts or screws shall be punched from the inside of the sheet and shall be in the ridges of the corrugations as fixed and not in the holes.

Bat proofing shall consist of "Perspex" or similar approved translucent plastic corrugated sheeting.

2.4.3.3 Aluminum Sheets

The aluminum corrugated roof sheets shall be in accordance with BS 6100 - 1.3.2 having a minimum thickness of 0.559 mm (24 S.W.G.)

The aluminum troughed roof sheets shall be in accordance with BS 6100 - 1.3.2 Type A or B as specified in the Contract Documents having a minimum thickness of 0.9 mm (20 S.W.G.) and 1.2 mm (19 S.W.G.) respectively.

Sheets shall be lapped to the full extent indicated on the contract drawings or documents.

Corrugated roof sheets shall be fixed to timber purlins and corrugated roof sheets and Troughed roof sheets shall be fixed to steel purlins all as before described for galvanized corrugated steel roof sheets unless otherwise specified.

Troughed roof sheets shall be fixed to timber purlins on the crown of the trough at not less than 300 mm centers with 6 mm galvanized embossed washers under to give not less than 50 mm penetration of the purlins to which they are attached.

Sheets shall be stitched as before described for galvanized corrugated steel roof sheets.

All holes in sheets shall be neatly drilled or punched, of the required diameter and finished clean without rages, burrs.

Ridges shall have a tool top and plain wings not less than 450 mm girth, having a minimum thickness of 0.71 mm (22 S.W.G.) and fixed in a similar manner to the iron sheeting. Laps shall be not less than 150 mm.

2.4.3.4 Roof Tiling

The roofing tiles shall be first quality local clay tiles of the type as specified in the contract drawings and documents and shall be similar to those obtained from a firm approved by the Project Manager.

All tiles shall be well and evenly burnt, uniform in shape, size and colour and free from cracks, twists and other defects.

Samples shall be submitted to the Project Manager for his approval before the work commences and all tiles used shall be of equal quality to the approved sample.

Ridge and hip tiles shall be saddleback or half round tiles as indicated on the contract drawings of similar quality and manufacture as the roofing tiles.

Tiles shall be carefully graded for size, shape and colour upon delivery and again before fixing.

All tiles shall be carefully stacked on the edge of the site and rows of tiles shall be separated with a layer of straw, elephant grass etc. between each to prevent damage.

Any chipped, cracked or defective tiles shall not be used.

Nails, when required, shall be stout zinc nails not less than 36 mm long.

Mortar for bedding shall be gauged mortar as before described and if required shall be tinted with an approved colouring compound to match the tiling.

When required, tile battens shall be of sawn pressure impregnated structural timber as described in Carpenter.

Tile battens shall be not less than 50 x 35 mm sectional area or as indicated on the drawings and shall be accurately spaced at the specified gauge and securely fixed at the intersection with each rafter with 75 mm stout round wire nails.

All tiling is to be laid with the specified lap and when laid on battens the head of each tile shall be securely double nailed to the battens in every alternate course unless otherwise described.

An underlining of "Sisalkraft" orange label or other equal and approved reinforced waterproof paper shall be provided under all tiling battens. The paper shall be laid over the rafters with the length of the roll at right angles to the same. Laps at the heads of adjacent sheets shall be laid over the rafters with the length of the roll at right angles to the same. Laps at heads of adjacent sheets shall not be less than 75 mm and at the ends 300 mm end laps shall be made at a rafter. Sheets shall be lightly tacked in position to prevent movement whilst tiling battens are being fixed.

Form all verges, eaves, valleys, hips etc. as described, do all cutting, replace all broken or damaged tiles and leave all perfect and watertight on completion.

2.4.3.5 Bituminous Felt Roofing

Roofing shall be of three layers of bituminous felt all of which must be of Tropical Grade with a softening point temperature of not less than 104°C, and shall comply with BS 747 except where this is inconsistent with this temperature requirement.

The three layers shall be of self-finished Glass Fibre Felt weighing not less than 18.1 kg/10 m².

Oxidized bitumen shall be used for bedding and bonding felt layers and shall be applied hot and shall have a softening point temperature of not less than 104°C.

The first layer of felt shall be secured on all edges of the roof with hot bitumen in strips 150 mm wide, the surfaces beneath these stripes are primed with a cold cut-back bitumen. The main areas of the felt shall be spot stuck at 1800 mm intervals staggered and in very exposed situations this spacing shall be reduced to 900 mm.

The upper layers shall be continuously bedded and bonded in hot bitumen applied at the rate of 14.65 Kg/10 m² and shall be laid with lapped joints at all edges, side laps being not less than 50 mm and end

laps not less than 75 mm wide, and each layer shall be laid breaking joint, the felt being laid in the direction of the fall starting from the eaves.

The top layer, where so described, shall be surface dressed with light coloured quartzite or marble mineral gauge 6 to 12 mm of rounded shape, samples of which must be approved by the Architect, laid shoulder to shoulder at the rate of 16 Kg/m². Alternatively, and where so described, instead of the described in-situ surface finish or Glass Fibre Felt weighing not less than 27.2 Kg/10 m² with a factory applied mineral surface dressing to a specification not inferior to the above described in-situ dressing.

Built-up felt roofing shall not be laid under wet, damp or humid conditions and the sub-structure and screeds shall have been allowed to set thoroughly and dry out for at least seven days before felt laying is commenced and the surface must be completely free from all moisture, dirt and dust.

The Contractor shall satisfy himself that the sub-structure and screeds are in fit condition to receive the felt and that falls are adequate and not less than 1: 80. All flashings, turn-downs at the edge, etc., shall be generally in accordance with BS 8217.

Prices for built-up roofing shall include all straight cutting and waste.

The Contractor will be required to guarantee the whole of the bituminous felt roofing against defective workmanship and materials and maintain as required for a period of five years from the date of the Practical Completion of the Works notwithstanding anything to the contrary contained in the Contract Conditions.

2.4.3.6 Roofing Shingles

Shingles roofing shall have two layers, a bituminous felt waterproofing layer that complies with BS 747 and shingles that are placed on the bituminous felt. Shingles shall comply with BS 5534.

2.4.3.7 Proprietary Roofing Systems

When Proprietary or Specialist roofing systems are required to be used as specified in. The contract documents shall be carried out strictly in accordance with the proprietors or specialist manufacturer's instructions. Under no circumstances will any deviation therefrom be allowed.

2.4.3.8 Roof Screeds

The lightweight concrete roof screeds shall be mixed strictly in accordance with the specification of the manufacturers.

The surface of the concrete roof on which the screeds are to be laid shall be perfectly dry before laying commences.

The screeds shall be laid to a fall of not less than 1 in 80 to give falls and cross falls as indicated on the drawings and the surface floated perfectly smooth and free of all irregularities and projections to receive the felt roofing.

On completion of the screeds, they shall be covered with a waterproof cover to prevent too rapid drying or the reabsorption of rainwater before being covered with felt.

Screeds shall be brushed with a stiff brass broom to remove any surface dust or debris before felt laying commences.

2.4.3.9 Make Good

Carefully inspect all roofing works on completion and make good or replace all defective materials and workmanship, clean out all eaves, gutters, rainwater outlets, etc. and leave all perfectly sound and watertight.

2.4.4 Carpentry

2.4.4.1 Timber

Timber for carpentry work shall be well seasoned preservative-treated timber as later described, graded and free from defects.

Hardwood shall be second or selected grade in accordance with the “Hardwood Timber Grading”, and softwood shall be in accordance with the Second Strength Grade of the “Softwood Strength Grading Rules”.

All timber shall be free of live borer, rot and decay, brittle heart and compression failure and loose unsound or dead knots.

In as much as is practicable, timber shall be purchased immediately after the contract is signed to enable it to be adequately seasoned before required for use.

2.4.4.2 Timber for Special Structures

Timbers for designed structural work requiring timber of high strength and quality will be specified by name in the Particular Specification or the Bills of Quantities, and in accordance with the Regulations for Structural Design.

2.4.4.3 Preventive Treatment for Timber

All timber for carpentry work shall be vacuum pressure treated with Celcure or Tamalith or other approved medium, toxic to termites, crypto Termes and other timber pests. All cut ends of timber so impregnated shall be treated with two coats of “B” crystals or other approved methods.

A “charge sheet” giving details of treatment shall be supplied to the Project Manager if he so directs.

Pressure treatment shall be carried out by a specialist firm with approved equipment.

2.4.4.4 Seasoning

Timber shall be seasoned after preservative treatment has been carried out to a moisture content.

After delivery to the site, timber shall be carefully stacked to ensure free circulation of air throughout the stack and covered with a waterproof cover to prevent excessive drying by the sun or re-absorption of rainwater.

2.4.4.5 Samples and Testing

The Project Manager may select any samples of timber he may require for the purpose of testing i.e. strength, moisture content, penetration of preservatives, identification of species etc.

Samples for testing shall consist of cross sections not exceeding 50 mm thick out at least 500 mm from the end of the piece. They shall be packed in polythene bags with the ends tightly tied, labeled and delivered either to any approved laboratory as directed.

2.4.4.6 Sawn Timber

All timber, except as specified elsewhere, shall be die square clean sawn as left from the saw and shall hold the full dimensions specified.

2.4.4.7 Wrot Timber

The term “wrot” shall mean finished to a perfectly smooth finish to receive paint or other surface treatment. Pieces which have been machine planned shall be finely smoothed by hand plane and glass paper or sanding machines to remove all planning machines or other marks.

3 mm reduction of specified size will be allowed in respect of each wrot face except in members 25 mm thick or less or where described as finished size “finished” when the members shall hold the full size stated.

2.4.4.8 Workmanship

All carpentry work shall be executed by skilled workmen, with workmanship of the best quality, accurately set out in strict accordance with the drawings and be framed together and securely fixed in the best possible manner with properly made joints; all brads, nails and screws etc, shall be provided as necessary, directed and approved, and the Contractor’s prices shall allow for all the foregoing.

2.4.4.9 Jointing

All timber shall be as long as possible and practicable to eliminate joints. Where joints are unavoidable, surfaces shall be in good contact over the whole area of the joint before fastenings are applied.

Scarfed joint shall be of a length not less than twice the greatest dimension of the timber member and shall be bolted if required. Whenever practicable, scarfed joints shall be placed at a point of support in order to obtain maximum strength.

No nails, screws or bolts shall be placed in any split end. If splitting is likely, or is encountered in the course of the work, holes for nails shall be pre bored at diameter not exceeding 4/5th of the diameter of the nails. Clenched nails must be bent at right angles to the grain.

Lead holes shall be bored for all screws. When the use of bolts is specified, the holes shall be bored from both sides of the timber and shall be of the diameter $D + D/16$, where D is the diameter of the bolt. Nuts must be brought up tight but care is to be taken to avoid crushing of the timber under the washer.

A tolerance of 1 mm will be allowed in the positioning of bolt holes.

2.4.4.10 Connectors

When trusses are required to be bolted together with timber connectors, the single- or double-sided toothed type connectors shall be used, in accordance with relevant standards or as directed by the Project Manager on Connectors for Timber.

2.4.4.11 Nails and Bolts

All nails, bolts and metal fastenings shall be of mild steel, free of all rust and defects and of approved manufacture.

2.4.4.12 Roofs

The roofs shall be constructed in accordance with the details and scantlings shown on drawings. All ironwork necessary at joints, etc., is to be fitted and bolts, nuts and washers provided and fixed as required. Trusses shall be hoisted into position at the spacings shown and such temporary strutting as may be required shall be provided. Purlins shall be of the size and intervals shown. Rafters shall be cut and splayed as shown on the drawings. Plates shall, so far as possible, be in one length between points of change of direction. Joints between continuous lengths or at changes of direction and intersections shall be halved.

2.4.4.13 Ends of Timber

The ends of all cut timbers, whether exposed, built in or otherwise shall be painted with two coats of “Wykamol” or other equal and approved to prevent rot and entry of borers.

2.4.4.14 Fixing Slips and Plugs

The Contractor shall provide and fix all necessary hardwood plugs and fixing slips to walls and dovetailed blocks into concrete soffits, etc., for the purpose of providing fixings for joinery and other Trades.

All hardwood fixings shall be clean and dry and dipped in an approved wood preservative before fixing.

Where work is described as “plugged” it shall be fixed with nails to treated hardwood plugs inserted into the brick or block work joints. Plugs shall be of dry hardwood with the end cut on the twist, dipped in an approved wood preservation and tightly driven into the raked-out joint in the wall.

Where work is described as “plugged and screwed” it shall be fixed with steel screws unless otherwise specified to cylindrical fibre or polyvinyl plastic plugs of approved manufacture let into holes of suitable size drilled in the walls. When the wall is of such a material that it is impossible to drill neat round holes, they shall be packed with a suitable plastic plugging compound such as “Raw Plastic” or “Philplug” or other similar approved as instructed by the manufacturers.

Plugs shall be inserted in walls to provide fixings not more than 750 mm apart horizontally. The number of plugs at each fixing point will depend on the width, height and thickness of the material to be fixed but a minimum of two will be required with an additional one for each 150 mm width or height in excess of the first 150 mm.

2.4.4.15 Insect Damage

All timber brought onto the site shall be free of live borer beetle or other insect infestation and it will be the responsibility of the Contractor to see that it remains free of infestation until the end of the maintenance period.

If upon inspection any timber is found to have been attacked, the Contractor shall be required to execute at his own expense all necessary remedial measures to eradicate it, including the removal and replacement of all infected timber and such other measures as he is directed to take by the Project Manager.

2.4.4.16 Cleaning

The Contractor shall remove and destroy all cut ends, shavings and other wood waste from all parts of the building and the site generally both whilst the work is in progress and at its completion.

2.4.5 Joinery and Ironmongery

2.4.5.1 Timber

Timber for joinery work shall be well seasoned preservative treated timber all as described in above Clause “Carpentry” with the following exceptions:

- Hardwood shall be First or Prime Grade in accordance with the “Hardwood Timber Grading” and softwood shall be in accordance with the First Appearance Grade of the “Softwood Appearance Grading Rules”.

2.4.5.2 Preventive Treatment

Preservative treatment of all timber for joinery work shall be carried out in accordance with above Clause “Carpentry”.

2.4.5.3 Seasoning

Timber shall be seasoned after preservation treatment has been carried out to moisture content as described with above Clause “Carpentry”.

Seasoned timber shall be stored inside an enclosed building until required for use.

2.4.5.4 Samples for Testing

The Project Manager may select samples for testing all as described in above Clause “Carpentry”.

2.4.5.5 All Joinery to be Wrot

All joinery timber shall, unless specifically so described, be wrot within the definition given in above Clause “Carpentry”

2.4.5.6 Selected Timber for Polish

When timber is to be lacquered, varnished or polished this will be specifically described in the Particular Specification or Bills of Quantities as “hardwood/ softwood selected and kept clean for polish”.

Such timbers shall be carefully selected and matched for uniformity, symmetry and evenness of both grain and colour.

2.4.5.7 Plywood

Plywood shall comply with BS 6566, Parts 1 -8 – Plywood manufactured from Tropical Hardwoods, of the first grade. Plywood for external use shall be weatherproof resin bonded, Bonding W.B.P. Quality.

The Project Manager may require samples for testing in accordance with the provisions in the relevant B.S or Nigerian Standard and the Contractor shall supply these and he will be reimbursed with the cost as previously described.

2.4.5.8 Block Boards

Block boards shall comply with BS 8701 and shall be of the first grade. Blockboard for external use shall be weatherproof resin bonded, Bonding W.B.P. quality. Tests may be called for as previously described.

2.4.5.9 Wood Chipboards

Chipboard shall comply with BS 5268 and unless otherwise specified the faces shall be filled and finished to receive paint. Tests may be called for as previously described in BS EN 181104.

2.4.5.10 Veneers

When veneering of blackboards, chipboards, etc. is required, it shall be carried out in an approved manner. The sheets of veneer in adjacent panels shall be carefully matched for uniformity of colour and symmetry in the direction of the grain, laid with tight edges and secured with approved adhesives under pressure to the base.

2.4.5.11 Adhesives

Organic or casein glues in accordance with BS EN 12765 may be used for all non-load bearing internal work or work where the moisture content will never exceed 15%.

For external work or when the moisture content is likely to exceed 15% only resin type adhesives in accordance with BS EN 12765 shall be used.

2.4.5.12 Nails and Screws

Nails shall be as described in "Carpentry". Screws shall, unless otherwise specified, be steel screws in accordance with US.194-1 or BS 1210 "Wood Screws".

Unless otherwise described, nails shall be of length equal to two and a half times the length of the material which is being fastened and screws shall be not less than No. 8 gauge and of a length not less than twice the thickness of the timber being fixed.

2.4.5.13 Workmanship

The Joinery work shall be carried out by skilled workmen and in an approved manner exactly in accordance with the Project Manager's detailed drawings.

The joiner shall carry out all necessary mortises, tenons, rebates, grooves, notching, tongues and housings and all other labours necessary for correct jointing. He shall also provide all tongues, dowels, metal plates, screws, nails and other fastenings that may be required for the proper carrying out of the work.

The joiner shall carry out all works necessary for the proper construction of all frames, linings, panels, etc. and their support and fixing in the building. All joinery work shall be arranged, joined and fixed to allow for minimum shrinkage and damage either to its strength or appearance.

Joinery work shall be commenced as soon as practicable and all frames and components shall be loosely framed and assembled, but they shall not be finally glued, pinned and wedged until they are required for fixing on site.

Where joints shall be commenced as soon as practicable and all frames and components shall be loosely framed and assembled, but they shall not be finally glued, pinned and wedged until they are required for fixing on site.

2.4.5.14 Joints

Where joints are required even though not specifically indicated on the drawings, they shall be the recognized form of joint for such positions and shall be made in accordance with BS 1186- 2 and BS 1186- 3.

All nails shall be punched and stopped with linseed oil putty.

Loose joints shall be made where provision for shrinkage is required e.g., tongued and grooved in fill or paneling.

Glued joints shall be made when the joint must be sealed or when shrinkage or other movement in the boards etc. can be discounted. In glued joints all surfaces in contact shall be sawn or wrot and shall be perfectly clean and free from dirt, dust, sawdust, oil and any other contaminating matter likely to impair the strength of the joint. All joints shall be properly cramped until the wedges and pins are driven or subjected to adequate pressure which shall be maintained until the glue has set.

All glues shall be used in accordance with the manufacturer's instructions.

2.4.5.15 Moulding

All mouldings shall be accurately worked in accordance with the details and unless otherwise specified shall be worked on the solid.

2.4.5.16 Fixing or Building Frames

All frames for normal joinery construction shall be built-in as the adjoining walling or masonry is carried out.

Frames which are to receive polish or other clear finish previously referred to shall be carefully stored until the openings to receive them are completed and all plastering or other wet trades are finished and then built-in.

2.4.5.17 Fixing Beads

Except as otherwise described, all beads, fillets and small mouldings, architraves and skirtings which are not required to be removed shall be fixed without stout round or oval pins, brads or nails.

When specifically stated, work shall be fixed with steel or brass screws with the heads let in and pelleted with matching wood pellets.

All glazing beads for doors and opening lights and beads for securing mosquito gauze to all types of frames shall be fixed with brass cups and screws.

2.4.5.18 Scribing

All skirtings, cover fillets, architraves, etc., shall be accurately scribed to fit the contours of any adjacent irregular surfaces to form a close butt joint.

2.4.5.19 Grounds

Provide and fix, where indicated on the drawings, particular specifications or bills of quantities, all necessary sawn grounds to receive skirtings, linings and other "built-in" fittings.

2.4.5.20 Flush Doors

Flush doors unless specifically otherwise described, shall consist of hardwood skeleton framing 75 mm wide to all stiles top and bottom rails, 50 mm wide horizontal intermediate rails not more than 150 mm apart, with suitable blocks to receive mortise locks on each long edge and covered on both sides with 6 mm plywood finished for paint and approved hardwood lipping 30 mm thick on each vertical edge.

All flush doors unless otherwise described shall be 45 mm finished thickness and shall be properly framed and put together in accordance with the requirements of BS 459.

External quality flush doors where so described shall be as described above except that the plywood shall be external quality bonding W.B.P. plywood as previously described and all adhesives used shall be of the resin type.

All flush doors shall be perfectly flat on both faces free of all waves, ripples and distortion of any kind. Any door which after the application of paint or polish shows any of these defects shall be removed

2.4.5.21 Priming

All joinery work which is prepared for painting shall be knotted and primed as soon as it is prepared and ready for incorporation in the building. The backs of all frames, linings, skirting boards, bottom edges of doors and sashes etc., and other timber likely to come into contact with plaster or masonry shall be similarly primed.

Priming shall consist of one coat of priming paint in accordance with BS 2523.

Touch up the priming coat of all members as necessary before finally incorporating in the Works.

2.4.5.22 Polish or Clear Finishes

Where Joinery is to be polished or varnished it shall be given the first coat of the selected treatment as soon as it is ready for incorporating into the Works.

2.4.5.23 Inspection

Facilities shall be given to the Project Manager to inspect work in the course of fabrication in the Contractor's Workshop.

2.4.5.24 Storage and Delivery

All completed joinery shall be carefully stored in an enclosed building until it is required for use and shall not be prematurely brought to the site.

All joinery in transit shall be carefully protected from damage and kept under a waterproof cover.

2.4.5.25 Protection of Joinery

All joinery likely to be damaged after being fixed in position shall be adequately cased and protected by the Contractor until completion of the Works.

2.4.5.26 Ironmongery

All ironmongery is to be as specified in the Particular Specification or Bills of Quantities with regards to manufacture and finish.

All ironmongery shall be carefully stored, sorted, assembled and fixed in the best manner with matching screws, and shall be left oiled if required and in perfect working order.

All keys shall be stamped with an identity number corresponding to its lock and if directed by the Project Manager it shall have a stamped brass identification tag attached to it by means of a steel split ring.

All ironmongery shall be removed before painting work is carried out and after completion it shall be refixed, adjusted, cleared and left in full working order.

All damaged or defective ironmongery shall be replaced at the Contractor's own expense.

2.4.5.27 Dowels

The feet of all door frames or other vertical posts or timbers shown on the drawings shall be firmly anchored to the floor with a 9 mm diameter mild steel dowel 100 mm long let into the frame, etc., and the floor for equal amounts. Dowels shall be bedded to the frame in red or white lead.

2.4.5.28 Mosquito Gauze

Where indicated on the drawings, mosquito gauze shall be brass or copper gauze not less than 0.559 mm (24 S.W.G) x 20 mesh.

2.4.5.29 Making Good

Should any joiners work to bend, shrink or warp before the end of the Maintenance period, such work shall be removed and replaced entirely at the Contractor's own expense together with any other work disturbed in consequence thereof to the entire satisfaction of the Project Manager.

2.4.6 *Metal Work*

2.4.6.1 Materials generally

- i. All materials shall be the best of their respective kinds, free from defects, and all work shall be carried out in the most workmanlike manner and strictly as directed by the Project Manager.
- ii. The materials in all stages of transportation, handling and piling shall be kept clean and injury from breaking, bending and distortion prevented.

2.4.6.2 Structural Steel

Structural steel shall comply with BS 4-1: 1993 Steel of Non-British origin shall comply with the tests enumerated in BS 159: 1992 and samples shall be submitted to the Project Manager for this purpose and for his approval.

All structural steelworks shall be fabricated in accordance with BS 449-2:1969 – The use of Structural Steel in Buildings.

2.4.6.3 Welding

Welding of steel shall be carried out strictly in accordance with BS 5950 – General requirements and/or DD ENV 1090 Eurocode.

2.4.6.4 Bolts

All bolts shall be of the best quality mild steel of lengths and weights approved by the Project Manager. Bolts shall project at least two threads through nuts and all bolts passing through timber shall have washers under heads and nuts.

2.4.6.5 Metal Windows and Doors

All metal windows and doors shall unless otherwise specifically described be of the domestic type in accordance with BS EN 990: 1996 – Steel Windows generally for Domestic and Similar Buildings.

Windows generally shall be Standard Metal Windows of the type and layout shown on the drawings, constructed from sections rolled from best quality mild steel. Corners shall be electrically welded and glazing bars shall be locked at points of intersection and machine-tensioned to frames. All welds shall be ground flush and all frames and casements shall be square and free from deformity of any kind.

2.4.6.6 Hanging

All casements shall open as indicated on the drawings and shall be fitted with projecting hinges with bronze or gun – metal pins; horizontal pivot-hung windows shall be fitted with bronze friction centers. All fittings shall be of bronze or gun-metal.

2.4.6.7 Fittings

All side-hung windows shall be fitted with a double notched wedge plate casement handle and peg casement not less in length than three quarters of the width of the opening light and suitable retaining pins welded to the frame.

Horizontally hung windows shall be fitted with a peg casement stay as above described but pivoted windows shall be fitted with spring loaded catches with either ring handles for pole operation or where specifically so described gears for remote control operation.

Doors shall be hung on heavy pattern projecting type hinges with bronze or gun – metal pins and fitted with a three-lever mortise lock of “Union” or other equally approved manufacture with two keys and bronze handles to each. One leaf of folding doors shall be fitted with two 150 mm bronze concealed bolts.

2.4.6.8 Glazing Clips

All sections shall be slotted or drilled to receive glazing clips.

2.4.6.9 Fixing Lugs and Screws

Adequate mild steel fixing lugs and screws shall be provided at no more than 450 mm centers at jambs, heads or cills and where these are less than 450 mm in length, they shall be fitted with not less than one lug per member. Lugs shall be of the adjustable type for building into walls with slotted holes to allow vertical adjustment of the fixing screws.

Frames shall be screwed either to the fixing lugs or direct to wood frames with suitable screws.

Frames fixed directly to masonry brickwork shall be fully bedded in gauged mortar and neatly pointed all round externally in an approved waterproof mastic compound. Frames screwed into wood sub-frames shall be bedded in an approved waterproof mastic compound before screwing in position and the surplus mastic neatly dressed off and pointed on both sides.

2.4.6.10 Composite Windows

Composite windows and doors shall be provided as shown in the contract documents and shall include all necessary coupling mullions, transoms and cills etc. as indicated.

All mullions and transoms shall be bedded in approved mastic.

2.4.6.11 Protective Finish

All metal windows shall be given one coat of approved red oxide paint at the works. The metal shall be thoroughly cleaned before the paint is applied.

After delivery to the site, the paint coat shall be touched up with similar paint as required before the application of subsequent coats.

2.4.6.12 Fly Screens

Where fly screens are indicated on the drawings unless specifically otherwise shown, these shall be manufactured in accordance with the shop drawings provided by the Contractor and approved by the Project Manager.

The frames, opening lights and mullions shall be manufactured from good quality mild steel, all properly framed and welded together.

Where plate mullions and transoms are required these are to consist of 1.626 mm thick sheet 112 mm girth with one edge bent, drilled and set screwed to the window and the other edge drilled and set screwed to the metal angle frame of the fly screen.

Opening lights shall be provided with one pair of brass hinges and two brass turnbuckles to each and filled in with 20 mesh x 10.274 m (32 S.W.G) brass gauge screwed with mild steel beads fixed to the inside of the angle frame.

All fly screen frames shall be thoroughly cleaned and prepared at the manufacturer's works and painted with one coat of approved red oxide paint.

2.4.7 Paving

2.4.7.1 Cement

All cement shall be as described in Clause 2.4.1.2 "Cement".

2.4.7.2 Sand

Sand for paving shall be clean well graded sand in accordance with BS 1199: and BS 1200 and shall be washed if required.

2.4.7.3 Granolithic Coarse Aggregate

Coarse aggregate for granolithic paving shall be clean, properly graded quartzite chippings finely crushed to pass a 6 mm mesh and down but free from dust and organic matter.

2.4.7.4 Water

Water shall be as previously described.

2.4.7.5 Granolithic Paving

The mix for granolithic paving concrete shall consist of one part cement, one and a quarter parts sand and two and a half parts coarse aggregate as described by volume (1 : 1¼ : 2½).

If the coarse aggregate grading approaches the upper limit of 20% passing a 4.5 mm sieve, the proportion of sand should be reduced accordingly.

The provisions of “Concrete” regarding batching and mixing shall apply to granolithic concrete and in all cases the water content shall be kept as low as possible consistent with obtaining full compaction.

The paving may be laid:

- i. monolithic with the concrete base under i.e. within 3 hours of the base being laid, or
- ii. as separate construction i.e. after the concrete base has been allowed to dry and attain its full strength.

The special conditions applying to laying, thickness and size of bays for each method are fully described hereafter.

All paving shall be thoroughly compacted without segregation or excessive laitance.

After placing, leveling and compaction the topping shall be troweled at least three times at intervals during the next 6-10 hours to produce a uniform, dense and hard surface with as much coarse aggregate just below the surface as possible. During the second subsequent troweling any laitance shall be removed. The final troweling should be at such a time that considerable pressure is required to make an impression on the surface. Under no circumstances should cement be sprinkled on the surface and troweled in to absorb surplus water.

As soon as the surface has been finished it shall be shaded from the sun and breeze to prevent rapid drying. Immediately the surface has hardened sufficiently it shall be covered for at least seven days with damp sand or hessian, building paper, plastic etc., and shall be kept completely and continually damp. After the curing period it shall be allowed to dry out slowly.

2.4.7.6 Granolithic Paving (Separate Construction)

The area of bays shall be determined by the layout, the structure and the method of construction to be adopted. The position of construction joints, movement joints and day work joints in the base shall be carefully planned in relation to the layout as such joints will necessitate corresponding joints in the paving.

The paving is to be laid in areas not exceeding 15 sq. metres or in panels the length of which shall not exceed 1½ times their width. Plastic or ebonite strips as described shall be used to define the joints in the paving and overall bays and load bearing walls.

The base shall be thoroughly hacked shortly before the paving is to be laid to provide a good bond. All laitance shall be removed to expose the coarse aggregate and all dust and dirt cleaned out. The base shall be thoroughly wetted but all excess water removed before grouting. If the paving is to be laid less than 24 hours after the base, preparation may be done by wire brushing.

Before paving is placed, a thin layer of grout consisting of cement and water mixed to the consistency of thick cream shall be brushed into the surface of the base. The grout shall be followed immediately by the paving as previously described.

The paving, when fully compacted, shall be not less than 36 mm + 6 mm and service pipes or conduit shall not be laid in it.

2.4.7.7 Granolithic Paving (Monolithic)

Where the thickness of the base and paving is 150 mm or greater the area of individual slabs shall not exceed 30 sq. metres.

When the thickness of base and paving is between 100 mm and 150 mm the area of slabs shall not exceed 15 sq. metres.

The area and shape of slabs will depend on the layout of the building but shapes approaching the square shall be preferred and in no case shall the longer dimension exceed 8 metres. Plastic or ebonite strips as described shall be used to define the joints in the paving and overall beams and load bearing walls.

The paving, when fully compacted, shall be average 19 mm thick with a minimum thickness of 12 mm.

2.4.7.8 Chemical Surface Treatment

Integral hardeners or surface treatments where specified shall be used strictly according to the manufacturer's instructions.

2.4.7.9 Screeds

Screeds for in-situ terrazzo and other tile pavings shall consist of cement and sand (1:3) and shall be laid in a similar manner as described for granolithic paving (monolithic or separate) to the specified thickness and finished with wood float or steel trowel.

2.4.7.10 Terrazzo Paving

The materials used and method of laying is to be in accordance with BS 8204.

The terrazzo paving is to be of an approved colour as selected by the Project Manager and composed of two parts of white or coloured marble chips to one part tinted white cement laid rolled and troweled to a dense even surface and rubbed down at completion to a grit finished surface free from holes and blemishes.

Terrazzo paving shall not be less than 15 mm finished thickness and laid in panels 1000 x 1000 mm maximum or to patterns as indicated on the drawings and divided by ebonite or coloured plastic strips securely anchored into the screed and having their top edges finished flush with the surrounding paving.

The paving is to be laid on a cement and sand screed as described of the thickness indicated (but not less than 19 mm) and is to be finally ground and polished to the approval of the Project Manager. The concrete sub-floor shall be thoroughly cleaned and free from dust, grease and other foreign materials and coated with cement slurry before the laying of screeds and paving.

2.4.7.11 Concrete and Quarry Tile Paving

Concrete floor tiles and fittings shall comply in all respects with BS 1197-2 and samples shall be submitted to the Project Manager for testing and approval.

Quarry floors, tiles and fittings shall comply in all respects with BS 6431 and samples shall be submitted to the Project Manager for testing and approval.

All tiles shall be well soaked in water before use.

Tiles shall be laid to the patterns indicated on the drawings with either close butt joints or wide joints as required.

All tiles shall be laid on a prepared cement and sand screed and be bedded and joined in cement mortar (1:3) as before described and pointed as indicated on the drawings.

2.4.7.12 Cork Tile Paving

Cork tile paving shall be carried out by an approved specialist firm and shall consist of medium density cork tiles each size 305 x 305 x 6 mm thick with tongued and grooved edges laid with close but continuous joints in both directions and bedded in an approved adhesive.

Cork tiles shall be of a natural colour approved by the Project Manager.

The tiles shall be laid on a clean dry cement and sand (1:3) screed as before described and after laying shall be surfaced and sealed with three coats of approved polyurethane lacquer buffed down between coats.

2.4.7.13 Flexible P.V.C Floor Tiling

Flexible P.V.C floor tiling shall be carried out by an approved specialist firm and shall consist of tiles in accordance with B.S. 3261 of approved manufacture and colour to the sizes and thickness as indicated in the Drawings, Particular Specification or Bills of Quantities. The tiles shall be laid to the patterns as indicated (if any) on the drawings with close butt joints and bedded in approved mastic on a clean, dry cement and sand (1:3) screed as before, described with a stool trowelled finish.

On completion, any surplus mastic which may have squeezed out of the joints shall be removed, the tiles cleaned with an approved cleaner and two coats of approved P.V.C. tile sealer applied.

2.4.7.14 Dividing Strips

Dividing strips shall be black ebonite or plastic of approved colour to the sizes and positions as indicated on the drawings, Particular Specification or Bills of Quantities. The strips shall extend to the full depth of the pavings in which they are inserted and in the case of terrazzo work shall be let into the screed under for a depth of not less than 6 mm.

2.4.7.15 Cover up and Protection of Paving

The Contractor shall cover up and protect all pavings and finishes as required to assist slow and even drying and to prevent damage by traffic. Remove all such coverings and leave the work clean and perfect at completion.

2.4.8 Wall and Ceiling Finishes

2.4.8.1 Cement

All cement shall be as previously described in concrete works.

2.4.8.2 Lime

The lime for plastering shall comply with BS EN 459-1 or applicable Nigerian/International standards for non- hydraulic lime and be as rich as obtainable and to the approval of the Project Manager. It must be freshly burned and shall be slaked at least one month before being used by drenching with water, well broken up and mixed and the wet mixture shall be passed through a sieve of 10 meshes to 100 square mm. Lime putty shall consist of freshly slaked lime as above described, saturated with water until semi-fluid and passed through a fine sieve, it shall then be allowed to stand until superfluous water has evaporated and it has become of the consistency of thick paste, in no case for a shorter period than one month before using, during which time it must be kept damp and clean and no portion of it allowed to become dry.

Alternatively, approved hydrated lime with an average 70% Calcium Oxide CaO content may be soaked to a putty at least 24 hours before use.

2.4.8.3 Sand

The sand for plaster work shall be in accordance with BS 1199 and BS 1200: It shall be clean and well graded to a suitable fineness in accordance with the nature of the plaster and the finish to be obtained.

2.4.8.4 Plastering Generally

Where walls are to be rendered or plastered, the joints shall be raked out 12 mm deep and brushed clean to afford a key and joints and walls shall be sprayed with clean water before rendering or plastering. Concrete surfaces shall be hacked to form keys in addition.

All surfaces to be plastered must be scored for a key and brushed clean and well wetted before each coat is applied.

All materials shall be properly mixed either by hand or by machine.

Hand mixing shall be carried out on a clean, properly prepared platform which shall be thoroughly scraped and cleaned between batches.

Machine mixers shall be thoroughly cleaned out between each batch.

No batch of mixture shall be used after the initial set of the cement has taken place and no material shall be allowed to stand and be subsequently "knocked" up for reuse.

All cement plaster shall be kept continually damp in the interval between application of coats and for seven days after application of the final coat.

All arches and angles shall be clean and sharp except where the Drawings indicate otherwise.

The Contractor shall include filling plaster into chases and working around pipes, conduits, switch boxes and outlets, into rebates, up to metal window frames etc. and the like and for all making good.

2.4.8.5 Internal Plastering

The internal plastering is to be applied in three coats and to be 16mm minimum thickness as follows:

- a) 1st Coat – Cement and sand (1: 5 by volume), allowed to dry out thoroughly and well scratched to afford a key for the second coat.
- b) 2nd Coat – Cement and sand (1: 5 by volume), 6mm thick, finished true and level with a wood float.
- c) 3rd Coat – Cement Slurry or if lime is to be used, It shall be neat lime, plus 10% cement, not less than 2mm thick, applied as soon as the second coat can stand troweling and finished smooth with a steel trowel.

Plastering on expanded metal lathing is to have a preliminary or pricking-up coat in addition.

The setting coat of plaster shall not be applied until all conduits, pipes and the like have been fixed and until all air bricks etc., have been fixed and all chases and cuttings in the walls have been performed and made good.

2.4.8.6 External Rendering

External rendering consists of one part cement and five parts sand by volume (1: 5). One coat work is to have a minimum finished thickness of 12 mm and two coats work 19 mm.

Unless otherwise described, rendering is to be floated smoothly with a wood float.

2.4.8.7 Tyrolean Finish Rendering

Tyrolean finish rendering shall consist of a base coat of one part cement and five parts sand (1:5) by volume and a finishing coat of one part cement to four parts (1:4) of fine stone chippings 9mm and down applied to the base coat by means of an approved machine to a total finished thickness of not less than 20 mm.

The base coat shall be floated to a smooth even surface and liberally scratched to form a key.

2.4.8.8 Expanded Metal Lathing

Expanded metal lathing for plastering shall be in accordance with BS 1369 and unless otherwise described in the Particular Specification or Bills of Quantities shall have a stoved black asphalt paint finish.

The lathing shall be 9 mm mesh x 24 S.W.G (0.559mm). Lathing shall be not less than 25 mm at the sides and end laps, which shall be wired together at not more than 75 mm centres with stout iron-tying wire. The cut ends of all tying wires shall be bent back through the lathing.

Lathing shall be fixed with the long way of the mesh across the supports and shall be fixed to the same with stout galvanized staples at not more than 300 mm centres.

2.4.8.9 Wall Tiling

Wall tiles shall comply with BS 6431 Glazed Ceramic tiles and Tile Fittings for Internal Walls.

All tiles shall be of the size, colour and quality as described in the Particular Specification or Bills of Quantities and shall be perfectly true to shape and free of all blemishes and flaws.

Samples shall be submitted to the Project Manager for approval.

All wall tiling shall be fixed on a perfectly plane vertical screed of cement and sand (1: 3). Tiling shall be bedded on the prepared screed in a slurry of cement and sand (1: 4) or in an approved tile adhesive. The surface of each tile shall finish flush with the adjacent tiles. Joints shall be continuous straight joints both horizontally and vertically not exceeding 3 mm wide and shall be flushed up with white cement. Spacers shall be used to ensure that the correct joint width is maintained.

All cutting shall be kept to a minimum and the tiling shall be set out so that only the largest possible pieces of cut tiles are used.

Purpose-made tiles with round on one edge shall be fixed to all vertical external angles and to the top edge of dados and the wall face over.

2.4.8.10 Expanded Polystyrene Tiles

Expanded polystyrene tiles shall be in accordance with BS 2552.

Tiles shall be to thickness and sizes as indicated in the Drawings, Particular Specification or Bills of Quantities.

All tiles shall be chamfered on all edges, close butt jointed with continuous straight joints in both directions and either nailed to timber bearers with approved panel pins with the heads neatly punched in or glued on all edges either to timber bearers or to plaster or concrete soffits with an approved adhesive.

All tiling shall be properly set out so that all cut tiles to the border on all sides of a room are of equal width.

Special Note:- Under no circumstances are these tiles to be painted, decorated or subjected to any surface treatment of any kind. Therefore great care must be exercised during handling and fixing to see that they are kept perfectly clean.

2.4.8.11 Insulation Board

Insulation board shall be in accordance with BS EN 120/ 310/ 317/ 319/ 320/ 322/ 323/ 324/ 325/ 382/ 022

Sheets shall be set out to provide evenly balanced borders on all edges and shall be fixed to timber ceiling bearers spaced at 600 mm centers in both directions with stout galvanized gimp pins along each at 150 mm centers with their heads punched in and stopped. Joints between sheets shall be 3 mm wide.

Timber cornices shall be provided at the junction of all walls and ceilings as indicated on the drawings. Cornice members shall be plunged to the wall, not to the ceiling boards.

2.4.8.12 Flat Sheets

Sheets shall be butt-jointed and secured to timber bearers at minimum 400 mm centers with 30 mm long stout galvanized flat headed nails not more than 300 mm apart.

All holes shall be drilled (not punched) not less than 12 mm from the edge of the sheet and all nails shall be driven home so that the head finishes flush with the sheet.

Sheets to ceiling shall be set out in the same manner as described for the Insulation Board.

2.4.8.13 Make Good

The Contractor shall cut out and make good all cracks, blisters and other defects and leave the whole of the plasterwork perfect on completion. When making good defects the plaster shall be cut out cleanly as directed, with the edges undercut to form a good key with the surrounding work, and the new material shall finish flush with the adjacent plaster.

Tiled and sheeted surfaces shall be left perfectly clean on completion.

2.4.9 Glass Works

2.4.9.1 Glass

All glass shall comply with BS EN 12758 and shall be free from spots, bubbles, waves and all other defects. Samples of glass shall be submitted to the Project Manager for approval.

Unless otherwise described in the Particular Specification or Bills of Quantities, sheet glass shall be ordinary glazing quality and polished plate glass shall be glazing quality. The nominal thickness of glass is to be as described in the Contract Documents.

2.4.9.2 Putty

The putty used in glazing in wood frames is to be whiting ground with linseed oil. That used for metal frames to be composed of whiting, linseed oil and gold size in accordance with current BS 544.

2.4.9.3 Glazing

Panes shall be cut with 1.5 mm clearance all round.

Generally glaze all windows with glass carefully puttied and fully back puttied, where glazing is to wood the glass must be sprigged. Carefully trim off all superfluous putty.

Glazing clips are not necessary for small panes of metal windows but should be used for the no-glazing bar types. Where no glazing bars are used, the weight of the glass should be thrown on the lower hinge corner by means of small wood edges placed between the glass and the metal frame.

2.4.9.4 Bedding Strips

All glazing to wood doors or where otherwise directed shall be bedded in wash leather or other approved plastic shock absorbing material. The bedding material shall be cut to fit exactly the rebate line of the frame and it shall be secured with wood or metal beads fixed with cups and screws.

2.4.9.5 Cleaning on Completion

Remove all broken, scratched or cracked panes and replace them with new ones to the satisfaction of the Project Manager. Clean inside and out with an approved cleaner. On no account shall windows be cleaned by scraping with glass.

2.4.10 *Painting*

2.4.10.1 Workmanship

All paintings work shall be carried out by skilled tradesmen and finished in a manner in accordance with the best acceptable trade practice.

2.4.10.2 Subletting Work

The work shall not be sublet to a specialist firm without the written approval of the Project Manager.

2.4.10.3 Materials

All materials shall be the best of their respective kinds and shall be in accordance with their respective current Nigerian Standard.

2.4.10.4 Paint

All paints, including cement paint, oil paints, emulsion paint and oil bound distemper shall be ready mixed and obtained, unless specifically instructed to the contrary, from approved local manufacturers, and they shall be delivered to the site in sealed cans and shall be thoroughly mixed and applied in accordance with the manufacturer's instructions.

2.4.10.5 Linseed Oil

The linseed oil can be refined, boiled or raw.

2.4.10.6 Knotting

The knotting is to be in accordance with BS 1336.

2.4.10.7 Wax Polish

The wax polish shall be furniture polish of an approved brand.

2.4.10.8 Lacquer Treatment

Lacquer shall be an approved catalytic polyurethane lacquer and used strictly in accordance with the manufacturer's instructions.

2.4.10.9 Generally

The Contractor shall arrange his programme of work so that all other trades are completed and away from the area to be painted before painting is commenced. The Contractor shall remove all concrete and mortar droppings and the like from all work to be decorated and remove all stains therefrom to obtain a uniform colour of the surface.

All materials to be applied externally shall be of exterior quality and/ or recommended by the manufacturers for external use.

Unless specifically instructed by the Project Manager, no paints, distemper etc., shall be used as supplied by the manufacturers and direct from the tins.

If required by the Project Manager, the Contractor shall provide samples of paints and other decorative materials with containers which shall be forwarded to an approved laboratory for testing.

The priming, undercoats and finishing coats shall each be of different tints and the priming and undercoat shall be the correct brands and tints to suit the respective finishing coats, in accordance with the Manufacturer's instructions. All finishing coats shall be of colours and tints selected by the Project Manager.

Each coat shall be properly dry and in the case of oil or enamel paints shall be well rubbed down with fine glass paper before the next coat is applied. The paintwork shall be finished smooth and free from brush marks.

Colour cards of all paints, etc., shall be submitted to and samples prepared for approval of the Project Manager before laying them on, and such samples, when approved, shall become the standard for the work.

All paints, emulsion paints, and distempers shall be applied by means of a brush or spray gun or rollers of an approved type, where so agreed by the Project Manager.

No painting is to be done in wet weather or on surfaces which are not thoroughly dry.

2.4.10.10 Preparation

All surfaces to be painted shall be entirely free from all dirt, grease and dust.

i. Plaster

Areas of defective plaster shall be cut out and made good with similar plaster finished smoothly.

Large cracks shall be cut out, undercut and filled with plaster finished smooth and flush. Small cracks and holes shall be filled with an approved hard filler.

Plastered surfaces to be painted with oil paint shall be treated with one coat of alkali resistant primer.

ii. Metal

All rust and loose scales are to be removed by means of wire brushing or scraping.

All bare metal is to be primed with a primer conforming to BS 2523 and all bare patches of work priming shall be touched up and brought forward.

Coated surfaces, such as stack pipes, shall be thoroughly brushed down and painted with one coat of knotting.

Galvanised surfaces to be washed down after drying shall be coated with an approved solution approved by the Project Manager.

iii. Woodwork

All woodwork shall be rubbed down, all knots covered with a thick coat of good shellac knotting, given one coat of approved ready-mixed proprietary wood primer and all cracks, nail holes, defects and uneven surfaces etc., stopped and faced up with hard stopping rubbed down flush.

iv. Insulation or Fibre Boards

All holes shall be stopped with an approved plaster compound rubbed down flush and all surfaces treated with one coat of thinned paint or emulsion paint as specified.

2.4.10.11 Preparation of Existing surfaces

The preparation of existing surfaces shall comprise the following activities:

- i. Plaster, Insulation Board and remove all loose flaking, wash down, rub down, paint, fill in holes and cracks with an approved filler including cutting out cracks in old plasterwork, and bring forward bare patches.
- ii. Metal - Wash down, rub down, thoroughly scrape down as necessary to remove all loose and flaking paint and rust and prime and bring forward bare patches.
- iii. Woodwork - Wash down, rub down, remove all loose and flaking paints, fill in cracks and holes etc. with an approved filler and knot and prime and bring forward bare patches. Alternatively, where specified, completely remove paint by burning off or other approved means, rub down, fill in cracks and holes etc. with an approved filler and knot and prime as described for new woodwork.

2.4.10.12 Backs of Frames

Prime backs of all timber frames, skirtings and the like in contact with masonry or plaster with one coat of approved ready-mixed proprietary wood priming paint before fixing.

2.4.10.13 Remove Ironmongery

Metal fittings and fastenings etc., are not to be fixed until painting is completed. Where they have been fixed, they shall be removed and stored until painting is completed and then carefully cleaned and refixed in position. Lugs to metal windows and door handles shall be painted before glazing.

2.4.10.14 Cover up and Protect

Before painting is commenced, floors must be washed and the buildings thoroughly cleaned out and every precaution taken to keep down dust.

The Contractor shall provide covers to all gauze screens and sashes and elsewhere as may be required to prevent marking and staining by paint.

2.4.10.15 Cleaning up

Replace any cracked or broken glass. Remove and replace any gauze screens which may be stained with paint. Remove all other paint splashes, spots and stains and clean out and leave the buildings to the requirements and satisfaction of the Project Manager.

2.4.11 Fire Extinguishers, Cabinets, Pumps and Accessories

2.4.11.1 Fire extinguisher cabinets

All fixed recessed and semi-recessed hose reel cabinets and/or surface-mounted cabinets have a heavy gauge, steel or aluminum box and shall be located and installed in accordance with BS EN 671-1.

2.4.11.2 Fire extinguishers

Fixed fire extinguishing installations and equipment on premises shall be located and installed in accordance with BS EN 671-1. Portable fire extinguishing shall be in accordance with BS 5306-3.

2.4.11.3 Accessories

All accessories, fire blankets and brackets shall meet the requirements of 02/121662, 02/121663, 02/121665, 02/121667, 02/121668, 02/121669, 02/121670 and 02/121672.

2.4.11.4 Pumps

Fire hose reel pumps shall consist of a duplicate set of end-suction centrifugal pumps, each pump rated for 2.27 litres per second flow producing a minimum head to all hose reels of 25 metres and one number diesel engine driven centrifugal pump, pressure vessel, valves and accessories.

Each pump shall be supplied complete with an electric motor, base plate, anti-vibration mountings, gate valve on the suction port and gate plus non-return valve on the discharge port.

The common suction pipe to the duplicate pump set shall be fitted with an in-line strainer to BS 5154, generally as Crane type D 287 and foot valve strainer.

The fire hose reel pump shall be controlled by a pressure switch and tank to maintain the required minimum pressure head.

Pumps motors contactors, neon run-fail lamps, duty/stand-by automatic change-over switch and local isolator for the fire hose reels installation to be supplied and installed under this item shall be housed in a proprietary control panel. A bypass shall be constructed for the pumps.

2.4.11.5 Hose Reel Installation

i. Pipes and Pipe Fittings

Pipes shall be galvanised steel tubing to BS 1387:1967 Class C with pipe threads to BS 21.

Pipe Fittings shall be Wrought steel seamless pipe fitting to BS 1740 Part 1: 1971.

ii. Valves

Non-return Valves: lift type with bronze body and composition disk conforming to BS 5154 and generally as Crane type DM 118.

Gate Valves shall be bronze body and solid wedge disk having non-rising stem and wheel conforming to BS 5154 and generally as Crane type DM 160.

iii. Hose Reels

Hose reels shall be recessed, swinging, automatic type with 30 metres long x 25mm diameter hose and nylon spray/jet/shut-off nozzle conforming with BS 3169:1981

Each hose reel shall be fitted with a screw-down bronze globe valve to the requirements of BS 5154 on the inlet to the reel.

2.4.12 *Plumbing*

2.4.12.1 Statutory Requirements

All plumbing work, pipework and sanitary installations shall be carried out in accordance with the Regulations of the National Water and Sewerage Corporation or other Local Water Authority. Where no such Authority exists, then such work shall be carried out in accordance with the directions of the Project Manager.

2.4.12.2 Galvanised Steel Pipes and Fittings

Galvanised Steel Pipes shall comply with BS 1387 Class „B“ except where the Water Authority requires otherwise.

Fittings shall be galvanized malleable iron to BS 143 and BS 1256.

All pipes and fittings shall be obtained from an approved manufacturer.

Galvanised steel water tubes shall have screwed and socketed joints put together with ties and red leads and fixed to walls with approved patten clips spaced at not more than 1750 mm apart. Made-bends shall be formed cold and shall wherever possible be used in preference to elbows. Elbows shall be of the round kind where possible unless otherwise specified, pipes shall be fixed in chases in walls. Where pipes are required to be fixed to the wall surfaces, they shall be fixed with approved holder-bats 25 mm clear of the finished wall surface.

2.4.12.3 PPR pipes and fittings

The PPR pipes and fittings shall be produced from polypropylene Random type PN25 material or equivalent which has high molecular weight and excellent creep resistance.

The installation shall be in accordance with the manufacturer's recommendation with provision for expansion, including all necessary fittings and accessories. The pipe shall be tested at 15 bars for one hour, immediately after the preliminary test, the main test shall be carried out at 10bars for 24 Hours. There shall be no leakage of any kind not even in the form of moisture in either of the tests. The installation must be perfectly tight.

2.4.12.4 Cast Iron Soil, Waste and Vent Pipes

Coated cast iron soil waste and vent pipes and fittings shall be of a medium quality to comply with BS 416 with ears cast on and shall be obtained from an approved manufacturer.

Pipes shall have spigot and socket joints with a tarred hempen gasket rammed down the sockets and lead wool well caulked in, and shall be fixed to walls with clout rose-headed nails and 38 mm gas barrel distance pieces and hardwood plugs built into the wall. All junctions and bends on exposed cast iron soil and waste pipes shall be fitted with access doors and screwed inspection eyes. The top end of all vent pipes shall be fitted with a galvanized domical wire grating covered with 32 S.W.G. x 20 Mesh copper wire mosquito gauze.

u. P.V.C soil pipes and fittings shall be supplied and fixed where indicated on the Drawings and Schedules. They shall comply in all respects to British Standard 4514 and shall where appropriate bear the British Standard KiteMark as Terrain Manufacture or equal and approved.

2.4.12.5 Tubing Generally

All pipes shall whenever possible be located in such a manner as to minimize risk of mechanical damage and shall be readily accessible for inspection and repair, but shall nevertheless not appear unsightly.

All waste pipes shall be fitted with sweep-tees with screwed cleaning caps at each change of direction. All services shall be connected to sanitary fittings, tanks, etc. with approved union connectors. The exposed ends of all overflow pipes shall be mosquito-proofed by means of 32 S.W.G x 20 mesh copper wire gauze, tightly bound on with stout wire.

2.4.12.6 Water Service and Distribution Pipework

Service pipes shall be laid from the stop-valves at the boundary of the site to a storage tank; stop-valves being inserted in all positions as required by the Project Manager and all pipe work inside the building shall be securely fixed in position.

2.4.12.7 Branches to Drinking Water Draw-off Taps

Branches to drinking water draw-off taps shall be taken directly from the service pipe to drinking water draw-off points in the building.

2.4.12.8 Delivery Pipes

Delivery on distribution pipes shall be fitted with stop valves and shall be taken from the storage cistern to feed draw-off taps over baths, lavatory basins, water closet flushing cisterns, etc. and the hot water system.

2.4.12.9 Running, Jointing and Fixing Pipes

Branches taken from vertical services and delivery pipes shall have a slight rise or fall as the case may require for the release of air to cisterns or taps and to enable the system to be drained. Pipe runs shall be set out to avoid traps and air locks.

Cold water piping shall not run near hot water services. Where this cannot be avoided then both hot and cold water pipes shall be lagged.

2.4.12.10 Stops, Taps and Ball Valves

Stop-valves shall be provided and fixed on the service pipes at the entry to the buildings, at entry to water storage cisterns and on the delivery pipes close to water storage cisterns. Bib-taps shall be provided to the direction and approval of the Project Manager and shall be marked „hot“ and „cold“

All ball valves shall comply with BS 1212 and all copper float balls shall comply with BS 1968. Brass taps and valves shall comply with BS 1010-2.

2.4.12.11 Storage Cisterns

Storage tanks or cisterns shall be provided where shown. All storage cisterns shall be provided with galvanized mild-steel covers with rim turned down not less than 50 mm. The covers shall exclude entry of dust, debris, mosquitoes and vermin.

Storage cisterns shall have overflow pipes the cross section area of which shall not be less than 50% in excess of that of the supply pipe and shall be fixed at a height of not less than 25 mm above top water level, but below ball-valve inlet and shall be arranged to discharge externally. The outlet end of the overflow pipes shall be fitted with 32 S.W.G. x 20 mesh copper wire gauze of other approved materials to prevent entry of mosquitoes and vermin. Ball valves shall be provided and fixed to cisterns at a distance not less than 50 mm above the top of the overflow pipe.

There shall be uPVC tanks 4No. of 5,000L capacities complete with provisions for overflow, mains supply, and connection float valves.

2.4.12.12 Testing of Water Mains and Services

The service pipe from the Water Authority's main to the storage tank and all other terminal points inside the building shall be tested at a hydraulic pressure of not less than twice the working pressure in the Water Authority's main and the same pressure shall be maintained without drop and without further pumping for a period of not less than thirty minutes.

The down service pipes from the storage tanks to the various fittings shall be tested to a pressure specified by the Water Authority.

2.4.12.13 Sanitary Fittings General

All sanitary fittings shall be made of hard, smooth, non-absorbent and in corrodible material conforming to the latest Ni Standards or BS.

All fittings shall be fitted with traps with approved seals and where the trap is not an integral part of the fitting, a separate trap shall be connected between the fitting and the pipe. Separate traps shall be made of cast iron, galvanized iron lead, brass or copper and shall have a minimum seal of 35 mm and shall be fitted with a screwed cleaning- eye.

2.4.12.14 Water Closets

All water-closet suits shall be of approved material and shall comprise a flushing cistern and a pan are made to work together as a system and shall not be made up of pans and cisterns unsuitably selected.

Water closet pans shall be fixed to floors with large-gauge gunmetal screws and approved proprietary wall plugs. The brackets for water-waste preventer cistern shall be built into walls or secured with screws and approved proprietary wall plugs, and where cisterns are supported by lugs these shall be fixed by screws and proprietary wall plugs.

Water-waste preventers for high-level suites shall be set with the top of each cistern 2.15m above floor level.

2.4.12.15 Urinals

Urinals shall consist of glazed fireclay urinals, stalls, slab or bowl types. Slab or stall types shall not be less than 1.1m high and shall be fitted immediately above the edge of a glazed half round channel not less than 100 mm internal diameter and laid to a fall of not less than 1 in 40. Such a channel shall discharge into a salt-glazed ware or virtuous enameled trap with a water seal of not less than 50 mm in depth. Traps shall have an internal diameter of not less than 50 mm for a single stall or bowl and not less than 75 mm for a range of stalls or bowls.

Channel shall be provided with approved lead traps with removable cast gunmetal domical gratings.

2.4.12.16 Baths, Lavatory Basins and Sinks

Baths, lavatory basins, sinks etc. shall be of approved material and shall be provided complete with all fittings and accessories.

Lavatory basins or sinks shall be supported on suitable brackets which shall be built 115 mm into walls or fixed with heavy screws and approved proprietary wall plugs.

2.4.13 Borehole for Drinking Water, Hydrant & Panels Washing

The work comprises the prospecting by suitable methods for underground sources of water within Employer's property, sinking of one or more boreholes to this source, the supply and installation of pumping facilities, water treatment plant, ground level and elevated water storage tanks, distribution piping from the storage tanks to designated points and associated electrical and civil works.

2.4.13.1 Prospecting for underground sources

It is desirable to have the borehole located as near as possible to the housing estate/substation which occupies a fraction of the Employer's property. It is more important that the actual location straddles an aquifer where unlimited or at least reliable supply of water can be obtained at any time of the year. Studies of geological maps of the area shall therefore be undertaken in conjunction with local inquiries about boreholes recently sunk in the area. If possible, seismic/geophysical surveys shall be carried out to determine the probability of striking a reliable acquirer within the Employer's property.

As much as possible, shallow underground sources should be avoided unless it can be proven that it is part of deep-seated water bearing rock formation. Sources struck between six (6) and ten (10) metres shall be regarded as shallow.

2.4.13.2 Borehole drilling

The borehole shall be sunk in a diameter large enough to accommodate a 150 mm internal diameter PVC lining and gravel packing extending upwards from the well screen up to the grouting six (6) metres from the ground level. Generally, an average depth of sixty (60) metres may be reached before suitable water is encountered. Bidders shall therefore base their quotation on this depth.

However, in case a deeper penetration is inevitable at the chosen locations, two-unit rates of drilling per linear metre depth shall be offered: One for drilling through firm bed granular strata and the other through rock.

If the 60 metres depth fails to yield water, the contractor shall be obliged to continue drilling until an aquifer is encountered. In this regard the Contractor should envisage reaching down to as deep as one hundred (100) metres before giving up. However, it is to be expected that carefully planned and executed seismic surveys will eliminate to a great extent the uncertainty attendant on random or haphazard drilling. Where water is encountered before reaching the provisional depth, the drilling shall continue to the end of the stratum unless it gushes out to indicate that the aquifer has been penetrated.

In no case shall the penetration through an aquifer be less than ten (10) metres unless the boring has gone below the aquifer. Where water is obtained at a depth of about 40 m or less, further exploration should be carried down to 60 metres even if the aquifer has been left above. Water encountered at a depth of about 35 metres may not be acceptable unless it is ascertained that it is a reliable artesian aquifer and must have

been indicated through seismic testing and confirmed through the characteristics spray of water coming out from such wells.

Payment for work done to obtain water at a depth of 40 m and above shall be subject to reduction as the contract prices have been based on the provisional depth of 60 m

2.4.13.3 Borehole development

Standard pumping tests shall be carried out immediately after the drilling to determine the ultimate yield of the borehole. Samples of the water shall be obtained, adequately stoppered and sent for physical and chemical tests to determine the mineral contents, hardness, turbidity, PH and other characteristics.

The results of the tests shall form the basis of the selection of water treatment process yielding potable water for WHO standards. Soil samples from the aquifer shall also be taken for particles size grading if granular soil is encountered.

The borehole shall be lined with a 150 mm internal diameter PVC pipe and gravel packed to six (6) metres below the surface except where surface water has been encountered before the aquifer is struck. In this case, gravel packing shall not extend above this unwanted source. An electrically operated submersible pump of the vertical multistage centrifugal type whose capacity shall be established by calculation shall be installed.

This screen shall have perforations corresponding with the gravel packing will not significantly increase the pumping head to the surface. The upper six (6) metres of the borehole shall be grouted around the casing. This grouting shall be extended downwards to block off any encountered surface water. The headworks shall include the provision of a watertight removable cap through which the discharge piping and power cable will pass to the submersible pump. The size of the discharge pipe shall not be less than 50 mm and may be of light class PVC material.

2.4.13.4 Water treatment plant

The hardness if any, resulting from bicarbonates of calcium and magnesium shall be removed. If the total hardness exceeds the WHO standard, it should be reduced to acceptable levels. The alkalinity or acidity of the water as indicated by PH shall be removed to render the water neutral (PH between 6.5 and 7.5).

Turbidity, if appreciable, shall be removed or reduced to levels which shall render it acceptably clear. The mode of removal shall be consistent with the origin: colloidal suspension or chemical solution of deep-seated minerals. Iron minerals (ferrous or ferric) in quantities likely to stain appliances and utensils and found to be significantly above the upper limit or WHO standard shall be removed or reduced to within the WHO range.

Provision for filtration (rapid sand or gravity) may be considered and quoted for, although it is expected that primary sedimentation should take care of the small particles that escape the well screen in the aquifer. Removal of odour shall be effected through activated carbon filtration. The processed water shall be disinfected minimally before storage. It is expected that water from the aquifer shall be entirely free from

organic pollution or the presence of pathogenic organisms. The plant capacity shall be for 10,000 gallons in 12 hours.

2.4.13.5 Pumping facilities

Two electric motor centrifugal pumps each of about 5.00 HP shall be supplied and installed between the ground level and elevated storage tanks. They are to be connected in parallel so that one can be on standby for maintenance purposes.

Electric motor pumps of various capacities shall be supplied and installed between any two of the processing tanks as required.

2.4.13.6 Storage tanks

Potable water shall be stored in a 5,000 litres HDPE tank at ground level and in a 2,500 litres HDPE tank on 11.00 metres structural steel framed tower. Raw water, before treatment, shall be stored in a 2,000 litres ground level HDPE tank.

2.4.13.7 Tank supports and foundations

The ground tank shall be supported on reinforced concrete pedestals about 1.0 m high from the finished ground level and spaced in such a way as to minimise deflection of the base plates of the tank when it is full of water and minimise or prevent settlement under the tank.

The elevated tank shall be supported on a structural steel framed tower made up of members having adequate sections and stiffness to ensure a rigid structure that can bear the vertical loads and resist overturning and conspicuous swaying in a windstorm. The tower shall be provided with a ladder from the ground level, past the Catwalk and up the roof, rest platforms, peripheral walkway and a valve operating platform located about 3 m below the bottom of the tank complete with hand railing. The entire structural steel work shall be given two (2) coats of red oxide paint and a finishing coat of aluminium gloss paint.

Reinforced concrete foundations shall be designed to resist overturning and other forces on the superstructure and to safely distribute the superstructural loads on the local soil in such a way that the soil is not overstressed while settlements are also minimised or prevented.

2.4.13.8 Flow line diagram

A flow line diagram of the entire works from the borehole through the treatment plant to the storage tanks showing pumps and accessories shall be submitted.

2.4.13.9 Fencing

The entire area occupied by the borehole, tanks, pump cubicles and environ for about 3 m away from the fringes shall be cleared, levelled and filled with 50 mm – 75 mm gravel, 75 mm thick.

The boundary fencing shall be made of chain link wire mesh fabric supported on standard reinforced concrete posts having a height of 2.04 m above finished ground level. A lockable entrance gate 1.20 m wide, made of steel frame and covered with chain link wire mesh fabric, shall be provided. Flood-lighting by means of mercury or sodium vapour lamps shall be provided at the four corners of the enclosure at height of about 5 m above ground level.

2.4.14 *Drain Laying*

2.4.14.1 Drainage & Sanitation Rules

All drainage work is to be carried out in accordance with the Regulations for Sanitary Installations in Buildings

2.4.14.2 Excavation

Excavation shall be made for manholes, lines of pipe and other works to the depth as shown on the Drawings, or as shall be required by the Project Manager or as necessary to permit proper execution of the work, should there be erroneous over-excavation to levels below those required for drains, foundations or other works, refilling and making up of levels shall be carried out in concrete of approved mix and no other material shall be used for this purpose.

All excavations shall be kept clear of water or mud by approved means. Sides of excavations shall be adequately supported by timbering or other means approved by the Project Manager.

2.4.14.3 Laying Lines of Pipes

The Contractor shall provide and fix properly painted sight rails which will be checked by the Project Manager before any pipes are laid, and there shall be no fewer than three sights rails in position at one time on every length of pipe under construction.

Boning rods shall be provided and wooden pegs driven into the bottom of the trench at required intervals, the top of each peg being set at the exact level of the proposed invert of the pipe. The alignment and level of each pipe laid must be tested by inserting the shoe of the boning rod.

2.4.14.4 Materials

The quality and description of all materials and appliances including pipes, cement, etc. used for construction or repair of any drain shall be approved by the Local Authority or the Project Manager.

2.4.14.5 Size of Pipe and Fall

Drains shall be of adequate internal diameters and shall be laid with falls that ensure a self-cleansing velocity viz (a velocity of flow of 0.76 m per second when the pipe is 25% full).

2.4.14.6 Minimum Cover to Pipes other than Cast Iron and Steel

Where in case of pipes other than cast iron and steel it is not possible to have the minimum cover, such drains shall be entirely encased in concrete mix 1: 3: 6 not less than 150 mm in thickness all round the drain pipe.

2.4.14.7 Foundation for Drains

Drain pipes shall be laid with their barrels on a good, even, solid bed, free of irregularities. If so required by the Local Authority or the Project Manager, drain pipes shall be laid on an even bed of concrete or supported upon concrete piers spaced at approved intervals.

- a) Pipes shall under no circumstances be laid supported by their sockets but a hole shall be cut in the bed to allow the socket to hang. Such socket holes shall be filled solid with earth or concrete after testing the pipes.
- b) Pipes shall not be laid on temporary supports pending casting a concrete bed or filling the pipe. If a concrete bed is required, it shall be placed before the pipe is laid and where such a pipe is laid on or in green concrete, such concrete shall be sufficiently firm not to allow any movement of the pipe.
- c) If drain pipes of any material other than cast iron or steel are to be laid on made or unstable ground, such drain pipes shall be laid on beds of concrete mix 1: 3: 6 not less than 150 mm thick and the drain pipes shall be haunched with concrete mix 1: 3: 6 for the full width of the bed and to the crown of the pipe.
- d) Where cast iron or steel drain pipes are to be laid on made or unstable ground, such drain pipes shall be supported on concrete (mix 1: 3: 6) beds not less than 500 mm wide by 150 mm thick and where necessary the bed shall be reinforced adequately. In case of pipes laid over and above ground, they shall be supported on concrete, steel or other approved piers spaced at not less than 2.75 m (8"0") centers on concrete foundations.

The piers shall have for securing the pipes, a cast iron, steel or other approved plate fixed on top and an inverted „U“ steel strap loosely around the pipe and with both ends firmly fixed into the top of the pier rollers and an expansion joint shall be used.

2.4.14.8 Drain Junctions

Every branch drain or tributary drain shall, at the point of junction, join the rain drain obliquely in the direction of the flow of the main drain and at half channel height above the main channel. All bends and turnings shall be uniformly curved and any alteration in the size of the drain shall be properly tapered and of good shape.

2.4.14.9 Provision of Inspection Chambers

Appropriate inspection chambers shall be provided:

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- a) At every point in a drain where two or more branch drains converge;
- b) At every point in a drain where there shall occur any angle, bend, deviation from a direct alignment, change in gradient, difference in level or alteration in size; provided that pipe bends shall be allowed without inspection chambers for the connection of soil pipes, gullies, soil waste fittings to a drain, if such bends are surrounded by not less than 100 mm thick concrete mix 1: 3: 6
- c) At such points that no part of a drain shall be more than 15.25 m distant from the center of an inspection chamber without a rodding eye; provided that no connection or bend shall exceed 6 m in length measured from a gully trap, soil-pipe or soil-fitting, or the center of an inspection chamber without a rodding eye.

Provided further that if sewers exceed 150 mm in diameter it shall be permissible to provide an inspection chamber of manholes at such points that no part of such sewer shall be more than 75 m distant in the length of such sewer from the center of an inspection chamber or manhole.

2.4.14.10 Construction and Sizes of Inspection Chambers

Every inspection chamber shall be of such internal dimensions as the authority shall require, save that the finished internal horizontal dimension of inspection chambers shall be governed by the number of inlets.

2.4.14.11 Inspection Chambers in Buildings

Inspection chambers located in buildings shall be built in walls not less than 225 mm thick rendered in cement and sand (1: 3) trowelled smooth and finished not less than 20 mm thick internally. The cover shall be of the double cover screw down type on rubber or other watertight and airtight seating and shall be made and maintained watertight and airtight.

2.4.14.12 Inspection Chamber Covers

Every inspection chamber of manhole shall be fitted with a strong, movable airtight cast iron manhole cover and frame of fine quality metal and of adequate size and approved design and construction, fixed not lower than the surface of the adjoining ground or floor and so that surface or rain water cannot course over it.

2.4.14.13 Channels and Benching in Inspection Chambers

Branch drains shall discharge into the main channel by means of splay channel bends. A drain pipe, whether its branch or main, shall not project inside the walls of an inspection chamber by more than 50 mm.

Channels shall be of salt-glazed or glazed fireclay ware or other approved material of half-round or three-quarter cross section as may be required to prevent riding or splashing. In-situ channels shall have the same cross-section and shall be finished in cement mortar (1: 3) trowelled smooth. Sides of channels in

every inspection chamber shall be brought up vertically to a height not less than the diameter of the drain pipes and in any event sufficiently high to prevent riding or splashing from branch drains.

2.4.14.14 Ventilation

A drain shall be properly ventilated with at least one ventilating pipe not less than 100 mm diameter in case of the main drain and in the case of a branch drain, not less than the diameter of the branch drain itself. The ventilating pipe shall be immediately connected to the branch drain pipe. The vent pipe shall be located as near as practicable to the building and shall be brought to such a height so as to effectively prevent any escape of foul air from the drain into the building in the vicinity thereof. The top end of the ventilating pipe shall not be less than 1 m above the eaves level of any adjoining roof and not less than 1.5 m above the top of any opening into a building within an unobstructed distance of 6m horizontally.

The end of ventilating pipes shall be adequately covered with an approved copper or aluminum mosquito wire gauze securely fixed on.

2.4.14.15 Soil Pipe Materials

Soil or vent pipes shall be constructed of cast iron, Plastic or other equal and approved materials complying with the relevant BS or US.

- i. Wherever a soil or vent pipe is located it shall be permanently and easily accessible for inspection and maintenance.
- ii. No soil or vent pipe shall pass through any habitable room unless enclosed in a duct constructed in such manner and of such material as shall be approved by the authority.
- iii. If any soil or vent pipe is fixed in a chase or duct, movable access covers shall be provided in such a chase or duct at all inspection points in the soil or vent pipe.
- iv. Any soil or vent pipe inside a building shall be of cast iron or other approved material and shall have airtight socket joints.
- v. Soil or vent pipes shall not be encased in the thickness of solid walls.
- vi. Soil pipes shall be circular and of an internal diameter of not less than 100 mm and shall be continued up without diminution in diameter and without any bend or angle being formed in such soil pipes to such a height and in such a position as is required under these rules.
- vii. Inspection eyes shall be provided at all bends and junctions in soil pipes. No right-angled junctions shall be made in soil pipes and branch soil pipes shall join others obliquely in the direction of flow. All bends and turnings shall be truly curved and shall not reduce the internal diameter of the pipes.

2.4.14.16 Anti-Siphonage to Soil Pipes

Soil pipes receiving discharge from more than one soil- water fitting shall have the following provisions:

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- i. Traps of the soil-water fittings shall be ventilated by an anti-siphon pipe which shall have an internal diameter of not less than 50 mm and shall be connected to the arm of the soil-pipe at a point within 750 mm from the highest point of the trap on the side of the water seal nearest to the soil pipe.

- ii. Anti-siphon pipes shall either have open ends as high as the top of the soil-pipe OR be carried into soil pipes at points above the highest connections to the same soil- pipes.
- iii. Anti-siphon pipes shall be of cast iron, plastic or other equal and approved. materials complying with the relevant BS for the main soil- pipe and shall be joined appropriately.

2.4.14.17 Channels or Open Drains

(I) Channels or open drains for the conveyance of foul water shall be semicircular in cross-section and of salt-glazed vitreous enameled clay ware and masonry lined with cement and sand (1: 3), 15 mm thick trowelled smooth. All channels shall be in concrete (1: 3: 6) not less in width than 150 mm greater than the finished width of the channels and not less than 100 mm in thickness. Where such a channel is greater in depth than the radius, the side and top shall be of glazed tiles or rendered with cement mortar (1: 3) not less than 15 mm thick trowelled smooth.

(II) Channels or Open Drains

The permitted length of channels shall be as follows:

- a) An external channel for the conveyance of waste-water only to an external gully trap, shall not exceed 2m.
- b) A channel or open drain for the conveyance of foul water from premises used or to be used as from a slaughterhouse, stable, cowshed, or other places of like nature to an external gully trap, shall not exceed 2 m in length.
- c) Internal channels shall be permitted only in premises described here below and can be of unlimited length: -
 - i. premises mentioned in paragraph (b) above.
 - ii. Laundries or rooms used for ablutionary purposes provided they are not within a dwelling.
 - iii. Ice factories or aerated water factories.
 - iv. Laboratories if such channels do not connect two or more rooms and do not receive the discharge from any waste water fitting other than from a sink used or used solely for laboratory purposes.
 - v. Institutional kitchens or other premises approved by the authority for the reception and disposal of floor washings.

2.4.14.18 Wastepipes and Waste Water Fittings

- a) Wastepipes and overflow pipes shall be made of cast iron, wrought iron, copper, plastic or other material approved by the Authority. Waste pipes and overflow pipes more than 1.25 m long shall be fixed at angles not greater than 70 from the horizontal without anti- siphonage measures being provided.
- b) Waste pipes shall be properly trapped by an efficient siphon trap, located as near as practicable to the point of which such a wastepipe or overflow pipe is attached to the waste-water fitting. Under special circumstances untrapped waste pipe may be and shall not exceed 2 m in length. Such untrapped waste pipes shall discharge externally into an open channel not less than 600 mm in length.
- c) Wastepipes shall have internal diameters of not less than 40 mm save in case of a lavatory basin waste-pipe which can be 35mm internal diameter. Waste-pipes which receive the discharge of more than one waste water fitting shall have internal diameters of not less than 50 mm. However, waste-pipes receiving the discharge from not more than two lavatory basins may be of 40 mm internal diameter.
- d) Waste-pipes shall be taken through external walls at the nearest practicable points and shall discharge over open channels or trapped gullies. Waste-pipes shall discharge at heights of not more than 75 mm above the invert level of channels or above the trapped gullies to minimize splashing.
- e) Waste-pipes not exceeding 3.65 m in length shall be vented from a point as near to the traps as possible and such venting shall be contrived as per the provisions for anti-siphon pipes.
- f) No right-angled branch joints shall be made in waste-pipes. Every branch waste pipe shall join another waste-pipe obliquely in the direction of the flow of such waste pipe and all bends and turnings shall be truly curved. Whenever required, adequate and satisfactory means of access shall be provided at junctions or bends in waste-pipes.

2.4.14.19 Rainwater Pipes

Rainwater down pipes shall be solely for disposal of rainwater from the roof buildings and shall not be used for the purpose of carrying soil-waste, waste- water or be used as a ventilating pipe, anti-siphon pipe to any drain, soil pipe or wastepipe.

2.4.14.20 Overflow Pipes

Overflow pipes from any water storage cisterns, flushing cisterns or water-waste preventers shall not be connected to drains, soil-pipes, waste drainpipe, ventilating pipes or soil-water fittings. Overflow pipes shall discharge into external open air and, whenever possible, in a conspicuous position. Overflow pipes shall be protected against the ingress of mosquitoes, insects and other vermin.

2.4.14.21 Requirement of Gully Traps

Gully traps shall, whenever possible, be provided in suitable positions outside the building to receive effluent foul or wastewater prior to connecting to the drainpipe. Gully traps shall be:

- a) Of good, glazed stoneware, cast iron, pitch fibre or other approved material.
- b) Provided with a water seal of not less than 65 mm in depth and an outlet of not less than 100 mm diameter.
- c) Wall and securely fixed in a concrete (mix 1:3:6) surrounding not less than 100 mm thick shall be cast iron, mild steel and with the top finished protected against the ingress of surface or storm with a solid Kerb, smooth on the inside, at least 100 mm high above the adjoining ground level to prevent the ingress of surface or storm water.
- d) Fitted with a cast iron, steel, concrete or other approved movable grating or cover.

2.4.14.22 Provision of Grease Traps

Whenever liquid waste of a fatty character is to be discharged into a drain or sewer, an approved grease trap shall be provided at a point preceding the in-let of the drain or sewer. The grease trap shall be fitted with a cast iron, zinc, galvanized iron or other approved tray or of such an approved character perforated or of a sieve for the liquid to filter through prior to discharge into the drain or sewer.

2.4.14.23 Septic Tanks and Cesspool Biological Filters

Septic tanks, cesspools and other works for the treatment, reception or disposal of sewage shall :

- a) Not be constructed under any buildings or within 3 m of any building or plot boundary; nor within 30.5 m of any well, spring or stream of water used or likely to be used by man for drinking or domestic purposes or for manufacturing drinks. Nor be constructed in such a position to render any such water liable to pollution.
- b) Be constructed in such a manner and in such a position as to afford means of access thereto for the purpose of cleaning the same and removing the contents thereof.
- c) Be provided with sufficient cover and be so protected as to prevent any nuisance from emanating therefrom and prevent the breeding of mosquitoes in connection therewith.

2.4.15 *Subterranean Storm and Surface Water Drainage*

2.4.15.1 Site

The drainage of sites and roofs of buildings shall comply with the following:

- a) The sub-soil of the site of the building shall, where the depress of the site renders it necessary, be effectively drained by means of earthenware field pipes or other suitable pipes properly laid to a suitable outfall, or other manner which the authority may require.

- b) The roof of the building shall be so constructed as to drain effectively to suitable and sufficient gutters on the trough, unless a splash apron in concrete or other approved impervious material sufficient to protect the foundations of buildings is provided. Where gutters or troughs are used they shall be connected to a sufficient number of downpipes constructed so as to carry away all water from the roof without causing dampness to any part of the walls or foundations of buildings and shall cause such water to be carried off in a manner approved by the Authority.
- c) Provision shall be made for carrying off any surface water of a building when desirable and in a manner approved by the Authority.
- d) Rain water pipes or trunks for the purpose of conveying any water from a roof shall not be connected to discharge directly into a closed drain but shall be caused to discharge directly into the open air, into an open channel, pavement drain or over a properly trapped gully, or into such gully above the level of the water in the trap thereof.

2.4.15.2 Roof

Eaves, gutters and downpipes shall be of galvanized iron, steel, cast iron, or other equally suitable materials approved by the Authority and shall conform in all respects to the relevant BS or Nigerian Specification. In as much as is practicable, a rain water harvesting system shall be installed on buildings to conserve the rain water and control floods. The design and particular specifications shall be provided in the contract documents, where a rain water harvesting system has been provided for.

2.4.15.3 Surface Water

All eaves gutters shall be borne and supported by approved brackets not more than 1m apart, and shall be properly aligned so as to provide continuous and even fall to the point of discharge. Discharge or outlet points shall be spaced at not more than 9.15 m center to center.

2.4.15.4 Drains, Sewers and Channels for Surface or Storm Water

Materials for the construction of drains, sewers and channels for the surface or storm water drainage shall conform to the specification in the Building Byelaws.

2.4.15.5 Silt Traps and Grills or Gratings

Before inlet to a storm water sewer an approved silt trap shall be provided.

Metal or other approved grills or gratings shall be provided in every system of drains and channels for storm water to retain all solid matter at a point as near as practicable to where such a system connects with the public sewer. All storm water shall pass through such grills or gratings which shall be easily accessible for cleaning and if necessary shall be built in conjunction with an inspection chamber.

2.5 Streetlight Specifications

2.5.1 General

The specification, manufacturing, testing, installation and performance of the street lighting systems shall be in accordance with the applicable standards as outlined below.

2.5.2 Applicable Standards & Guidance Documents

The following documents (or equivalent International approved documents) shall be followed. Versions listed shall be superseded by updated versions as they become available.

2.5.2.1 Life-Cycle Cost Analysis:

- Supplement to BS ISO 15686-5 - Standardized Method of Life Cycle Costing for Construction Procurement

2.5.2.2 Mechanical:

- Degrees of Protection Provided by Enclosures (IP Code for ingress protection and IK Code for Mechanical Strength): IEC 60529 (IP) and IEC 62262 (IK)
- Testing of Materials:
 - i. ASTM B 117-07a Standard Practice for Operating Salt Spray (Fog) Apparatus, 2007 and ASTM D1654 - 08 Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments, or
 - ii. ISO International Organization for Standardization. ISO 9227 Corrosion tests in artificial atmospheres—Salt spray tests, 2006.
 - iii. ISO8289A: Low voltage test for detecting and locating defects
 - iv. ISO 4892-1: Plastics -- Methods of exposure to laboratory light sources

2.5.2.3 Electrical:

- Electrical Safety - General and for Road Lighting Luminaires: EN 60598-parts 1, 2-1 & 2-3
- Electromagnetic Compatibility:
 - EN 61547, EN 61000-3-2, EN 61000-3-3 & EN 55015 (CISPR-15) – for
 - (Immunity Requirements, Harmonics

Requirements, Flicker Requirements & Radiated and Conducted Emissions, respectively).

- ANSI C82.77-2002 - Harmonic Emission Limits & IEEE Std 519 1992 -
- Harmonic Limits
- FCC 47 CFR Part 15 Radio Frequency Devices
- RoHS Directive 2002/95/EC, on the restriction of the use of certain hazardous substances in electrical and electronic equipment

2.5.2.4 Lighting Design/Project Setting Out

- Road:
 - IESNA RP-8-00 (Roadway Lighting)
 - CIE 115 - 2010(Lighting of Roads for Motor and Pedestrian Traffic)
 - BS 5489-1(Code of Practice for Design of Road Lighting), BS EN 13201- 2 (Road Lighting – Performance Requirements),13201 - Road Lighting ME/MEW Classes
- Roundabouts:
 - IESNA RP-8-00 (Roadway Lighting, Conflict Area) and DG-19-08 (Design Guide for Roundabout Lighting)
 - CIE 115 (Lighting of Roads for Motor and Pedestrian Traffic) – Zones of Conflict
 - EN 13201 – Road Lighting CE Classes
 - BS 5489-1(Code of Practice for Design of Road Lighting), BS EN 13201- 2 (Road Lighting – Performance Requirements)
- Maintenance:
 - IESNA DG-4-03 Design Guide for Roadway Lighting Maintenance.
 - CIE 154:2003 The Maintenance of outdoor lighting systems

2.5.3 System Components

2.5.3.1 Streetlight Pole

- a) Foundations. Structural analysis shall be submitted by the Contractor to
- b) show that the foundation design meets the load of the given street light pole type in its “Fully Loaded” state. For all standard foundations, full design details shall be submitted for review and approval.
- c) Foundation conduits. Electric conduits shall be installed through the foundation and shall enter the streetlight poles from the base plate. These conduits are

required to be installed always for cabling entry purposes for both present and future needs to avoid any potential future remedial works to the foundations to be incurred. Earthing cables will use these conduits.

- d) Steel work. All poles' steel work shall be manufactured out of BS grade S355 steel for 10-12m poles. Hot dipped galvanising (100 Microns minimum coating thickness) surface treatment shall be applied to both internal and external surfaces. All additional fixtures shall be on steel attachments of BS Grade S275 with hot dipped galvanizing (100 microns minimum).
- e) Brackets and Base Plate Cover. Pole brackets and base plate cover shall be manufactured out of BS grade S275 Steel. This shall have high strength and finish to the solar PV streetlight pole. All steel components shall be hot-dip galvanised to a minimum thickness of 100 microns and painted as per the applicable clauses of this document. The base plate cover shall be supplied along with the pole.
- f) Fasteners. All fasteners supplied shall be made of corrosion resistant materials such as stainless steel; - Grade 316, brass, hot-dip galvanized steel etc, based on the materials with which it will be in contact. Bi- metallic contact shall be properly designed to avoid any galvanic or bi-metallic corrosion.
- g) Electric Equipment. M8 x30 mm long threaded studs carrying two nuts and two washers shall be provided as an earth point. It shall be located as shown on the Drawings. The electrical termination cut-outs shall be supplied in accordance with the Supply Company's (Street Lighting) requirements and as shown on the Drawings. Each pole as required shall be polyethylene rope (dia. 4mm) "draw wired" to assist in feeding electrical and service cables.
- h) Product Identification Tag. There should be a Name Plate affixed to the pole in an appropriate location and manner to suit the pole design and access which will give
 - Name of the Project.
 - Serial Number
 - Year of installation
 - safety sign (hazard sign)

2.5.3.2 Lighting Sources

- Light Emitting Diode (LED) type of streetlight luminaires will be used for all streetlights. Colour correlated temperatures (CCT) should range from 3000K to 5000K while luminous efficacy should be not less than 120 lumens/watt.

2.5.3.3 Remote Monitoring and Controls

Streetlight control/operation shall be fully monitored via a wireless Public Light Management System (PLMS).

PLMS Technical Requirements:

- Wireless, Wi-Fi, Cloud or RFI system fully tested and compatible with the solar system proposed (GSM 900/1800, GPRS, SMS, ZigBee etc.)
- Wireless communication complying with IEEE 802.15.4a
- The proposed system shall be fully compatible with the specified LED luminaire and driver proposed for the project and the inverter/controller
- Any brand of manufacturer's LED luminaires shall be able to be controlled from the system to ensure luminaire choice can be made openly for the best current marketplace products available for the project.
- System interface/software to be password encrypted, able to monitor the system and cater for revised programming settings for future if required
- System interface can be interconnected to the central system and control room in the future as and when required.
- Fault/Error/Tampering Reporting - Comprehensive & instant overview about infrastructure problems like lamp/driver errors, battery errors, controller errors per pole
- Optional iPhone/iPad/Android mobile application interface for maintenance work at site – Basic status info and instant setting configuration via mobile phone, while on site
- Data Export for further in-depth analysis or integration into existing inventory management systems.

Operating Conditions:

- Operating temperature: 0°C to +50 °C
- Storage (non-operating) 0°C to +60 °C

2.5.3.4 Streetlight Pole Assembly

- a) Assembly of the Streetlight Pole. The pole shall be complete with all accessories and all necessary component assembly. The final assembly of poles and components shall be ready for installation at site without any work required other than using suitable fixing tools.
- b) Mast arm for the Luminaires. The mast arm for the luminaire fitted to the pole for the correct orientation of the streetlights. The luminaire shall be fixed to the mast arm and electrically wired with no exposed cabling. Finally, the cable end

shall be connected to the solar charge controller or inverter as required by the system type. Voltage drops should not exceed limits set in the Design and Specifications document.

2.5.3.5 Pole Design Submission and Production

- a) Design for Strength. The poles shall be capable of withstanding a basic wind speed of 35 m/s or 125 km/hr (3 second gust) when equipped with the equivalent of the actual type and number of LED lamps for the project and the associated fittings or accessories. All poles shall be designed in accordance with the requirements of the latest edition of American Association of State Highway and Transportation Officials (AASHTO) or equivalent European or International standard. Design calculations shall be submitted, showing the following:
 - i. Wind load derivation on luminaires and mounted accessories
 - ii. Wind loading derivation on the pole
 - iii. Sectional area of the pole at regular intervals of height along the pole, especially at areas of cross-section change and hand hole opening
 - iv. Stress at the intervals specified in (iii) above
 - v. Strength of the pole at the intervals specified in (iii) above
 - vi. Combined Stress Ratios at the intervals specified in (iii) above
- b) Design for Deflection. Actual deflection against the deflection limit of the poles shall be clearly stated in the design calculations and shall conform to AASHTO or equivalent European or International standard. The actual deflection calculated shall be based on the basic wind speed of 35m/s and shall be measured at the lantern position(s). The calculated deflection shall be the sum of deflection on the vertical pole section as well as the outreach bracket arm and array mount section(s). Deflection of both the vertical pole and the arm(s) shall be shown in the Contractor submission.
- c) Compliance Statement. A compliance statement, certifying the poles were built conforming to the specifications, shall be submitted prior to delivery of poles to the site. Pole delivery to project sites shall not be accepted without this.

2.6 Electrical Services Requirements

2.6.1 General Requirements

1. General electrical requirements specified in these technical specifications are in addition to the requirements of the General Conditions of Contract and specific requirements set to the particular project in the Specification and Bill of Quantities.
2. The supply, erection, installation, testing and commissioning of the complete Low Voltage (415/240V) A.C. supply network, electrical installation services and streetlights as shown on drawings, schedules and described in the Specification and Bill of Quantities for each work shall be understood as included.
3. The procurements, installations and other works described in this specification and other related design documents are for manufacture, testing, supply, delivery to site, execution, demonstrating, commissioning and maintaining of the specified system to complete and fully operational condition.
4. Any work whether shown or not on the drawings and/or described in this specification but which can reasonably be inferred as necessary for the completion of installations and proper operation of the systems will also form part of the extent of the contract.
5. Workmanship and the method of installation shall conform to the IEE Wiring Regulation Sixteenth Edition and International Electrotechnical Commission, IEC Regulations for Electrical Installations and Equipment in Buildings. All work shall be performed by skilled tradesmen to the satisfaction of the Project Manager. Any work that does not conform to the best standard practice will be removed and reinstated at the contractor's expense.
6. Permits, Certificates or Licenses must be held by all tradesmen for the type of work in which they are involved and such Permits, Certificates or Licenses exist under Government Legislation.
7. The Contractor shall be responsible for the coordination of the works on site with other trades. The Contractor shall plan the installation before the work is commenced and he shall ensure correct installation to the design intent during the course of construction. Any work which has to be re-done due to negligence in this respect shall not constitute an extra to the contract.
8. The Contractor shall produce and submit shop drawings for the inspection of the Project Manager prior to any installations as required in the General conditions of the contract.
9. Copies of all shop drawings shall be submitted to the Project Manager for vetting and approval. Thereafter, the contractor shall submit copies of approved working drawings.
10. The form (transparencies/paper copies) and number of sets of shop drawings to be submitted to the Project Manager shall be as specified in the General Conditions of the Contract.
11. The Contractor shall prepare and submit complete "as-installed" drawings of all installations for the inspections of the Project Manager. All "as-installed" drawings have to be approved by the Project Manager.
12. The form (transparencies/paper copies/electronic copies) and number of sets of final approved "as-installed" drawings to be submitted to the Client shall be as specified in the General conditions of the Contract.
13. After completion and the preliminary handing over of the systems, the Contractor shall supply to the Project Manager complete relevant Operation and Maintenance(O&M) and data manuals/data sheets and instructions of all systems and equipment and written in English Language.
14. The Contractor shall be responsible for the work, materials and equipment provided/executed under the contract. The Contractor shall guarantee that all materials and equipment of the systems are suitable and of sufficient capacity to meet the specified performance criteria and

requirements set for them in the related design documents. The Guarantee and Maintenance period shall be as stated in the Particular or Special Conditions of Contract.

15. Electrical materials shall be stored in locked rooms or containers in their original packing. Light fixtures, sockets, switches, boards and the like shall be stacked on shelving, ensuring that no damage is likely to occur by stacking one over the other. Different materials shall be stacked at different locations. Packing list shall be supplied along with all supplied electrical equipment, materials and spares.
16. The Contractor shall comply with all statutory requirements and regulations issued by any Nigerian Regulatory Authorities within whose area of jurisdiction the project site is located.

2.6.2 *Electrical Work*

The scope of the electrical work to be carried out by the Contractor shall be as stated in the contract documents and shall generally comprise the following:

1. Complete installation of all cable routes including cable trays, raceways and ladders, trunking and all necessary conduits for surface and flush mounted installations and cabling of 415/230V networks.
2. Cable routing diagrams showing paths of cables from the control building to the various equipment
3. List of cables showing cable number, type of cable, estimated length and nature of electrical signals transmitted. This should also include cable length with their safety margins for each type of cable
4. Complete installation of Main Distribution Board (MDB), all Sub Main Distribution Boards (SMDBs), Final Distribution Boards (FDBs) and motor control centers (MCCs).
5. Complete installation of earthing and lightning protection systems.
6. Complete installation of all luminaires including normal luminaires as well as self- contained emergency luminaires.
7. Complete installation of diesel generating system where required.

2.6.3 *Related Builder's Work*

1. All builder's work including concrete foundations and support structures necessary and required for the electrical equipment and service shall be provided whether such works are shown in full details on the design drawings or not.
2. The Contractor shall provide reinforced concrete foundations for all floor mounted equipment and machinery in accordance with requirements and instructions of the equipment manufacturer.
3. The Contractor shall provide to the Project Manager fully dimensioned builder's work drawings showing all foundations, bases, and holes required and the overall sizes and masses of the plant concerned.
4. The Contractor shall provide necessary concrete foundations and supports for items requiring supports, such as hangers for conduits, cable trays, etc. Support structures shall be constructed of steel of adequate strength, bolted or welded together and painted with two coats of lead primer.

Unless otherwise specified, welding of supports to the building structure steelworks is not permitted.

5. All methods of anchoring and fastening to building structures shall be detailed and submitted to the Project Manager for approval prior to any such installations.
6. Foundations shall be designed to fit the shape of the complete base and shall conform to the contour designated by the manufacturers. All necessary anchor bolts, washers, templates, etc. shall be furnished complete and bolts shall be built into foundations with properly sized sleeves.
7. Vibration isolation units shall be provided to minimize the intensity of vibration and noise to the building structure as specified.

2.6.4 Climatic Conditions / Special Requirements for Equipment

1. All materials and equipment shall be capable of continuous and prolonged operation in the prevailing climatic conditions of Nigeria. When selecting materials and equipment, the effect of sunshine, thunderstorms and the impurities within the air shall be considered.
2. Particular attention is to be paid to the effects of high or low altitude. Low density of air decreases insulating and heat transfer capacities of all electrical equipment. Manufacturers of all materials and equipment must be consulted to obtain valid de-rating factors.

2.6.5 Electrical Supply

All electrical equipment, accessories and fittings shall be designed and manufactured to operate continuously in the electricity supply system of Licensed Service Provider mains supply or emergency supply from the stand- by diesel generating set having the following characteristics:

- a) Voltage: 400/240 volts
- b) Phase, Protective Multiple Earthing (PME) system
- c) Frequency 50 Hz
- d) Neutral solidly earthed
- e) The Diesel Genset must have a Power Factor, P.F of at least, 0.8

2.6.6 Standards and Specifications

1. The whole of the Electrical works shall be carried out in compliance with:
 - a) Regulations for Electrical Installations and Equipment in Buildings.
 - b) The latest Regulation issued by NERC/NEMSA.
 - c) The relevant Regulation of BS 7671:1992 and Amendment No.1,1994 (AMD 8536) "Requirements for Electrical Installations" (IEE Wiring Regulations 16th Edition).
 - d) IEC publication 60364 -Electrical Installations of Buildings Part 7-712: Particular requirements for special installations of Solar Photovoltaic (PV) power supply systems; and
 - e) The latest relevant recommendations of the International Electrotechnical Commission (IEC) and other approved national standards.
2. Except where otherwise indicated in the specification, the contract works and all manufactured items shall comply with the relevant BS or Nigerian standards as appropriate. In each case, the latest edition of such specifications shall apply. Should it be necessary to order equipment

covered by other National or International Standards, the approval of the Project Manager must be obtained, in writing, before completing the tender documents.

3. The Contractor shall submit for the Project Manager's evaluation standards, catalogs, manuals and drawings of all proposed materials and equipment to present the proposed equipment. The contractor shall also, prior to any procurement, obtain the Project Manager's approval for any departures and deviations from the final design drawings and specifications.
4. Where standards to which equipment and material must comply are cited, equipment and materials meeting other approved standards may be accepted. Where materials, appliances and fittings, patented or otherwise, are prescribed, or the names of manufacturers are given, the intent is only to establish the quality and required services. Substitutes of equal quality to those specified shall be accepted subject to prior approval by the Project Manager. Such a proposal by the contractor shall be accompanied with sufficient evidence and a comparison table to demonstrate that the required critical parameters are of equivalent standard.
5. No order shall be placed by the Contractor for major equipment unless written approval of the Project Manager has been obtained.
6. All materials shall be new, meet the requirements set for them in this specification and in the General Conditions of the Contract and they shall be approved according to the contract regulations.
7. Unless otherwise indicated, the Contractor shall obtain similar types of electrical equipment from the same manufacturer wherever practicable. The components within any equipment shall as far as possible be produced and assembled by the same manufacturer.
8. The Project Manager has the right to reject material or equipment which does not comply with the requirements of the specification. In such cases the Contractor shall provide other materials or equipment that comply with the specification.
9. All electrical equipment shall be provided with suitable means of suppressing radio frequency interference fully in accordance with various requirements stipulated in relevant international standards. Especially for rotating equipment and for dimmer systems shall be provided further radio interference suppression confirming these equipment will in no way cause interference with the radio communication or any other telecommunication, extra-low voltage or control system.

2.6.7 *Power Intake – Underground and Overhead*

1. Underground cable ducts for incoming power supply cables and other service cables to buildings shall be supplied and installed by the Contractor. It shall be the responsibility of the Contractor to ensure that the underground duct is installed correctly according to the requirements, and best fit for the purpose. Underground cables shall be PVC insulated, of the cross-linked polyethylene type, XLPE so that the lowest point is at least 2.7m above ground level. The cables shall be held in position by suitable brackets and strain relief to prevent mechanical wear and stress of electrical connections. Cables for outdoor exposed usage shall be fully UV- resistant operating at a maximum conductor temperature of 700C.
2. The contractor shall liaise closely with the respective Distribution Companies in their respective locations to obtain information and technical details on existing installations. It shall be the

responsibility of the Contractor to liaise with the manufacturer from which the items have been sourced to ensure that adequate information concerning easy bends, directions or runs, etc., is given before work commences.

3. Overhead suspended cables shall be mounted on reinforced concrete poles. Where crossarms are to be used, it must be of fiber glass material or galvanized angle iron. Under no circumstance shall wooden cross arms or wooden poles be used.
4. The overhead lines shall use silicon standoff insulators mounted on reinforced concrete poles.
5. The design of the line shall assume a maximum span of 50m between concrete poles and sectionalized after ten spans, maximum. The section points shall be made of H-pole arrangement.

Anti-climbing guards must be fitted in suitable positions where climbing is facilitated by virtue of design such as:

- a. When two stays are sufficiently close to each other
 - b. H-pole or multi-pole structures
 - c. All poles carrying transformers and distribution equipment.
6. Danger Plates shall be provided and conspicuously fixed on all poles at approximately 2m above ground.
 7. Precast concrete and PVC pipes shall comply with BS 3505 and BS 5481 respectively.
 8. Manholes shall be in pre-cast concrete C-20 quality, brick or Class A hollow blockwork as indicated and detailed on the drawings. The manholes shall be laid on a minimum concrete bed of 150mm, C-20 concrete. Manholes other than pre-cast concrete shall be rendered internally and externally with two coats of cement mortar. Joints of precast concrete manholes shall be flush pointed. Manhole covers shall be in cast iron cover and frames or C-25 precast concrete as detailed on drawings.

2.6.8 Conduits for Internal Wire Drawing

1. All metal conduits shall be medium gauge and shall be laid in straight and symmetrical lines. The end of all conduits shall be carefully reamed to remove all burrs and sharp edges after the screw threads have been cut. The ends of the conduits shall be butt-welded solidly in all couplings and where conduits terminate in switch fuses, fuse boards, adaptable boxes etc., they shall be connected thereto by means of smooth bore male brass brushes, compression washers and sockets.
2. All bends shall be made on site to suit site conditions and not more than two right angle bends shall be permitted without the interposition of a draw box. No tees, elbows or bends will be permitted, unless specifically mentioned in the specification or on the drawings.
3. All PVC conduits shall be of high impact PVC type as stated earlier on. Ends shall be carefully trimmed of all burrs. Joints shall be made using adhesive supplied or recommended by the conduit manufacturer.

2.6.9 Cables (Single and Multi-Core) and Conductors

1. Underground cables shall be PVC insulated, PVC bedded, steel wire sheathed- armored and PVC served overall. Unless specifically indicated otherwise, all cables shall have multi-strand copper conductors.
2. Cables shall be in accordance with Regulations for Electrical Installations and Equipment in Buildings and shall be of approved manufacture in accordance with BS 6004, 6007 & 6346 or other appropriate BS, IEC and other approved international standards and codes. The current carrying capacity of the conductors shall be according to Regulations for Electrical Installations and Equipment in Buildings and the relevant tables in the IEE Wiring Regulations 16th edition.
3. All internal wiring shall be in PVC insulated cables and /or conductors and colour identification shall be in accordance with the relevant Clause of Regulations for Electrical Installations and Equipment in Buildings.
4. Underground cables shall be at least 0.6m below the surface and be indicated with markers (coloured plastic tape, minimum 50mm wide or lining with bricks or slates, 0.2m above the cable).
5. Before cables are laid, the bottom of the trench shall be evenly graded and cleared of loose stones and shall then be covered with a 50mm layer of sand or sieved earth which shall have been pressed through a sieve with a maximum mesh of 13mm.
6. The cables shall be carefully laid in the bed without dragging and they shall then be covered with fine sand or sieved earth in such quantity as to ensure a cover of 75mm after tamping.
7. The warning tape shall be coloured yellow/black stripes and bear the following legend in block black capitals, at regular intervals: "Caution- Electric Cable Below" It shall be laid at a depth 200mm below the final grade.
8. Concrete marker posts shall be erected at intervals of 25m and at changes of directions of cable trenches and throughout the length of the cable route. A plate shall be fixed to the post stating "Buried Cables" and their position marked on the final "As Installed" drawings.
9. Adequate number of ducts shall be provided at points of entry into buildings. These shall be in the form of easy sweep ends, having a bending radius appropriate to the size of the largest cable but in any case, not less than 10 times a cable diameter.
10. After installation and the final tests, all cable ducts will be sealed using fine resistant materials to the satisfaction of the Project Manager, to prevent ingress into buildings of water, vermin, termites etc.

2.6.10 Main and Sub Distribution Boards

1. The Contractor shall supply and install distribution boards in the positions indicated on the drawings. All main sub-main distribution boards shall be complete with isolator or fused switch as applicable and shall conform to BS EN 60439. Distribution boards shall be in accordance with Regulations for Electrical Installations and Equipment in Buildings. The Contractor shall submit detailed drawings of the proposed panel layout for approval of the Project Manager.
2. The distribution boards shall be complete with all necessary earth bonding, gland-plates, cable entries, fixing brackets and supports for the cables specified and the locations indicated.

3. Distribution boards shall be of the type fully enclosed, sheet steel or PVC cabinets with hinged cover and protection class shall not be less than IP 43. Each compartment shall be one standard panel section having the number of pitch units as detailed in the drawings. Boards shall consist of approved single, double and triple pole moulded-case and/or miniature circuit breakers. The current rating and type of each panel shall be indicated on the appropriate distribution board diagram.
4. Consumer units shall comply with BS EN 60439 and shall be provided with an internal circuit designation chart. These shall be securely fixed and equipped with Perspex or similar covers and shall have space for each outgoing circuit to give clear identification. Unprotected paper labels will not be accepted.
5. Main switchboards and control panels shall be equipped with voltmeter, ammeter selection switches and indicating lamps. All instruments and protective relays shall be flush mounted and effectively sealed against ingress of moisture, dust and insects.
6. Moulded-case circuit breakers shall comply with BS EN 60947-2. They shall have the voltage and current ratings, rated duty, rated short-circuit breaking capacity and rated short-time withstand current as indicated.
7. Miniature circuit-breakers shall comply with BS EN 60898 and shall have the voltage and current ratings and category of duty and be of the type as indicated.
8. Contactors shall comply with BS EN 60947-4-1 and be electromagnetically suitable for the control arrangement as indicated.
9. The design and arrangement of the panel shall be such as to permit the ready addition or replacement of incoming and outgoing cables. There shall also be ready access to any component requiring maintenance including all bolted or clamped connections.
10. Unused reserve pitch units shall be fitted with moulded plastic cover strips. Full facilities shall be provided within the panels for the fitting of future additional circuit breakers. The circuits fed from the distribution board shall be marked on a card fixed to the inside of the lid. This card must indicate without ambiguity the location of all the outlets fed from each distribution way and the size of the fuse or circuit breaker rating. The information must either be typed or printed on the card, or presented in similar legible manners.
11. Distribution and sub-distribution boards, bus bar rating, type of mounting (surface, flush), etc. shall be indicated in the drawings. The reference number of the Board shall be used in the Bill.

2.6.11 Wiring Accessories, Small Equipment and Material

1. Accessory boxes shall comply with BS 4662 or BS 5733 and where they are of insulating material they shall have the ignitability characteristic as specified in BS 476.
2. Accessory boxes shall be of adequate depth to accommodate the accessories without causing compression of the cable. Generally, boxes shall be 35mm deep and shall have one fixing lug that is floating so that the final level of the accessory can be adjusted.
3. Front plates of accessories shall be of the material and finish as indicated, but generally the finish of various types of accessories in the same area shall match. For flush mounting the plates shall overlap the boxes. For surface mounting, the plates shall match the profile of the box without overlap.
4. Where pilot lamps are required, they shall comprise a neon lamp with a resistor and a red colored lens, unless otherwise indicated.

5. Wall mounted switches located inside buildings shall have rocker-type actuating members unless otherwise indicated. When mounted adjacent to one another they shall be grouped in a multi-gang box with a common front plate.
6. Dimmer switches for the control of tungsten filament lamps shall comply with BS 5518. For other dimmer switches the limits and the method of measurement of radio- frequency interference generated by the electronic assembly shall be in accordance with BS 800.
7. Socket outlets shall be switched type as required, and of the type and rating where indicated and may have pilot lamps where required.
8. Socket outlets for wet locations shall be provided with spring-loaded cover required to achieve total enclosure to ensure the required degree of protection against moisture.
9. Unless otherwise indicated, time switches shall be self-starting, self-winding, synchronous motor type rated at 230 volts. The motor shall be protected by a fuse, which shall be easily accessible. The rated current of the switch shall be as indicated.
10. The sensing unit of photo-electric control shall comprise a photo- conductive cell enclosed in a translucent plastic dome sealed to a mounting base. The control unit shall comprise a load controlling single pole switch; its rated current shall be as indicated.
11. Bells and buzzers shall have contact-less movements and shall not incorporate a transformer. Bell gongs shall have a minimum diameter of 75mm unless otherwise indicated. For bells mounted outside a building, the enclosure shall provide a minimum degree of protection of IP54 and shall have a tapped entry for steel conduit. The base and cover of buzzers shall be of plastic material.
12. Push-button shall have a current rating of 1A unless otherwise indicated and shall be suitable for flush or surface mounting as indicated.
13. Indicator units for alarm or call systems shall incorporate the number of signals as indicated and enclosures shall be of metal, wood or plastic and finished as indicated. Glass front plates shall be finished black and inscriptions shall be as indicated.
14. Plugs rated at 13A shall be of a non-resilient material unless otherwise indicated and fused plugs shall be fitted with fuses rated as indicated.
15. Air conditioners shall be of the specified size, rating and finish as specified in the Bill of Quantities are shown on drawings and shall be understood as including all related work.
16. Fans and ventilators shall be wall mounted or hanging of the specified type and rating shown on drawings or schedules and specified in the Bill of Quantities.
17. Conduits for the telephone system shall be installed completely as indicated on drawings. The wiring for each telephone outlet shall be carried out by the Authority having jurisdiction. The Contactor shall liaise with the Authority having jurisdiction to verify that adequate concealed conduits have been included.
18. Conduits for the television system shall be installed completely as indicated on drawings. The wiring for each television outlet shall be carried out by the supplier and /or manufacturer .The Contractor shall liaise with the supplier and /or manufacturer to verify that adequate concealed conduits have been included.
19. Conduits for computer network systems shall be installed complete as indicated on drawings. The wiring for each data outlet shall be carried out by the supplier and /or manufacturer. The Contactor shall liaise with the supplier and /or manufacturer to verify that adequate concealed conduits have been included.

20. Terminal blocks shall comprise connectors contained within a moulded housing. The moulded housing shall be of an insulating material suitable for the maximum operating temperature of the conductors.
21. Conductors shall be clamped between metal surfaces and no screws shall make direct contact with conductors. The design shall be such as to maintain sufficient contact pressure to ensure connections of negligible impedance at all times.
22. Mounting heights of accessories or equipment shall be in accordance with Regulations for Electrical Installations and Equipment in Buildings unless otherwise indicated. Where difficulty in locating accessories or equipment occurs the Project Manager shall be consulted
23. Especially for new substation and where necessary, the building contractor shall include the supply and install 4mm thick INTERLOCK paving stones all around the Switch/Control room Building as well as concrete Kerb. He shall also make provisions for cutting of vegetation, removal of topsoil of the SwitchYard and its disposal.
24. The contractors shall Provision for anti-weed over the whole surface Switchyard and substation area with laterite of 300mm thick, compacted soil as well as gantry floor to be done with pure cement paste blinding to avoid weeds, insects and vermin.

2.6.12 *Information and Communication Technology*

1. Asynchronous Transfer Mode (ATM) which supports speeds corresponding to Synchronous Transport Module-1 (STM1) frame of 155Mbps that can integrate voice, data, and multimedia shall be used. It should have such capacity to enable and support situations requiring large bandwidth usage, particularly when multimedia and other bandwidth-demanding applications are in use. It shall also have the speed and required bit rate to support real time communication.
2. The fast Ethernet standard (100Mbps) over Unshielded Twisted Pair (UTP) cable shall be used for connection of desktops from hubs and servers.
3. Unshielded Twisted Pair (UTP) floor cabling which supports multiple applications – Voice, Data and multimedia are recommended for local area networking.
4. For the riser backbone system connecting different levels of floors with the server, optical fiber cables shall be utilized.
5. Server shall be located on the ground floor or basement in a cubicle designated as a server room.
6. Modular patch panels and patch cords shall be used for the termination and interconnecting of data circuits in structured cabling systems.
7. Data communication ports shall be of RJ-45 connectors fed through Cat-6 Unshielded Twisted Pair (UTP) cable.
8. The wiring, cable preparations and cable terminations for each data communication port shall be carried out by the supplier and/or manufacturer. The Contractor shall liaise with the Supplier and /or manufacturer to verify that an adequate trunking system and that concealed conduits have been included.
9. Conduit installation for telephones, public address, radio and televisions shall be carried out to the same standard as for power and lighting services. Where detailed in the Particular Specifications, plastic conduits shall be used and, when necessary, an earth wire drawn in cables or a draw wire shall be installed as specified.
10. Broadband and Power over Ethernet applications shall comply with IEEE 802.3, IEEE 802.11, IEEE, 802.5 and IEEE 802.3af standards as a minimum.

2.6.13 *Luminaires and Lamps*

1. Luminaires shall comply with BS 4533 and emergency lighting luminaires shall comply with Industry Standard and shall be marked with a certification label and shall be installed as indicated on the drawing and the Bill of Quantities.
2. Tungsten filament lamps shall be of the general service type in accordance with IRR BS 161 and fluorescent lamps shall comply with BS 1853.
3. The Contractor shall include for the provision of handling, taking delivery, safe storage, wiring, assembling and erecting of all lighting fittings as specified. All means necessary to protect electrical materials and fixtures during transport and before, during and after installation shall be provided to ensure that no damage occurs to the materials or their surfaces. Electrical fixtures shall be supplied in their original packing.
4. All pendant fittings shall be fixed to conduit boxes with brass screws. Lighting fittings detailed for the purpose of establishing a high standard of finish shall under no circumstances be substituted without prior approval of the Project Manager.
5. In case of rectangular shaped ceiling fitting the extreme ends of the fittings shall be secured to suitable support in addition to the central conduit box fittings. Support shall be provided and fixed by the contractor.
6. The whole of the metal work of each lighting fittings shall be effectively bonded to earth. Where ball and/or ankle joints are not made by the manufacturers, the contractor shall include the cost of additional work necessary in his tender. Minimum size of internal wiring shall be 1.5 mm squared. Each lighting fitting shall be provided with the number, type and size of lamps as detailed in the specifications.
7. Self-contained emergency lighting luminaires shall be of the non- maintained type self-contained and equipped with an 8W fluorescent tube and shall be fitted with a means of testing which shall comprise a push- button or similar device that cannot be left in the test position. They shall be provided with a means of isolating the lamp circuit for maintenance purposes.
8. Unless otherwise indicated, fixed luminaires shall be Class I and hand lamps shall be Class III rated at 50 volts.
9. Unless otherwise indicated, enclosure to luminaires shall provide a minimum degree of protection of IP20 when located within buildings and IP23 when located outside buildings, but luminaires mounted externally and less than 2m above finished ground or paved level shall be IP44.
10. The Contractor must order the appropriate type of lamp holder in ordering lighting fittings, to ensure that the correct lamp holders are provided irrespective of the type normally supplied by the manufacturer.
11. Lampshades shall be of extra heavy duty and shall be provided for every specified lighting fitting. They shall be heavy brass type (except for plain pendants where reinforced bakelite type shall be used). Lampshades are supported by flexible cable, the holders shall have "Cord grip" arrangements and in the case of metal shades earthing screws shall be provided on each of the holders.

2.6.14 Site Lighting

1. Site lighting columns shall be constructed and installed in accordance with BS 5649 and shall be of the type as indicated, columns set in ground shall be fitted with a base plate unless otherwise indicated.
2. The principal roads and access areas on the site shall be illuminated by suitable LED lamps mounted on lighting columns or wall brackets on buildings.

2.6.15 Lighting Protection and Earthing

1. The lightning protection installation shall be in accordance with the recommendations of the British Code of Practice as set out in BS 6651-1985.
2. To ensure an effective system, particular attention shall be paid to the quality of the materials used which shall be electrically and mechanically sound and provide good erosion resistance in a tropical environment.
3. The whole structure shall be provided with air terminations, down conductors and earth terminations together with all necessary joints, bonds and earth electrodes including test joints.
4. The installation of the earthing system shall be in accordance with the:
 - a. Recommendations of the British Code of Practice BS 1013;
 - b. Regulations for Electrical Installations and Equipment in Buildings and;
 - c. The latest Regulation issued by NEMSA/NERC;
5. The Contractor shall supply, install and connect all necessary conductors, clumps, connectors, terminals, etc. for an efficient earthing system.
6. Each termination shall be constructed using copper rods buried into the ground to a depth of at least 3m. In order to achieve the necessary earth impedance of 5 ohms or less, rods shall be combined in groups with a separation between rods not less than the length of the rods.
7. Concrete inspection pits shall be installed above each rod complete with copper bars to which bolted sections can be made to link earth rods together to form an integrated network. To this bar shall also be connected all other earth connections, including the down conductors to form the lightning protection system.
8. The conductors between earth electrodes or groups of electrodes shall either be copper strip, copper braid or copper cable (un-insulated) and will be buried at a depth of 0.5m
9. Wall mounted copper earth bar shall be provided in each building for which an earth electrode shall be installed. This bar will act as a terminal strip for bolted connections from switchgear, earth, the casing of electrical equipment and any other structure which requires bonding to earth. All such connections shall be sized in accordance with IEE Wiring Regulations, Sixteenth Edition.
10. Switching equipment units including switchgear, surge arrestors and circuit breakers should comply with equipment safety and other requirements in accordance with IEC 62271-1, IEC 62271-100 standards which mostly addresses the Lightning Impulse Withstand Voltage.
11. Each termination network not incorporating lightning shall have a resistance to earth determined by maximum earth fault loop impedance (as defined by the IEE Wiring Regulations Sixteenth Edition) which shall be acceptable for the correct functioning of the over current protection devices installed thereby.
12. The Lightning Protection System shall comply with BS 6651.
13. Aluminium Tape: Aluminium tape used for roof termination networks and down conductors shall be bare to BS 2898-1350 and shall have a minimum cross sectional area of 50mm².

14. Copper Tape: Copper tape used for earthing shall be bare and made from high conductivity copper to BS 1432-C101/C103 and shall have a minimum cross sectional area of 50mm².
15. Fixing of Tape Conductors: Conductor tapes shall be fixed to the background using metallic tape clips of the spacer bar type using 1! x no.10 countersunk wood screws and wall plug.
- When straight through, cross or tee joints are formed in the tape, square tape clamps shall be used and these shall be fixed to the background as described above for tape conductor clips.
- Copper conductor fixing accessories shall be made from high quality copper alloys and aluminium accessories shall be made from high quality aluminium alloys.
- No accessory meant for copper conductors shall be used on aluminium conductors and vice-versa.
- When aluminum fittings are installed – an approved oxide inhibiting compound shall be applied to the connection after it has been made.
- At the junction between aluminum down conductors and copper earthing conductors, a bimetallic connector shall be used. The connector shall be firmly fixed to the background using 1! X no.10 countersunk wood screw and wall plug.
16. Air Termination Network: The air termination network shall be arranged so that no part of the roof is more than 5 metres from an air termination conductor.
17. Down Conductors: There shall be one down conductor for every 10 meters of the building perimeter at ground level.
- Down conductors shall be as evenly spaced, and shall be routed as directly from the air termination network to the earth termination, as the building contour will permit.
- The existence of re-entrant loops in the down conductors shall not be permitted, except as allowed by BS 6651.
18. Earth Termination Network: The earth termination network shall be executed in copper tape and copper clad earth electrodes only.
- The connection between the tape and the earth rod shall be made with a proprietary rod to tape clamp of high strength copper alloy body and screw. Commercial brass shall not be used for this purpose. This connection shall be made at least 150mm above the immediate surrounding ground and enclosed in an earth inspection chamber.
- The inspection pit and cover shall be made of concrete of internal dimensions 160 x 160mm and minimum depth of 210mm. The top of the pit shall not be below the general surrounding ground.
19. Earth Resistance: The resistance to earth of the complete lightning protection system measured at any point, shall not exceed 5 ohms.
- The resistance of each individual earth shall not exceed ten times the number of down conductors in the complete system.
20. Testing and Commissioning: As the installation proceeds and on completion of the installation and at the expiration of the maintenance period, the Contractor shall carry out tests in the presence of the Project Manager on all sections of the Electrical Services Installation and shall

submit six signed copies of the results of the tests to the Project Manager, together with six copies of a Completion and Inspection Certificate as required by the IEE Wiring Regulations, Part 7.

Site testing of all systems and components comprising the Contract works shall be carried out in the presence of and to the complete satisfaction of the Project Manager. After the Contractor has first satisfied himself that the systems are operating correctly.

The Contractor shall prepare and submit for approval comprehensive commissioning documents prior to commencement of testing.

No section of the installation shall be energized until these tests have been completed.

The Contractor shall provide all certified instruments, equipment, plant, labour and materials necessary for conducting specified site tests and shall be responsible for and prepared to demonstrate the accuracy of all test instruments supplied by him.

All installations, plants and tests must satisfy the requirements of the Factories Act and the requirements of all other interested Authorities and the Contractor shall include for all safety devices, etc. required by such Act or Authority.

Observations shall be made of the operation and performance of the installations and subsequent readjustments made as necessary.

Accurate records of all commissioning and testing shall be kept and results comprehensively reported to the Project Manager when the installed system(s) are functioning correctly.

Where it is not possible at the time of commissioning and/or demonstration of the plant for full load conditions to be obtained or assimilated, the Contractor shall repeat the requisite operations of the commissioning and demonstrations under such full load conditions (or the reasonable approximation or simulation of such conditions acceptable to the Project Manager) at the first opportunity.

The Contractor shall ensure that all equipment and plant under his supply shall be tested at the maker's works before dispatch and six copies of test certificates in respect of each test shall be forwarded to the Project Manager.

All works tests shall comply with the relevant British Standard Specification or IEC Standard Specification and shall be sufficient to show that equipment will function correctly when installed as part of the Sub-Contract works.

Each item of electrical plant or equipment so tested shall be fitted with a plate giving at least the following information:

- i. Date of Test
- ii. Individual equipment serial number
- iii. BSS number if any
- iv. Test Voltage
- v. Operating voltage (if different from test voltage)
- vi. Test current
- vii. Full load current (if different from test current)
- viii. Loading (expressed in kVA) and power factor Phase
- ix. Frequency (expressed in Hz)

The above information shall be included on the test certificate for each item of plant or equipment. This shall also include a description of any method of wiring and/or connection with the location of the test and signature of the witness.

The following test results shall be submitted:

- a) Continuity of ring final circuit conductors
- b) Continuity of protective conductors, including main and supplementary equipotential bonding
- c) Earth electrode resistance
- d) Insulation resistance
- e) Insulation of site-built assemblies
- f) Protection by electrical separation
- g) Protection by barriers or enclosures during erection
- h) Polarity
- i) Earth fault loop impedance
- j) Operation of residual current devices and fault voltage operated protective devices
- k) Each circuit breaker shall be operated manually or electrically 50 times to the satisfaction of the Project Manager. Where the circuit breaker is designed for electrical operation, at least 10 of these operations shall be made with 80% normal voltage applied to the trip coil in accordance with BS 116:1952. During this test the trip-free feature shall be demonstrated.

2.6.16 Closed Circuit Television (CCTV) Surveillance

1. The works shall involve Supply and installation of a Closed Circuit Television (CCTV) Surveillance System complete with mounting accessories.
2. The works shall also include preparation of 3 Sets of Hard and Soft Copies of "As-Built" Drawings, Manuals, Testing and Commissioning the System to the Satisfaction of the Engineer.
3. The CCTV system cameras shall produce sharp, detailed and stable images on the monitor in sufficient detail to provide positive identification of individuals within the protected areas under all conditions of light.
4. Where required, wide coverage public areas shall be viewed with pan, tilt and zoom (PTZ) IP cameras, to provide close-up images and tracking of events. Fixed position and fixed focus IP cameras shall be used where a specific risk has been identified in a particular area and it is important that should an event occur it is viewed in real time or recorded.
5. The cameras shall be fitted with automatic light compensation devices to provide compensation for variations over a wide range of scene brightness. Where a camera must operate in total darkness, the nature of the possible events will be analysed to determine whether the situation requires a special application camera such as one that uses infra-red illumination.

6. The works shall also include preparation of 3 Sets of Hard and Soft Copies of "As-Built" Drawings, Manuals, Testing and Commissioning the System to the Satisfaction of the Engineer.

2.6.17 Centralised Television System

1. The television system, where required, shall generally be centrally connected and distributed per Block/Building. The television system shall comprise a Dish, UHF/VHF Antenna, Amplification and Distribution accessories and a fully integrated wiring system. The Contractor shall provide both accessible wire ways to facilitate the installation in accordance with the design and faceplates to outlets.
2. Wiring from distribution points to television outlets will be carried by the Contractor in 25 mm diameter conduits. Co-axial cables suitable for the television installation shall be used. Television outlet points shall be flush mounted with a steel box.

2.6.18 Fire Detection and Alarm System

1. The works shall include supply and installation of the fire detection and alarm system elements complete with fixing accessories of the intelligent addressable fire detection system or approved equivalent.
2. The system components shall be Loop wired using 2-core fire resistant OHLS 300/500V stranded copper cables.
3. The works shall also include preparation of 3 Sets of Hard and Soft Copies of "As-Built" Drawings, Manuals, Testing and Commissioning the System to the Satisfaction of the Engineer.

2.6.19 Training of Client's Personnel

1. The Contractor shall upon the request of the Client, as a separate item, carry out training of several persons who will be selected by the Project Manager for the correct and careful operation, control and maintenance of all the electrical services provided under the Contract before the final taking over of the project.
2. The training shall be carried out by the qualified commissioning staff of the Contractor for each service and shall be continued throughout the contract period till the final taking over of the project, if the General Conditions of the contract do not call for more extended period or as mutually agreed between the Client and the Contractor.

2.6.20 Inspection, Testing and Commissioning

1. On completion of the electrical installation, the contractor shall, in the presence of the Project Manager or his representative, test the installations as required by the Project Manager and the local concerned authorities to demonstrate compliance with the IEE Wiring Regulations Sixteenth Edition and Regulations for Electrical Installations and Equipment in Buildings.
2. The following tests shall be carried out:
 - a. Verification of polarity (D.C. and single phase/ earth circuit)
 - b. Phase rotation

- c. Resistance to earth of earthing system
 - d. Insulation resistance. Phase / phase and phase / earth.
 - e. Earth loop impedance
 - f. Operation of over current and earth relays by injection tests
 - g. Levels of illumination
 - h. Correct sequencing of all control equipment
3. The works will not be accepted and taken over before the connection of the power supply. After the power supply connection, the contractor shall commission all his equipment to fulfill his contract obligations. Supply of power is the client's obligation.
4. The Project Manager shall be given full opportunity to witness all tests and shall approve all tests. He will have the right to ask for specific test results to be repeated. The Contractor shall provide accurate instruments and apparatus and all labour required to carry out the above tests. The instruments and apparatus shall be made available to the Project Manager to enable him to carry out such tests as he may require.

2.7 HVAC

2.7.1 Mechanical Ventilation

2.7.1.1 General

The Particular and General Specifications for Mechanical Ventilation are detailed in this part. The Contractor shall supply and install Mechanical Ventilation Equipment as detailed herein and in the Contract Drawings.

2.7.1.2 Climatic Conditions

The following climatic conditions apply at the site, equipment, apparatus, materials and installations shall be suitable for these conditions.

1. Max. Highest Temp. 35 degrees Celsius
2. Lowest Temp. 13.3 degrees Celsius
3. Mean Temp. 28 degrees Celsius

2.7.1.3 Design conditions for air conditioning installation

- a) Inside temperature for all areas shall be 22 degrees Celsius.
- b) All Noise Level Max 45dB
- c) Outside conditions: Temperature = 35 degrees Celsius, dry bulb;

2.7.2 Air Conditioning System

2.7.2.1 Types of AC Systems

The Air Conditioning System shall be by split unit air conditioning system for the Conference/training rooms/Halls. The Contractor should adhere strictly to these contract specifications.

2.7.2.2 Indoor Units

The indoor units shall either be Concealed ceiling units or High wall split units. The indoor units shall be of low noise of 32dBA and shall operate on 240V, 50HZ, 1 Phase. The indoor concealed ceiling units shall have a drain lift pump. The power supply shall have a built-in protection unit to prevent damage due to power fluctuations. The unit shall be fitted with a removable washable filter.

2.7.3 Ducting

2.7.3.1 Materials

The materials from which the ductwork shall be made shall be galvanized steel.

For ducts with the longer side equal to or less than 599mm, the thickness shall be 0.6mm. For ducts with the longer side equal to or less than 1000mm, the thickness shall be 0.8mm.

For ducts with the longer side equal to or less than 2500mm, the thickness shall be 1.0mm.

2.7.3.2 Construction and Erection

All seams, joints and connections to the plant shall be made to reduce air leakage to a minimum.

Internal roughness and obstructions to airflow (other than dampers, vanes etc.) will not be accepted.

Sharp edges on corners or on the inside and outside of the ductwork, flanges, supports etc. will not be accepted.

All openings for branches shall be cut before the ducting is erected and shall not be less than the connection dimensions.

Connections to the plant shall be made with angle flanged joints. Ductwork which may also have to be moved to enable plants to be removed or accessed for maintenance shall incorporate flanged joints, suitably painted and protected.

2.7.3.3 Fabrication and Consideration

The Contractor shall supply and install ductwork runs and sizes as approved. Alterations will be permissible only after Project Manager's approval.

The Contractor shall be responsible for taking all measurements on site that are necessary for the manufacture of and installation of the ductwork. The Contractor shall make the arrangements, where necessary, for walls, doors, etc. to be down so that he can install the Plants.

The Contractor shall be responsible for checking all Architects, Civil Engineers, Structural Engineers and other Contractor drawings to see that the ductwork shall be accommodated within the structure and does not foul pipework, light fittings, electric trunking and all other services.

When ductwork is run in false ceilings, bulkheads etc. the Contractor shall ensure that adequate clearance is available for ceiling supports, light fittings and other services and equipment.

2.7.3.4 Sheet metal ducts

All sheet metal ducts, unless otherwise stated for special purposes, shall be manufactured from galvanized mild steel sheets.

2.7.3.5 Jointing of ductwork

Jointing shall be arranged with the following:

- a) Longitudinal joints up to and including 1.2mm duct thickness with Pittsburgh lock, riveted at a maximum of 65mm centres.
- b) Joints between ducts riveted, flanged or bolted according to sheet metal gauge, and location.
- c) Slip joints with a minimum of 75mm slip and be taped with Arbol No. 1291 or equal and approved.
- d) Loose flanges fitted where the position of the ducts cannot be determined during planning.
- e) Jointing compound for sealing joints of the slip type. Sealing strips according to application between flanges.
- f) Flanged drilled for 10mm diameter bolts at a maximum of 100mm centres, for duct sizes up to 760mm longest side, over 760mm longest side drilled for 10mm diameter bolts at 150mm centres except for holes in flanged connections to plant which shall be made with the plant flanges. All bolts, nuts, washers etc. shall be cadmium plated.

2.7.3.6 Flexible connections

Flexible connections shall be as follows:

- a) Revertex, silintium or neoprene or as specification Part C.
- b) Approximately 1500mm long fixed ends, minimum.
- c) Secured by either flanged or a bolted metal strip.
- d) Fitted between fans and ductwork.
- e) Fitted between grilles/diffuser and ductwork in ceiling grids.

2.7.3.7 Supports

- a) Fixing from a structurally sound part of the building by mild steel straps, hanging brackets on a rolled steel angle.
- b) Spacing at not more than 3m centres and beneath vertical risers. Branches must not be used as supports.
- c) For timber or heavy-duty cork spacers between duct and the support where thermal insulation is specified; elsewhere felt inserts shall be provided.
- d) Fixing by clipping or building in. No drilling or burning holes and welding to the roof trusses and other building structural steel members will be permitted without written permission from the Engineer.
- e) The corners of rolled steel sections to be neatly trimmed off. Screwed rods used for duct hangers shall not project below the bolts.
- f) Equipment such as fans where fitted in ductwork shall be fitted with their own supports. The Contractor shall ensure wherever fans or similar equipment are connected to the ductwork system, the connections are made with a heavy duty rot or vermin-proof neoprene or similar material, flexible connection to prevent vibration transmission to the duct work or building fabric. Flexible connection shall be secured by a pre-drilled mating flange, or when fixing to a spigot, the spigot should be beaded and a jubilee clip or split flat iron ring should be used.

- g) Where ductwork passes through the structure which is not a fire barrier, fireproof packing shall be provided between the duct and masonry with a mastic sealant.
- h) Where ductwork passes through floors and walls, galvanised sheet steel sleeves or builders' work timber frames shall be provided. The space between the duct and sleeve or frame shall be packed with asbestos rope or mastic to prevent air movement or noise transmission from one space to another. Ducts must not come into direct contact with the building fabric.
- i) All supports and brackets shall be wire brushed and painted one coat of red oxide paint prior to and after erection. All nuts and bolts shall be sheradised. The fastening of electrical cables to ductwork will not be permitted.

2.7.3.8 Ductwork

The Contractor shall supervise the positioning of ducting deliveries and off-loading of the plant. Duct runs shall be erected on the supports provided and aligned, prior to connections to items of equipment, to present a neat and workmanlike appearance with allowances made for all clearance for insulation and other adjacent services. Transverse joints for rectangular and circular ducts shall be made on site in a manner similar to that already detailed.

Transformation and taper pieces shall, wherever possible, be constructed so that the included angle does not exceed 30 degrees.

Air conditioning ducts shall be insulated with rock wool covered with aluminium foil.

2.7.3.9 Test Holes and Access Doors

An adequate number of test holes shall be provided adjacent to all plant, inlet and outlet louvres, at branches, after balancing dampers and elsewhere as required by the Contractor for balancing the system. Test holes after dampers shall be positioned clear of the damper and at a position where the air stream is flowing evenly along the duct. Rubber plugs shall be provided to seal test holes.

The Contractor shall provide sufficient access doors for the purpose of maintenance and inspection. Access doors shall be of the hinged type or door openings in the ductwork shall be adequately stiffened and made airtight with purpose-made rubber gaskets around the door perimeter.

2.7.4 Dampers

2.7.4.1 General

Volume Control Dampers shall be fitted in all branch ducts and shall be of multi-leaf opposed blade construction.

2.7.4.2 Fans

Fans shall be capable of the performance indicated in the schedules. Although the value of the resistance to airflow is indicated for the systems, this does not relieve the Contractor of the responsibility for providing fans capable of delivering the required air volume through the system. Air supply fans shall have a replaceable filter assembly, anti-vibration mountings and shall be supplied with direct on-line starters of suitable rating incorporating over current and under voltage protection. The fans shall have an enclosure of IP 65 and shall be of Vent Axia make.

The make and design of the fans and attenuators shall be as indicated in the schedules. If no particular make of fan is indicated, the Contractor shall submit full details of the fan including the drive and motor together with supporting evidence from the manufacturers of noise levels and efficiencies to the Architect for approval.

Belt driven fans shall be fitted with pulleys suitable for V belts, all as specified.

Machine bolts, nuts and washers only shall be used for assembly of fans. All bearing surfaces for the heads of bolts or washers shall be counterfaced.

Holding-down bolts for fans and motors shall be a square section under the head or be fitted with snugs to prevent them turning in the base plate when the nuts are tightened.

Any fan

These shall be which is too large or too heavy for safe handling shall be fitted with lifting eyes or other lifting facilities to enable mechanical lifting equipment to be used.

2.7.5 Grilles, Diffusers and Louvres

2.7.5.1 General

of the type specified in the schedules, positively and firmly located within the ductwork system. The Contractor shall provide the necessary air seal between the grille and structure in all cases. The Contractor shall provide all accessories for connecting/adapting the diffusers/grilles to the ductwork.

All diffusers connected to ducting shall be provided with integral dampers.

Fixing screws that are visible shall be of a non-rusting type, the colour and type to be agreed with the Architect.

2.7.5.2 Louvres

The Contractor shall supply and install at the termination of fresh air and exhaust air ducting at the external walls, louvered inlets and outlets with insect-proof screens.

Louvres shall be of robust extruded aluminum alloy section or hot dipped galvanized mild steel construction as indicated in the schedules. The finish shall be to the Architect's approval. The louvres shall have specially designed water shedding blades and shall be fitted with a galvanized steel wire mesh screen of 20mm diamond mesh and at least 2mm diameter wire, mounted in a frame of galvanized steel

rod with securing lugs or flat galvanized mild steel. Flanges shall be fitted with a returned edge, drilled for screw fixing.

2.7.5.3 Air Extract Grilles

All supply and extract grilles shall be constructed from aluminium alloy or mild steel, with a finish of approved colour. Flanges shall be fitted with a return edge, complete with plastic foam or sponge rubber sealing gasket. The grilles shall be suitable for fixing to timber grounds, mild steel or plastic ducting. All grilles shall incorporate an aluminium alloy or mild steel opposed blade, volume control damper adjustable from within the ventilated space without grille removal. Two sets of volume and pattern adjustment keys shall be handed to the Project Manager.

2.7.5.4 Air Supply Diffusers

All air diffusers shall be constructed from aluminium alloy or mild steel and shall be of the sizes suitable for the operating conditions indicated in the schedules. All diffusers shall incorporate an aluminium alloy or mild steel volume control damper adjustable from within the ventilated space without the removal of any part of the diffuser.

Two sets of volume control damper keys shall be handed to the Project Manager.

2.7.5.5 Transfer Grilles

Transfer grilles shall be of the sizes and suitable for the operating conditions indicated in the schedules. The grilles shall be manufactured from aluminium or mild steel with an approved finish. The grilles shall be sight-proof and rattle-free with a flange frame auxiliary frame for the reverse side.

2.7.5.6 Finline Linear Grilles

Continuous line grilles shall be installed where indicated on the Drawings, and to the dimensions indicated in the schedules.

The grilles shall be fabricated from aluminium extrusions and all the components shall be mechanically interlocked to give a blemish-free appearance. Where the overall length of the grille is greater than the standard manufactured length it shall be made up of sections which shall butt together to give hairline joints. Keyways and splice plates to facilitate the jointing shall be provided by manufacturers.

The grilles shall have flanges not less than 25mm in width and return edges. The grilles shall be held in position with concealed fasteners.

2.7.5.7 Fire Damper

Fire dampers complying with BS 476 and CP 413 shall be installed in the ducting as per Contract Drawings. The spindles of the dampers shall be placed off centre. When the fusible links melt, the dampers close automatically.

2.8 Specifications for Diesel Storage Tanks

2.8.1 *Applicable Standards and Regulations*

- International Fire Code (IFC) published by the international Code Council
- Occupational Health and Safety Act (OSHA) requirements for flammable and combustible liquids (29 CFR 1910.106)
- API 650 – Welded Tanks for Oil Storage: API Std 650 establishes minimum requirements for material, design, fabrication, erection, and testing for vertical, cylindrical, aboveground, closed- and open-top, welded carbon or stainless-steel storage tanks in various sizes and capacities for internal pressures approximating atmospheric pressure (internal pressures not exceeding the weight of the roof plates), but a higher internal pressure is permitted when additional requirements are met. This Standard applies only to tanks whose entire bottom is uniformly supported and to tanks in non-refrigerated service that have a maximum design temperature of 93°C (200°F) or less.
- API 653 – Tank Inspection, Repair, Alteration, and Reconstruction: Covers the inspection, repair, alteration, and reconstruction of steel aboveground storage tanks used in the petroleum and chemical industries. Provides the minimum requirements for maintaining the integrity of welded or riveted, non refrigerated, atmospheric pressure, aboveground storage tanks after they have been placed in service.
- API 2000 – Venting Atmospheric and Low-pressure Storage Tanks: Covers the normal and emergency vapor venting requirements for aboveground liquid petroleum or petroleum products storage tanks and aboveground and underground refrigerated storage tanks, designed for operation at pressures from full vacuum through 103,4 kPa (ga) [15 psig]. Discussed in this International Standard are the causes of overpressure and vacuum; determination of venting; means of venting; selection, and installation of venting devices; and testing and marking of relief devices.
- API STD 650 Welded Tanks for Oil Storage, 11th Edition, Includes Addendum 1 (2008)

2.8.2 *System Requirements*

- The diesel storage tanks, piping system, pump selection and associated

equipment shall comply with ISO 28300:2008 standards as well as other applicable standards, more specifically Pressure Equipment Regulations (PER) regulation No 734.

- Diesel Storage Tanks Capacity: Sites with 3MW solar PV plants will be equipped with a minimum of 11,000 litres diesel storage tank while those with larger capacities have 22,000 litres capacity diesel storage.

2.8.3 Material Selection

- All materials, fittings and accessories are to be new and in accordance with the requirement of the current specifications and standards where such exist with the relevant standards such BS or others.
- The tank should be designed at a higher pressure than the operating pressure to allow a factor of safety to cater for pressure build-up in the pressure vessel during operation. Therefore, a coated low carbon steel tank is desired for this application since the tank is to be subjected to complex stress (internal and external pressure on the vessel) induced in the material.
- The piping system shall be made up of mild steel with NPT standard fittings. The pipe supply line from the diesel storage tank is proposed to be 2" inch NPT standard for better flow and shall be flanged couple, with the reducer, on the existing diesel generator receiver pipe. The return pipe line from the generator to the return tank inlet and from the return tank exit to the storage tank shall be of the same size (1" inch pipe).

2.8.4 Bund and Environmental Impact

- The diesel storage tanks shall be installed with the bund designed to contain spillages resulting from the leaks of the tanks. The volumetric capacity of the bunded area shall be not less than the total volume of diesel that can be released from the tank in the bunded area, assuming that it is a full tank. The magnitude of the bunded area shall be constructed in respect to the size of the tanks, and the height of the bund wall shall correspond to class II of the fluid as set out in the relevant standards.
- The bund shall be constructed with a drain valve that shall be utilised to extract or remove rain water, diesel spillages, and or any other fluid contained in the bundled area. To cater for suspended solids, it is proposed to connect a hose- pipe from the nearby pressurised water tap to flush out the suspended solids through the drain.

- The design should also consider the risk of pollution to surface and groundwater, soil and environment. The bunded area shall be constructed so that the diesel spillages do not contaminate the environment; this is in accordance with relevant international standards and national regulations.

2.8.5 Pressure Relief Vent

- The diesel product is categorized as class II: since it has a closed-cup flash point of 55°C which is within the range of above and below, 38°C and 60.5°C respectively as stipulated in ISO 28300:2008. The storage vessels should be fitted with the pressure relief vents, to protect the vessel in the event of pressure build up. However, the vent shall be included if it is found that the vessel operating pressure is exceeding 50kPa, this in accordance with Pressure Equipment Regulation (PER). The vent shall be positioned in such a way that the discharge faces away from the area deemed to be hazardous. The magnitude of the vapour cloud shall be dealt with in the detailed design specification.
- Pressure Equipment Marking: Pressure equipment shall be marked in accordance with the relevant health and safety standard and Regulations.

2.8.6 High Level System Design

- This proposed system will work with an above-ground tank (also hereafter being referred to as tank 1) that will gravity feed the generator.

Tank 1 has three warnings, a low level warning, an overfill warning and a critical low. As with the current system, at the critically low level the generator will switch off automatically. While running, the generator will pump excess diesel into the return tank. The return tank has two level settings, namely a high and low setting. When the high level is reached, the diesel returning from the generator will be pumped back into tank 1. A manual setting will also be added to pump the diesel from the return tank to tank 1. Refer to appendix B for the process flow diagram of the proposed system. All the changes will be incorporated into the existing control setup of each generator.

- Programmable Logic Controller (PLC): PLC will be needed for monitoring

and controlling the system. The PLC can also monitor if the transmitters are working properly. Suitable PLC will be decided on in the detailed design specification.

- Human Machine Interface (HMI): The HMI will make it easier to detect faults in the system as well as having an accurate visual representation of the fuel and pressure levels in the tank. This addresses the problem that the current system had where the operational tank overflowed because the high level switch was not working. The suitable HMI will be decided on in the detailed design specification.
- Level Transmitters: Level transmitters will facilitate detecting faults, in fact, a faulty sensor will be easily identified by the PLC. The level transmitters will also give an accurate measurement of the fuel as well as possible water in the tank. Local indication as well as a 4-20mA signal to the PLC is required. The suitable level transmitters will be decided on in the detailed design specification.
- Pressure Transmitter: A pressure transmitter has to be incorporated because the system has an above ground tank. The pressure transducer will be added to the above-ground tank. Local indication as well as a 4-20mA signal to the PLC is required. The suitable pressure transmitters will be decided on in the detailed design specification.
- Flow Meter: The flow meter will be used to monitor the flow between the above ground tank and the generator. This will signal if there are any blockages in the pipeline. The suitable flow meters will be decided on in the detailed design specification.

2.9 Proposed Equipment & Furniture for Workshop & Training Centre

The below listed are indicative only:

2.9.1 Mechanical Workshop Equipment

The equipment for the Mechanical Workshop is indicated in the following table.

Sr. No.	Load details	Specification	Unit	QTy
1	G-Clamp	G-Clamp, 1.5 inch	Nos	2
2	Workbench with only vice (2 nos)	work bench (wooden base) with 2 nos bench vice fitted on the workbench	Set	10
3	Complete Toolbox	Complete Toolbox (wrench, screw driver, spanner, hammer, hack saw)	Set	10
4	Jacks	Mechanical Jack 1 Tone	Nos	2
5	Palette Truck		Nos	1
6	Cutting Machine	Metal Cutting Machine - Cutting capacity at L profile - 30 x 130 mm 0 degree - Cutting capacity at rectangle - 100 x 196 mm 0 degree - Cutting capacity at square - 119 x 119 mm 0 degree - Rated input power - 2.4 kW, 220V	Nos	2
7	Grinding Machine	Portable Grinding Machine	Nos	2
8	Chain blocks a) 5 ton chain hoist b) 2 ton chain hoist		Set	2

Sr. No.	Load details	Specification	Unit	QTy
11	Small vertical boring machines	Small Vertical Boring Machines - Voltage: 415V, 3Ph - Power(W): 5.5 KW - Max.boring diameter: 200mm - Max. boring depth: 500mm	Nos	2
12	Bench drilling machine	Bench Drilling Machine - Capacity - 1/2" (13mm) - Motor - 0.5 HP - Voltage: 220 V	Nos	4
13	bending machines	Steel Bar Bending Machines - Voltage - 220V Power - 3 kW	Nos	2
14	Hydraulic pump	1 HP	Nos	2
15	Shelf	Steel Shelf (48" Width x 72" Height x 18" Length)	Nos	10

Sr. No.	Load details	Specification	Unit	QTy
16	Air compressor	Air compressor - Motor Capacity - 3 HP Voltage 220V	Nos	1
17	Hack saw		Nos	10
18	Hammer		Nos	10

2.9.2 Electrical Workshop Equipment

The equipment for the Electrical Workshop is indicated in the following table.

Sr. No.	Load details	Specification	Unit	QTy
1	Work Bench	Workbench with electrical socket (220V,5/15A) without any tools	Set	10
2	Multimeter	Multimeter 0 To 1000 V DC/AC, 0-10A	Nos	10
3	63A industrial socket	3phase 415 V	Nos	4
4	13A & 15A socket	single phase 220V	Set	10
5	Electrical tool kits	1 keyed chuck, 1 plastic carry case, 5 masonry drill bits (4, 5, 6, 8, 10 mm), 5 metal drill bits (2, 3, 4, 5, 6 mm), 4 wood drill bits (4, 5, 6, 8 mm), 1 claw hammer with rubber grip, 10 screwdriver bits (ph1, ph2, pz1, pz2, s4, s6, h4, h5, t20, t25), 1 screwdriver magnetic adaptor, 7 sockets (4, 5, 6, 7, 8, 9, 10 mm), 1 nut driver adaptor (1/4 inch), 1 measuring tape (3 meter), 1 combination plier (6 inch), 1 adjustable wrench (6 inch), 1 adjustable knife (1 inch), screws (3 mm - 10 pieces, 4 mm - 10 pieces, 5 mm - 10 pieces), S-Plugs (4 mm - 10 pieces, 6 mm - 10 pieces, 8 mm - 10 pieces) and 1 3-directional split level.(Bosch GSB 10 RE KIT - 500 W Professional Tool Kit)	Set	10
6	workshop battery tester	50 to 500A /12 V analog	Nos	10
7	vibration monitors	10 kHz Digital Vibration Meter	Nos	1

Sr. No.	Load details	Specification	Unit	QTy
8	Dielectric test sets	5 KV dielectric test kit	Nos	2
9	Cable Fault locator	Off line cable fault locator	Nos	10
10	Digital loop tester	Control Wire Continuity Check	Nos	5
11	Insulation tester	1 kV insulation tester	Nos	5
12	Earth tester	measure up to 100 milliohm meter (Resistivity)	Nos	2
13	Clamp meter	-DC and AC current and voltage - 600 A and 600 V with 100mA resolution	Nos	2
14	Avo meter	Digital Multimeter (AVO Meter) - 1000 V DC / 750 V AC ranges - 10 A AC / DC ranges	Nos	10
15	Tachometer	Tachometer Measuring range - 100 to 29999 rpm	Nos	5
16	Frequency generators	Function /Signal Generator Multiscope Electronics.	Nos	5
17	Shelf	(48" Width x 72" Height x 18" Length)	Nos	10
18	Oscilloscope	Dual channel	Nos	2
19	Soldering iron and lead	100W	Set	10

Sr. No.	Load details	Specification	Unit	QTy
20	Laptop	Intel Core i7 8th Gen, Quad Core, 1.8 GHz Clock Speed, 8 GB RAM, 512 GB Hard Disk Intel UHD Graphics 620 13.3 inches, 1920 x 1080 pixels Windows 10 OS	Nos	6

2.9.3 Mini PV Module Assembly Equipment

The Mini PV Module Assembly Equipment is indicated in the following table.

Sr. No.	Load details	Specification	Unit	QTy
1	Mini PV Laminator	Ecolam 6040	Nos	1
2	Mini Stringer machine		Nos	1
3	Mini Framing machine (Horizontal)	Eco frame V	Nos	1
4	Mini sun simulator	Sun Simulator (BXM-2012SA)	Nos	1
5	Mini Electroluminescence tester	Portable Solar Module EL Tester BEL-2400	Nos	1
6	Mini Solar cell layup machine	Solar PV Production Line Machine of Layup Solar Cell String	Nos	1
7	Devices for plastics cutting (Encapsulating and backsheet)		Nos	1

2.9.4 Solar Installation Training Equipment

The Solar Installation Training Equipment is indicated in the following table.

Sr. No.	Load details	Specification	Unit	QTy
1		100Wp	Nos	4
2	Solar panels polycrystalline	250Wp	Nos	4
3	Charge controllers - PWM(Solar dc 30-60 V) with battery voltage 12 V	20A / 12 V	Nos	4
4	Charge controllers - PWM(Solar dc 30-60 V) with battery voltage 24 V	20A/24 V	Nos	4
5	Charge controllers - PWM(Solar dc 30-60 V) with battery voltage 12V	40 A/ 12 V	Nos	4
6	Charge controllers - PWM(Solar dc 30-60 V) with battery voltage 24V	40A/ 24 V	Nos	4
7	batteries (Lead Acid)/ other available technology locally	2v 100Ah &	Nos	4
8		12v 100Ah	Nos	4
9	Inverters	12v 500VA	Nos	2
10	Inverters - 2nos each	24v 1500VA	Nos	2
11	Mounting structures	2 X 2" MS pre galvanized	Set	1
12	Solar Radiation Hand held meter	MEASURING RANGE: 0-2000 W/m2, Resolution 0.1 W/m2,	Nos	4
13	Solar tool kit	cable 4sqmm ,Fuse , DC breaker ,SPD,	Nos	1
14	Clamp meters/mustimeters (DC/AC)	Digital Clamp Meter, - DC and AC current and voltage, - 600 A and 600 V	Nos	4
15	Angle meters	0 to 90 degree digital angle meter	Nos	4

Sr. No.	Load details	Specification	Unit	QTy
16	Hydrometer	digital hydrometer (batteries specific gravity (density) scale ranging from 1.100 to 1.300)	Nos	4
17	Compass		Nos	4
18	DC fan	12 V	Nos	4
19	DC bulb	12 V 8 watt LED	Nos	12
20	Tools	Crimping tools, cable insulation strippers, insulated cable knives, cable cutters, carpet knives, measuring tapes, electric drilling machine with drilling bits, mini hacksaws with blades, soldering iron set, battery charger, safety kits, first aid box, ladders. Compass	Set	4

3 Warranties and Testing – General

Equipment Warranties

The following equipment manufacturer warranties will be required as a minimum.

- Product Warranty on PV Modules – 12 years with a performance warranty over 25 years as described Minimum Technical Requirements of 97.5% in the first year and a maximum linear degradation coefficient of -0.6%/yr from year 2 to 25.
- Product Warranty on Inverters – 10 years
- Product Warranty on Transformers – 2 years
- Product Warranty on Module Mounting System – 10 years
- Product warranty of PCS - 5 years
- Product warranty of Li-ion battery system - 5 years
- Capacity performance warranty of Li-ion batteries - 10 years or 4500 cycles at 80% DoD and 1C (or equivalent at 0.5C)

Factory Acceptance Test (FAT)

There will be Factory Acceptance Tests (FAT) in line with IEC standard 61511. The FAT process will assess the equipment during and after the assembly process in the factory by verifying that it is built in accordance with design specifications before the equipment leaves the factory for the final installation at the plant. FAT ensures that the components and controls are working properly according to the functionality of the equipment as detailed in the test plan.

FAT must be conducted for all major equipment (PV, Inverters, PCS, Battery, Generator, BOS etc) to be attended by at most Seven (7) of the employer's representatives and other stakeholders. Members will consist of staff from PMU, REA, POE, FMOP etc. The travel costs, travel allowances etc are to be borne by the EPC. The FAT cost (return tickets, Hotel Accommodation, Subsistence allowance and provision for local transportation to be provided to participants shall be consistent with the World Bank approved standard rates), will be part of the overall equipment cost.

The FAT schedule is such that it is conducted at the early stage of the project when the site preparation and civil works are still in progress in readiness to receive the plant equipment. With this approach, FAT will not impact on the scheduled project timelines during the construction phase.

Performance Monitoring and Acceptance Testing

Independent acceptance testing will be undertaken on the system within 7 days of Practical Completion. Costs for Independent Acceptance Testing and Performance Monitoring shall be borne by the Employer, except where the tests are unable to be conducted due to incomplete works or Contractor unavailability. In this case, the Contractor will be liable for any additional costs (ie. travel costs and fees) borne by the principal. Independent Acceptance Testing shall include, but not be limited to:

- A review of all required documentation submitted.
- A visual inspection of all components to confirm:
 - i. General quality of electrical and civil works;
 - ii. Compliance with relevant standards, the specification, and approved design drawings.
- I-V tracing of all PV strings.
- Earth continuity testing of all PV module frames.
- DC isolator operation under full load.
- Insulation resistance testing of all cables.
- Loss-of-communications control test.
- Infra-red imaging of relevant electrical components.

System performance is to be monitored by the Contractor and the Owners Engineer (either remotely or on-site) for 120 hours; the Performance Monitoring Period. Over this period, individual system components must meet the following minimum performance criteria:

1. Weighted PV inverter availability > 97%;
2. Average PV inverter efficiency > 95%; and
3. $PR(CORR_PAC) \geq PR(DESIGN) \% \times 0.975$ (on the MV side of the transformer).

Where: PR (corrPAC): is as defined in IEC 61724 "Performance Ratio describes the ratio between the annual energy generated by the Solar Park, and the energy that the system would deliver, receiving the same solar irradiation but working ideally at STC" [%].

PR (DESIGN) is Guaranteed Performance ratio The PR (DESIGN) will be the plant modelled PR calculated using PVsyst during the detailed design stage and approved by the Owners engineer during the detailed design review. The Contractor will be required to demonstrate that the system can maintain power quality while undergoing all control operations over the Performance Monitoring Period:

- Connecting to the network.
- Disconnecting from the network.
- Limiting active power to a set point;
- Providing ancillary services As part of PAC milestone, the PV Plant shall :
 - 1) Successful commissioning of PV Plant
 - 2) Designed installed power operating at 100% capacity
 - 3) Inverter operating at 100% capacity

- 4) Monitoring system correctly and perfectly working
- 5) Security and surveillance fully operational.

The Final Acceptance Performance Test (FAC Test) shall be conducted after 12 months of operation and shall be carried out in accordance with this Schedule. All Tests shall be performed in accordance with the Test Procedures approved by the Employer and in compliance with relevant Nigerian Codes.

4 Environmental and Social (ES) Requirements

The Use of solar radiation as a renewable energy source is environmentally desirable and consistent with green and inclusive growth. The construction, operation and maintenance of solar based power plants under the EEP 3 has the potential to cause unintended adverse impacts on the natural and human environment, where proper measures are not adhered to.

The key environmental and social impacts associated with solar power developments are associated with land take, construction and operation activities. This can include land acquisition associated with potential involuntary resettlement and/or economic displacement, and land use changes, possible voluntary land donation. In the medium term, risks associated with disposal of lead-acid batteries and lithium batteries used in the power plants will present a challenge for the project's sustainability. Additional risks include stress on local water use and supply, construction impacts (including community and occupational health and safety), waste management (in addition to batteries) and bird mortality. If not managed well, all of these can become systemic risks.

The Environmental and Social statutory (legal and administrative) frameworks guiding the EEP 3 component and project are regulations, guidelines and standards (Note: these regulations are not exhaustive) as follows:

- REA's Environmental and Social Management Framework
- The regulations, guidelines and standards of the Federal Ministry of Environment concerning energy, power generation and transmission activities in Nigeria.
- African Development Bank's Integrated Safeguards System.
- The regulations, guidelines and standards of the Federal Ministry of Power as it concerns high voltage power transmission in Nigeria.
- The regulations, guidelines and standards of the various State Ministries of Environment, and Social Welfare.
- All International Conventions/ Treaties on Environmental Protection/ Social Welfare to which Nigeria is a party.

The bidder is required to adhere to these environmental standards and requirements, and also Good International and Industrial best practices (GIIP).

The bidder is thereby required to demonstrate experiences and expertise in compliance with and knowledge of environmental standards and good practices, locally or internationally.

As an African Development Bank funded component, the bidder shall adhere to the African Development Bank's Environmental and Social Integrated Safeguards Systems (Operational Safeguard I – V as applicable).

- **Operational Safeguard 1: Environmental and Social Assessment** – governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements
- **Operational Safeguard 2: Involuntary resettlement land acquisition, population displacement and compensation** – consolidates the policy commitments and requirements on involuntary resettlement.
- **Operational Safeguard 3: Biodiversity and ecosystem** – to conserve biological diversity and promotes the sustainable use of natural resources.

- **Operational Safeguard 4: Pollution prevention and control, hazardous materials and resource efficiency** – covers the range of key impacts of pollution, waste, and hazardous materials for which there are agreed international conventions.
- **Operational Safeguard 5: Labour conditions, health and safety** – establishes the requirements concerning workers’ conditions, rights and protection from abuse or exploitation.

An Environmental and Social Impact Assessment (ESIA) has been prepared for the implementation of this project. Chapter seven of the ESIA contains detailed guidelines for the Environmental and Social Management Plans (ESMP) with existing environmental and social conditions of the respective project locations. This provides a framework for implementing Project environmental and social commitments including Gender Based Violence (GBV) (i.e. mitigation measures identified in the ESIA) as well as assigning responsibilities and costs to the respective actions required to mitigate the identified impacts.

The items in this table have been extracted from the ESMP section of the ESIA reports for each of the EEP 3 beneficiary Universities and thus constitute part of the requirements of the contract that will be entered into with the successful bidders.

Please refer to the Annex 1: Environmental and Social Management Plans (ESMPs).

Annex 1: Environmental and Social Management Plans (ESMPs)

4.1.Environmental and Social Management Plan for Federal University, Lokoja

Environmental Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Clearing and Preparation							
Vegetation loss; direct impacts on vegetation and soil-dwelling organisms; indirect impacts on fauna species	Vegetation clearing shall be limited to the areas within the site needed for the Project.	Inspection	Daily	Adherence to measures	EPC Contractor	REA (PMU) POE (Site Engineer)	
	Use of herbicides for clearing shall be avoided. Site clearing and preparation shall be done mechanically.						
	Bush burning shall be avoided.	Inspection	Daily	Adherence to measures			
	Any cleared areas which are not used will be re- vegetated using plants or seeds of locally occurring species.	Inspection	Monthly	Revegetated land			
	The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited.	Inspection	Monthly	Adherence to measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Hunting or deliberate killing of animals by workers shall be prohibited and monitored. Workers shall be sensitized on ecological protection	Inspection	Daily	Adherence to measures			
Removal of topsoil and soil compaction; loss of topsoil; increased erosion potential; reduction in structural stability and percolative ability of soil	Removal of vegetation and soil cover shall be restricted to the areas required for the Project. Soil conservation measures shall be implemented such as stockpiling topsoil or for the remediation of disturbed areas. Use of silt traps or similar systems to reduce discharge of silt shall be ensured.	Inspection	Daily	Revegetated land			
Air quality impacts due to emission from site clearing equipment; increase in ambient noise levels	Site clearing equipment / machinery shall be operated and maintained under optimum fuel- efficient conditions. Site clearing activities shall be carried out only during the daytime (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr)	Maintenance records; Fuel consumption records	Daily	Adherence to measures			
		Inspection	Daily	Adherence to measures			
Mobilization of Materials and Equipment to Site							

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Air quality impacts from vehicular emissions; Increase in ambient noise	Project vehicles with efficient engine performance and with minimal noise and air emissions shall be selected and used. This can be achieved through regular servicing and maintenance	Inspection; Maintenance records	Once before vehicle commences journey	Adherence measures	to EPC Contractor	REA (PMU) POE (Site Engineer)	
	All materials with potential to result in dust emissions shall be covered during transport.	Inspection	Once before vehicle commences journey	Adherence measures	to EPC Contractor		
	Site roads and access roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence measures	to EPC Contractor		
	Onsite vehicle speed on unhardened roads and surfaces shall be limited to about 15 – 20km/h so as to reduce dust generation.	Inspection	Daily	Adherence measures	to EPC Contractor		
	Unnecessary engine idling shall be avoided.	Inspection	Daily	Adherence measures	to EPC Contractor		
	Site roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence measures	to EPC Contractor		

Social Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Selection							
Loss of farmlands	Resettlement Action Plan (RAP/aRAP) shall be developed and implemented (involuntary Resettlement) to restore livelihood of the affected persons.	OS2, Involuntary Resettlement	Prior mobilization to site / site clearing and construction	Involuntary Resettlement (OS 2)	FULokoja Management	REA (PMU)	
	The affected persons shall be allowed to harvest their crops before commencement of construction activities.	Notification of project development to the affected persons	Prior mobilization to site/ site clearing and construction	Adherence to 100 measures			
	All affected students shall be provided with alternative land within the University campus to continue their farm demonstration activities.	Inspection	Prior mobilization to site / site clearing and construction	Adherence to measures			
	The commitment for the provision of alternative land for the affected personnel shall be documented in a letter signed by the University's Vice Chancellor.	Signed letter of commitment from FULokoja management	Prior mobilization to site / site clearing and construction	Adherence to measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
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 activities.	Implementation of NCDC guidelines	Prior to mobilization to site / site clearing and construction	Adherence to measures	EPC Contractor	REA (PMU)	
	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			
Mobilization of Materials and Equipment to Site							
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU)	
	Site clearing shall be limited to the daytime as much as possible.	Inspection	Daily	Daily time log	EPC Contractor	POE	
	Unregistered labourers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		
Increase in vehicular movement and traffic	A TMP shall be developed by the EPC contractor and implemented	CTMP	Daily	Benchmarks stated in the	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
including potential for road accident		implementation records		TMP			
	Appropriate signage and safety measures (barrier, formalized crossing points) to reduce the risk of accidents in the Project area shall be provided.	Safety signs and barriers	Before and during mobilization	Adherence to measures	EPC Contractor		
	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 Driver's licence	EPC Contractor		
	A procedure for recording traffic incidents/accidents associated with the Project shall be developed and implemented.	Incident forms	Daily	Completed incident forms	EPC Contractor		
	Employee violations of speed limit and other traffic rules will result in disciplinary action ranging from warning to dismissal.	Incident forms/GRM	Daily	Completed incident forms	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU) POE	
	Unregistered laborers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		

Environmental Management Plan for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Air quality impacts due to emission from construction equipment;	Regular maintenance and servicing of construction equipment /machinery shall be ensured.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor	REA-PMU POE	
Increase in dust from cleared land and windblown stockpiles	Routine water sprinkling shall be carried out to minimize dust generation during construction.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Increase in noise level	Construction activities shall be limited to day- time (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr).	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Construction machinery shall be turned off when not in use.	Inspection	Daily during Construction phase	Adherence to measures	EPC Contractor	POE	
	Construction equipment shall be properly maintained and serviced.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor		
	Noise complaints related to the construction activities shall be assessed and appropriately addressed.	Complaint records	Weekly during construction phase	GRM measures	EPC Contractor		
	Noise monitoring at locations with persistent noise complaints shall be maintained.	Noise monitoring records	Monthly during construction phase	FME _{env} Noise limit	EPC Contractor		
	Machinery/equipment to be used for construction work shall meet industry best standard in relation to noise attenuation	Inspection	Before commencement of construction phase	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
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 during excavation activities	Adherence to measures	EPC Contractor	REA-PMU POE	
	Stockpiles shall be appropriately covered to reduce soil loss as a result of wind or water erosion.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		
Loss of plant species as a result of introduction of alien plants; loss of fauna as a result of increased human activity and associated noise.	Construction workers shall be provided with appropriate training on ecological awareness, as appropriate to their work activities.	Training records	Once before start of construction phase	Certificates of Training	EPC Contractor	REA-PMU POE	
	All construction equipment shall be cleaned (mud and soil removed) at source before being brought to site to minimize introduction of alien species. If sand or other natural materials for building are required and brought onto site, the stored heaps will be monitored for the growth and germination of alien species and will be regularly cleared during construction.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		
	Regular monitoring 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		
Road damage, traffic and safety impacts	TMP shall be developed by the EPC Contractor and implemented.	TMP implementation records	Daily during construction phase	Benchmarks stated in the TMP	EPC Contractor	REA-PMU	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Speed limits for all construction-related vehicles shall be established and enforced.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	POE	
	Appropriate barriers and signage shall be provided to demarcate areas in which construction traffic is active.	Safety signs and barriers	Once before commencement of construction	Adherence to measures	EPC Contractor		
	Drivers' competency shall be assessed and where required training shall be provided.	Drivers' competency assessments; training records	Once before commencement of construction	Passing of competency assessment or training completion certificates	EPC Contractor		
	A procedure for recording all construction related traffic incidents/accidents shall be developed and implemented.	Incident forms	Daily during construction phase	Completed incident forms	EPC Contractor		
	The EPC contractor shall promptly repair damage to public infrastructure and repair or compensate for damage to private property.	Incident forms, GRM	Daily during construction phase	Completed incident forms	EPC Contractor		
Waste Disposal and Generation							

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
E-waste generation	The Waste Management Plan implemented	Waste Management records	Weekly during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	POE	
	E-wastes generated shall be stored in appropriate locations prior to recycling and/or disposal	Waste consignment notes, waste receptacles on Site	Weekly during construction phase	Adherence to measures	EPC Contractor		
Soil contamination from solid and liquid construction waste streams.	Hazardous substances and materials shall be stored in appropriate locations with impervious hardstanding and adequate secondary containment.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Portable spill containment and clean-up kits shall be available onsite.					POE	
	Construction workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor		
Groundwater contamination	Training shall be provided for workers on safe storage, use and handling of	Training records	Once before commencement	Certificates of completion of trainings	EPC Contractor	REA-PMU	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
liquid construction waste streams.	hazardous materials (e.g. fuel, lubricating oil) on site.		at start of construction			POE	
	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 during construction phase	Adherence to measures	EPC Contractor	FMEnv	
	Waste management plan (WMP) shall be implemented.	WMP implementation records	Daily during construction phase	Benchmarks stated in WMP	EPC Contractor		

Social Management Measures for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Discrimination during employment and training opportunities	Employment of workers for construction activities shall be open and fair. However, no person under the age of 18 shall be engaged on the project sites.	Employment records	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented for the Project	Implementation by the EPC Contractor	Once before start of construction	Evidence to show implementation of EEP GBV action plan	EPC Contractor	REA-PMU POE	
	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	FMEnv	
	All workers on the project shall be required to sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of construction	Signed CoC forms	EPC Contractor	Federal Ministry of women affairs	
	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	GBV/SEA	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	The EPC Contractor shall be required to hire a Gender/ GBV officer	Employ GRM Officer	Once before start of construction	Employment records and job description	EPC Contractor	service providers	
	Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be ensured	Engagement of GBV service provider	Once before start of construction	Records of ongoing engagement and consultation 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 convenience facilities and display of GBV signage	Once before start of construction	Inspection of facilities to ensure adequacy	EPC Contractor		
Influx of people increase in sexual transmitted diseases.	Construction workers (e.g. semi-skilled and unskilled craftsmen) shall be drawn from the local community as much as possible. and Labour management plan developed and implemented	Employment records and prepare a labour management plan	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	An induction and sensitization programme, including a Code of Conduct 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 / fraternization with the local community.	Induction records and training on the code of conduct	Once before start of construction	Adherence to measures	EPC Contractor	FMEnv Federal Ministry of women affairs/	
	Awareness education about GBV/ SEA/ HIV/ AIDS and other sexually transmitted diseases shall be created among the workforce and local communities.	Training records	Once before start of construction	Adherence to measures	EPC Contractor	GBV/SEA service provider	
	Public access shall be restricted to construction area via security fencing and appropriate signage.	Inspection	As required	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 records	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	Monthly during construction phase	GRM Measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Injury to construction workers during construction activities	Health and Safety Plan shall be developed and implemented.	Health and Safety plan implementation records	Daily during construction phase	Benchmarks stated in Health and Safety Plan	EPC Contractor	REA-PMU POE	
	Community members and 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 for all workers.	Daily toolbox records	Daily during construction phase for workers and monthly for communities as part of engagement	Benchmarks stated in Health and Safety Plan	EPC Contractor		
	Onsite safety officer shall be engaged to monitor the compliance of workers to safety rules.	Qualified and dedicated safety officer	Once before commencement of construction	Adherence to measures	EPC Contractor		
	PPE such as safety boot, coverall, eye google, safety helmets, reflective vests, etc. shall be provided to construction workers and the level of PPE compliance shall be monitored.	Availability of PPE	Daily during construction phase	PPE compliance	EPC Contractor		
	Safety training focused on safe working practices, information on specific hazards,	Training records	Before commencement of	Certificates of completion of trainings	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	first aid and fire- fighting shall be included in the induction programme for workers.		construction and weekly				
	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		
Influx of infected workers to the community. Exposure to infectious diseases (e.g. COVID-19) during construction	The EPC contractor shall implement the NCDC “Guidelines for employers and businesses in Nigeria” during construction works.	Implementation of NCDC guidelines	Prior to operations	Adherence to measures	EPC Contractor	REA-PMU POE	
	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 control measures	Continuous during operations	Adherence to measures			
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during construction.	Policies and implementation procedures	Continuous during operations	Adherence to measures			

Environmental management for Commissioning phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Increase in ambient noise level due to Plant testing	Strict compliance to the Standard Operating Procedures (SOPs) shall be ensured.	SOPs	Once before commissioning	Adherence to measures	EPC Contractor	REA - PMU POE	
	The EPC contractor shall develop Standard Operating Procedures (SOPs) for the operational phase of the Project	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		
	The Power Plant components shall be installed in line with the pre-established standards and as per manufacturer recommendations	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		

Social Management Measures for Commissioning Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Occupational health and safety hazards (e.g. injuries,	Plant testing shall be carried out by experienced personnel.	Qualified and dedicated Engineer	Once before commissioning	Adherence to measures	EPC Contractor	PMU – REA	

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

Environmental Management Measures 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	PMU – REA POE	
	Regular maintenance of diesel generators shall be ensured as required by the manufacturer	Inspection	Monthly during operations	Adherence to Measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Dust accumulation on the solar panels	A cleaning schedule shall be developed and implemented for cleaning the panels installed at the project site during operations	Inspection	Monthly during operations	Adherence to measures		University Staff	
	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			
Noise from diesel generators and inverters during power generation and evacuation	Inverters shall be maintained as per manufacturer's recommendations and operated as per original specifications.	Inspection	Monthly during operations	Adherence to measures			
	The diesel generators shall be operated with the sound proof covers at all times.	Inspection	Monthly during operations	Adherence to measures			
	Project personnel shall use appropriate PPE (e.g. ear muffs) to reduce exposure to noise impact.	Inspection	Monthly during operations	Adherence to Measures			
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			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Routine Maintenance, Waste Generation and Disposal							
E-waste generation and Disposal	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	At induction of new staff, and in annual refresher training	Certificates of completion of trainings	O&M Contractor	REA PMU POE	
	E-wastes generated shall be stored in appropriate locations prior to recycling; consignment notes will be maintained	Waste consignment notes, waste receptacles on Site	Continuous during operations	Adherence to measures	O&M Contractor	University Staff	
	Waste receptacles shall be provided within a secured area for collection of solid waste.	Waste consignment notes, waste receptacles on Site	Weekly during construction phase	Adherence to measures	O&M Contractor		
Soil contamination from spilled fuel, used oil, spent batteries and inverters	Waste that cannot be reused or recycled shall be disposed of at an approved dumpsite. Spent batteries and inverters shall be sent to manufacturers in line with the Extended Producer Responsibility (EPR) policy.	Consignment notes for spent batteries to manufacturers for recycling	Yearly	EHS Guidelines	O&M Contractor	REA PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	WMP shall be implemented.	WMP implementation records	Quarterly during operation phase	Benchmarks stated in WMP EHS Guidelines	O&M Contractor	FMEnv	
	Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.	Inspection	Continuously during operations phase	Adherence to measures EHS Guidelines	O&M Contractor		
	Portable spill containment and clean-up kits shall be available onsite.	Availability of spill response equipment	Quarterly during operation phase	Functional spill equipment Adherence to measures	O&M Contractor		
	Operation workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Quarterly during operation	Certificates of completion of trainings	O&M Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
			phase				
Electric shock injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA PMU POE	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures	O&M Contractor	FMEnv	
Groundwater abstraction from cleaning of PV panels	Water management / conservation plan shall be implemented	Implementation records of water management plan	Quarterly during operations	Benchmarks in water conservation plan	O&M Contractor	REA PMU POE	
				EHS Guidelines		FMEnv	

Social Management Measures for Operational Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Power Generation and Evacuation							
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented during operations	Implementation by the O&M Contractor	Continuously during operations	Evidence to show implementation of EEP GBV action plan	O&M Contractor	REA PMU University	
	All workers shall be required to undergo regular training and refreshers on GBV	Organize regular on-site training and refreshers	Monthly during operation phase	Records of attendance	O&M Contractor	GBV/SEA service provider	
	All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of operations	Signed CoC forms	O&M Contractor	POE	
	GBV sensitive channels for reporting in GRM shall be implemented for the Project	Establish GRM reporting channels	Once before start of operations	GRM records of	O&M Contractor		
	Separate facilities for men and women will be provided	Erection of separate convenience facilities	Once before start of operations	Inspection of facilities to ensure adequacy	O&M Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Health, safety and welfare of staff during operation	Provision of medical insurance scheme for employees shall be ensured.	Employment forms of employees	Quarterly during operations	Adherence to measures	O&M Contractor	REA PMU University POE	
	Appropriate safety signage shall be placed at strategic locations within the site.	Safety signs	Quarterly during operations	Adherence to measures	O&M Contractor		
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	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. COVID- 19)	The O&M contractor shall implement the Nigeria Centre for Disease Control (NCDC) safety Guidelines during operations.	Implementation of NCDC guidelines	Prior to operations	Adherence to measures	O&M Contractor	REA PMU University POE	
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during operations	Hygiene facility and implementation of infection prevention measures	Continuous during operations	Adherence to measures	O&M Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	A risk assessment of the occupational exposure to infectious diseases during construction shall be conducted, and appropriate control mechanisms shall be implemented.	Conduct risk assessment and implement controls	Continuous during operations	Adherence to measures	O&M Contractor		
	The O&M contractor shall develop policies and procedures for the identification and isolation of people with symptoms, as well as testing where appropriate.	Implementation of policies and procedures	Continuous during operations	Adherence to measures	O&M Contractor		
Routine Maintenance, Waste Generation and Disposal							
Electric shock injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA-PMU	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures		POE	

Environmental Monitoring Programme

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

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 (\$)
Atmosphere (Air Quality & Noise)	Project Site Power evacuation route	Air Quality Monitoring Equipment Sound level meter	TSP, CO, NOX, SOX, Noise Level (dBA)	FMEnv/ WHO/ AfDB	Monthly monitoring; Monthly reporting	EPC Contractor	Construction Phase	
Groundwater Quality	Borehole within the University	Thermometer, Water sampler, Turbidity meter, pH meter, AAS etc.	Temperature, salinity, conductivity, DO, BOD, TOC, COD, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals, TSS and Turbidity	FMEnv/ WHO/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Soil	Unpaved sections of the Plant	Composite soil samples collection for laboratory analysis.	pH, Moisture, TOC, THC, TPH, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals.	NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Solid Waste	Operational areas	Monitor the handling and disposal of solid wastes generated onsite; waste tracking documentation.	Operational solid wastes including used packaging waste.	FMEnv/ NESREA/ AfDB	Monthly monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

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 (\$)
Health and Safety	Workers and Operational areas	Observe compliance to PPE and unsafe working conditions	Health and Safety Plan	FMEnv/ NESREA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Training	Workers	Observe compliance with existing training plan	Training plan and records	FMEnv/ NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
General Housekeeping	Construction sheds and operational areas	Observe cleanliness and aesthetics of Plant	Cleanliness and aesthetics of Plant	FMEnv/ NESREA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Stakeholder Engagement	Local community Regulatory agencies	Observe evidence of stakeholder consultations	Stakeholder Engagement Plan	FMEnv/ NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

4.2.Environmental and Social Management Plan for Modibbo Adama University, Yola

Environmental Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Clearing and Preparation							
Vegetation loss; direct impacts on vegetation and soil-dwelling organisms; indirect impacts on fauna species	Vegetation clearing shall be limited to the areas within the site needed for the Project.	Inspection	Daily	Adherence to measures	EPC Contractor	REA (PMU)	
	Use of herbicides for clearing shall be avoided. Site clearing and preparation shall be done mechanically.					POE (Site Engineer)	
	Bush burning shall be avoided.	Inspection	Daily	Adherence to measures			
	Any cleared areas which are not used will be re- vegetated using plants or seeds of locally occurring species.	Inspection	Monthly	Revegetated land			
	The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited.	Inspection	Monthly	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	Adherence to measures				

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Removal of topsoil and soil compaction; loss of top soil; increased erosion potential; reduction in structural stability and percolative ability of soil	Removal of vegetation and soil cover shall be restricted to the areas required for the Project. Soil conservation measures shall be implemented such as stockpiling topsoil or for the remediation of disturbed areas.	Inspection	Daily	Revegetated land			
	Use of silt traps or similar systems to reduce discharge of silt shall be ensured.	Inspection	Monthly	Adherence to measures			
Air quality impacts due to emission from site clearing equipment; increase in ambient noise levels	Site clearing equipment / machinery shall be operated and maintained under optimum fuel- efficient conditions.	Maintenance records; Fuel consumption records	Daily	Adherence to measures			
	Site clearing activities shall be carried out only during the daytime (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr)	Inspection	Daily	Adherence to measures			
Air quality impacts from vehicular emissions;	Project vehicles with efficient engine performance and with minimal noise and air emissions shall be selected and used. This can be achieved through regular servicing and maintenance	Inspection; Maintenance records	Once before vehicle commences journey	Adherence to measures	EPC Contractor	REA (PMU) POE (Site Engineer)	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Increase in ambient noise	All materials with potential to result in dust emissions shall be covered during transport.	Inspection	Once before vehicle commences journey	Adherence to measures	EPC Contractor		
	Site roads and access roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Onsite vehicle speed on unhardened roads and surfaces shall be limited to about 15 – 20km/h so as to reduce dust generation.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Unnecessary engine idling shall be avoided.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Site roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		

Social Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Selection							
Loss of ad-hoc seasonal farmlands 20% of land	Resettlement Action Plan (RAP/aRAP) shall be developed and implemented (consistent with the requirements of OS 2, Involuntary Resettlement) to restore livelihood of the affected persons.	OS 2, Involuntary Resettlement	2	Prior to mobilization to site / site clearing and construction	Involuntary Resettlement (OS 2)	MAU Management	REA (PMU)
	The affected persons shall be allowed to harvest their crops before commencement of construction activities.	Notification of project development to the affected persons		Prior to mobilization to site / site clearing and construction	Adherence to measures		
	The commitment for the provision of alternative land for the affected personnel shall be documented in a letter signed by the University's Vice Chancellor.	Signed letter of commitment from MAU management		Prior to mobilization to site / site clearing and construction	Adherence to measures		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
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 activities.	Implementation of NCDC guidelines	Prior to mobilization to site / site clearing and construction	Adherence to measures	EPC Contractor	REA (PMU)	
	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			
Mobilization of Materials and Equipment to Site							
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU)	
	Site clearing shall be limited to the daytime as much as possible.	Inspection	Daily	Daily time log	EPC Contractor	POE	
	Unregistered labourers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		
Increase in vehicular movement and traffic	A TMP shall be developed by the EPC contractor and implemented	CTMP	Daily	Benchmarks stated in the	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
including potential for road accident		implementation records		TMP			
	Appropriate signage and safety measures (barrier, formalized crossing points) to reduce the risk of accidents in the Project area shall be provided.	Safety signs and barriers	Before and during mobilization	Adherence to measures	EPC Contractor		
	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 Driver's licence	EPC Contractor		
	A procedure for recording traffic incidents/accidents associated with the Project shall be developed and implemented.	Incident forms	Daily	Completed incident forms	EPC Contractor		
	Employee violations of speed limit and other traffic rules will result in disciplinary action ranging from warning to dismissal.	Incident forms, GRM	Daily	Completed incident forms	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU) POE	
	Unregistered laborers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		

Environmental Management Plan for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Air quality impacts due to emission from construction equipment;	Regular maintenance and servicing of construction equipment /machinery shall be ensured.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor	REA-PMU POE	
Increase in dust from cleared land and windblown stockpiles	Routine water sprinkling shall be carried out to minimize dust generation during construction.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Increase in noise level	Construction activities shall be limited to day- time (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr).	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Construction machinery shall be turned off when not in use.	Inspection	Daily during Construction phase	Adherence to measures	EPC Contractor	POE	
	Construction equipment shall be properly maintained and serviced.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor		
	Noise complaints related to the construction activities shall be assessed and appropriately addressed.	Complaint records	Weekly during construction phase	GRM measures	EPC Contractor		
	Noise monitoring at locations with persistent noise complaints shall be maintained.	Noise monitoring records	Monthly during construction phase	FME _{env} Noise limit	EPC Contractor		
	Machinery/equipment to be used for construction work shall meet industry best standard in relation to noise attenuation	Inspection	Before commencement of construction phase	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
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 during excavation activities	Adherence to measures	EPC Contractor	REA-PMU POE	
	Stockpiles shall be appropriately covered to reduce soil loss as a result of wind or water erosion.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		
Loss of plant species as a result of introduction of alien plants; loss of fauna as a result of increased human activity and associated noise.	Construction workers shall be provided with appropriate training on ecological awareness, as appropriate to their work activities.	Training records	Once before start of construction phase	Certificates of Training	EPC Contractor	REA-PMU POE	
	All construction equipment shall be cleaned (mud and soil removed) at source before being brought to site to minimise introduction of alien species. If sand or other natural materials for building are required and brought onto site, the stored heaps will be monitored for the growth and germination of alien species and will be regularly cleared during construction.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		
	Regular monitoring 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		
Road damage, traffic and safety impacts	TMP shall be developed by the EPC Contractor and implemented.	TMP implementation records	Daily during construction phase	Benchmarks stated in the TMP	EPC Contractor	REA-PMU	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Speed limits for all construction-related vehicles shall be established and enforced.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	POE	
	Appropriate barriers and signage shall be provided to demarcate areas in which construction traffic is active.	Safety signs and barriers	Once before commencement of construction	Adherence to measures	EPC Contractor		
	Drivers' competency shall be assessed and where required training shall be provided.	Drivers' competency assessments; training records	Once before commencement of construction	Passing of competency assessment or training completion certificates	EPC Contractor		
	A procedure for recording all construction related traffic incidents/accidents shall be developed and implemented.	Incident forms	Daily during construction phase	Completed incident forms	EPC Contractor		
	The EPC contractor shall promptly repair damage to public infrastructure and repair or compensate for damage to private property.	Incident forms, GRM	Daily during construction phase	Completed incident forms	EPC Contractor		
Waste Disposal and Generation							

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
E-waste generation	A Waste Management Plan shall be implemented	Waste Management records	Weekly during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	POE	
	E-wastes generated shall be stored in appropriate locations prior to recycling and/or disposal	Waste consignment notes, waste receptacles on Site	Weekly during construction phase	Adherence to measures	EPC Contractor		
Soil contamination from solid and liquid construction waste streams.	Hazardous substances and materials shall be stored in appropriate locations with impervious hardstanding and adequate secondary containment.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Portable spill containment and clean-up kits shall be available onsite.					POE	
	Construction workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor		
Groundwater contamination of	Training shall be provided for workers on safe storage, use and handling of	Training records	Once before commencement	Certificates of completion of trainings	EPC Contractor	REA-PMU	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
liquid construction waste streams.	hazardous materials (e.g. fuel, lubricating oil) on site.		t of construction			POE	
	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 during construction phase	Adherence to measures	EPC Contractor	FMEnv	
	Waste management plan (WMP) shall be implemented.	WMP implementation records	Daily during construction phase	Benchmarks stated in WMP	EPC Contractor		

Social Management Measures for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Discrimination during employment and training opportunities	Employment of workers for construction activities shall be open and fair. However, no person under the age of 18 shall be engaged on the project sites.	Employment records	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented for the Project	Implementation by the EPC Contractor	Once before start of construction	Evidence to show implementation of EEP GBV action plan	EPC Contractor	REA-PMU POE	
	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	FMEnv	
	All workers on the project shall be required to sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of construction	Signed CoC forms	EPC Contractor	Federal Ministry of women affairs	
	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	GBV/SEA service providers	
	The EPC Contractor shall be required to hire a Gender/ GBV officer	Employ GRM Officer	Once before start of construction	Employment records and job description	EPC Contractor		
	Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be ensured	Engagement of GBV service provider	Once before start of construction	Records of ongoing engagement and consultation	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
				with GBV service providers			
	The EPC Contractor shall provide separate facilities for men and women and add GBV-free signage at the project site	Erection of separate convenience facilities and display of GBV signage	Once before start of construction	Inspection of facilities to ensure adequacy	EPC Contractor		
Influx of people increase in sexual transmitted diseases.	Construction workers (e.g. semi-skilled and unskilled craftsmen) shall be drawn from the local community as much as possible. and Labour management plan developed and implemented	Employment records and prepare a labour management plan	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	
	An induction and sensitization programme, including a Code of Conduct 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	Induction records and training on the code of conduct	Once before start of construction	Adherence to measures	EPC Contractor	FMEnv Federal Ministry of	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	worker interactions / fraternization with the local community.					women affairs/ GBV/SEA service provider	
	Awareness education about GBV/ SEA/ HIV/ AIDS and other sexually transmitted diseases shall be created among the workforce and local communities.	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	As required	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 records	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	Monthly during construction phase	GRM Measures	EPC Contractor		
Injury to construction workers during	Health and Safety Plan shall be developed and implemented.	Health and Safety plan implementation records	Daily during construction phase	Benchmarks stated in Health and Safety Plan	EPC Contractor	REA-PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
construction activities	Community members and 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 for all workers.	Daily toolbox records	Daily during construction phase for workers and monthly for communities as part of engagement	Benchmarks stated in Health and Safety Plan	EPC Contractor		
	Onsite safety officer shall be engaged to monitor the compliance of workers to safety rules.	Qualified and dedicated safety officer	Once before commencement of construction	Adherence to measures	EPC Contractor		
	PPE such as safety boot, coverall, eye google, safety helmets, reflective vests, etc. shall be provided to construction workers and the level of PPE compliance shall be monitored.	Availability of PPE	Daily during construction phase	PPE compliance	EPC Contractor		
	Safety training focused on safe working practices, information on specific hazards, first aid and fire- fighting shall be included in the induction programme for workers.	Training records	Before commencement of construction and weekly	Certificates of completion of trainings	EPC Contractor		
	A mechanism procedure for receiving and addressing the concerns of workers shall be put in place and implemented.	Completed grievance forms	Weekly during construction phase	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Influx of infected workers to the community. Exposure to infectious diseases (e.g. COVID-19) during construction	The EPC contractor shall implement the NCDC “Guidelines for employers and businesses in Nigeria” during construction works.	Implementation of NCDC guidelines	Prior to operations	Adherence to measures	EPC Contractor	REA-PMU POE	
	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 control measures	Continuous during operations	Adherence to measures			
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during construction.	Policies and procedures	Continuous during operations	Adherence to measures			

Environmental management for Commissioning phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Increase in ambient noise level due to Plant testing	Strict compliance to the Standard Operating Procedures (SOPs) shall be ensured.	SOPs	Once before commissioning	Adherence to measures	EPC Contractor	REA - PMU POE	
	The EPC contractor shall develop Standard Operating Procedures (SOPs) for the operational phase of the Project	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		
	The Power Plant components shall be installed in line with the pre-established standards and as per manufacturer recommendations	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		

Social Management Measures for Commissioning Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Occupational health and safety hazards (e.g. injuries,	Plant testing shall be carried out by experienced personnel.	Qualified and dedicated Engineer	Once before commissioning	Adherence to measures	EPC Contractor	PMU – REA	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
electrocution, etc.) as a result of any wrong electrical connection.	Adequate PPE shall be worn	Availability of PPE	Once before commissioning	Adherence to measures	EPC Contractor	POE	
	Prior to the Plant commissioning, appropriate emergency equipment.	Availability of emergency response equipment	Once before commissioning	Adherence to measures	EPC Contractor		
Wrong electrical connection leading to explosion/fire	Plant testing shall be carried out by experienced personnel.	Qualified and dedicated Engineer	Once before commissioning	Adherence to measures	EPC Contractor	PMU – REA POE	

Environmental Management Measures 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	PMU – REA POE	
	Regular maintenance of diesel generators shall be ensured as required by the manufacturer	Inspection	Monthly during operations	Adherence to Measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Dust accumulation on the solar panels	A cleaning schedule shall be developed and implemented for cleaning the panels installed at the project site during operations	Inspection	Monthly during operations	Adherence to measures		University Staff	
	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			
Noise from diesel generators and inverters during power generation and evacuation	Inverters shall be maintained as per manufacturer's recommendations and operated as per original specifications.	Inspection	Monthly during operations	Adherence to measures			
	The diesel generators shall be always operated with the soundproof covers.	Inspection	Monthly during operations	Adherence to measures			
	Project personnel shall use appropriate PPE (e.g. ear muffs) to reduce exposure to noise impact.	Inspection	Monthly during operations	Adherence to Measures			
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			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Routine Maintenance, Waste Generation and Disposal							
E-waste generation and Disposal	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	At induction of new staff, and in annual refresher training	Certificates of completion of trainings	O&M Contractor	REA PMU POE	
	E-wastes generated shall be stored in appropriate locations prior to recycling; consignment notes will be maintained	Waste consignment notes, waste receptacles on Site	Continuous during operations	Adherence to measures	O&M Contractor	University Staff	
	Waste receptacles shall be provided within a secured area for collection of solid waste.	Waste consignment notes, waste receptacles on Site	Weekly during construction phase	Adherence to measures	O&M Contractor		
Soil contamination from spilled fuel, used oil, spent batteries and inverters	Waste that cannot be reused or recycled shall be disposed of at an approved dumpsite. Spent batteries and inverters shall be sent to manufacturers in line with the Extended Producer Responsibility (EPR) policy.	Consignment notes for spent batteries to manufacturers for recycling	Yearly	EHS Guidelines	O&M Contractor	REA PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	WMP shall be implemented.	WMP implementation records	Quarterly during operation phase	Benchmarks stated in WMP EHS Guidelines	O&M Contractor	FMEnv	
	Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.	Inspection	Continuously during operations phase	Adherence to measures EHS Guidelines	O&M Contractor		
	Portable spill containment and clean-up kits shall be available onsite.	Availability of spill response equipment	Quarterly during operation phase	Functional spill equipment Adherence to measures	O&M Contractor		
	Operation workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Quarterly during operation phase	Certificates of completion of trainings	O&M Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Electric shock injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA PMU POE	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures	O&M Contractor	FMEEnv	
Groundwater abstraction from cleaning of PV panels	Water management / conservation plan shall be implemented	Implementation records of water management plan	Quarterly during operations	Benchmarks in water conservation plan EHS Guidelines	O&M Contractor	REA PMU POE FMEEnv	

Social Management Measures 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							

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented during operations	Implementation by the O&M Contractor	Continuously during operations	Evidence to show implementation of EEP GBV action plan	O&M Contractor	REA PMU University	
	All workers shall be required to undergo regular training and refreshers on GBV	Organize regular on-site training and refreshers	Monthly during operation phase	Records of attendance	O&M Contractor	GBV/SEA service provider	
	All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of operations	Signed CoC forms	O&M Contractor	POE	
	GBV sensitive channels for reporting in GRM shall be implemented for the Project	Establish GRM reporting channels	Once before start of operations	GRM records	O&M Contractor		
	Separate facilities for men and women will be provided	Erection of separate convenience facilities	Once before start of operations	Inspection of facilities to ensure adequacy	O&M Contractor		
Health, safety and welfare of staff	Provision of medical insurance scheme for employees shall be ensured.	Employment forms of employees	Quarterly during operations	Adherence to measures	O&M Contractor	REA PMU	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
during operation	Plant	Appropriate safety signage shall be placed at strategic locations within the site.	Safety signs	Quarterly during operations	Adherence to measures	O&M Contractor	University POE
		Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	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. COVID- 19)		The O&M contractor shall implement the Nigeria Centre for Disease Control (NCDC) safety Guidelines during operations.	Implementation of NCDC guidelines	Prior to operations	Adherence to measures	O&M Contractor	REA PMU University POE
		Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during operations	Hygiene facility and implementation of infection prevention measures	Continuous during operations	Adherence to measures	O&M Contractor	
		A risk assessment of the occupational exposure to infectious diseases during construction shall be conducted, and appropriate control mechanisms shall be implemented.	Conduct risk assessment and implement Controls	Continuous during operations	Adherence to measures	O&M Contractor	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	The O&M contractor shall develop policies and procedures for the identification and isolation of people with symptoms, as well as testing where appropriate.	Implementation of policies and procedures	Continuous during operations	Adherence to measures	O&M Contractor		
Routine Maintenance, Waste Generation and Disposal							
Electric shock injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA-PMU	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures		POE	

Environmental Monitoring Programme

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

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 (\$)
Atmosphere (Air Quality & Noise)	Project Site Power evacuation route	Air Quality Monitoring Equipment Sound level meter	TSP, CO, NOX, SOX, Noise Level (dBA)	FMEnv/ WHO/ AfDB	Monthly monitoring; Monthly reporting	EPC Contractor	Construction Phase	
Groundwater Quality	Borehole within the University	Thermometer, Water sampler, Turbidity meter, pH meter, AAS etc.	Temperature, salinity, conductivity, BOD, TOC, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals, TSS and Turbidity	FMEnv/ WHO/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Soil	Unpaved sections of the Plant	Composite soil samples collection for laboratory analysis.	pH, Moisture, TOC, THC, TPH, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals.	NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

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 (\$)
Solid Waste	Operational areas	Monitor the handling and disposal of solid wastes generated onsite; waste tracking documentation.	Operational solid wastes including used packaging waste.	FMEnv/NESR/EA/ AfDB	Monthly monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Health and Safety	Workers and Operational areas	Observe compliance to PPE and unsafe working conditions	Health and Safety Plan	FMEnv/NESR/EA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Training	Workers	Observe compliance with existing training plan	Training plan and records	FMEnv/NESR/EA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
General Housekeeping	Construction sheds and operational areas	Observe cleanliness and aesthetics of Plant	Cleanliness and aesthetics of Plant	FMEnv/NESR/EA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

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 (\$)
Stakeholder Engagement	Local community Regulatory agencies	Observe evidence of stakeholder consultations	Stakeholder Engagement Plan	FMEnv/NESR EA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

4.3.Environmental and Social Management Plan for University, Dustin-Ma, Katsina

Environmental Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Clearing and Preparation							
Vegetation loss; direct impacts on vegetation and soil-dwelling organisms; indirect impacts on fauna species	Vegetation clearing shall be limited to the areas within the site needed for the Project.	Inspection	Daily	Adherence to measures	EPC Contractor	REA (PMU) POE (Site Engineer)	
	Use of herbicides for clearing shall be avoided. Site clearing and preparation shall be done mechanically.	Inspection	Daily	Adherence to measures			
	Bush burning shall be avoided.	Inspection	Daily	Adherence to measures			
	Any cleared areas which are not used will be re- vegetated using plants or seeds of locally occurring species.	Inspection	Monthly	Revegetated land			
	The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited.	Inspection	Monthly	Adherence to measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Hunting or deliberate killing of animals by workers shall be prohibited and monitored. Workers shall be sensitized on ecological protection	Inspection	Daily	Adherence to measures			
Removal of topsoil and soil compaction; loss of topsoil; increased erosion potential; reduction in structural stability and percolative ability of soil	Removal of vegetation and soil cover shall be restricted to the areas required for the Project. Soil conservation measures shall be implemented such as stockpiling topsoil or for the remediation of disturbed areas. Use of silt traps or similar systems to reduce discharge of silt shall be ensured.	Inspection	Daily	Revegetated land			
Air quality impacts due to emission from site clearing equipment; increase in ambient noise levels	Site clearing equipment / machinery shall be operated and maintained under optimum fuel- efficient conditions.	Maintenance records; Fuel consumption records	Daily	Adherence to measures			
	Site clearing activities shall be carried out only during the daytime (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr)	Inspection	Daily	Adherence to measures			
Mobilization of Materials and Equipment to Site							

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Air quality impacts from vehicular emissions; Increase in ambient noise	Project vehicles with efficient engine performance and with minimal noise and air emissions shall be selected and used. This can be achieved through regular servicing and maintenance	Inspection; Maintenance records	Once before vehicle commences journey	Adherence to measures	EPC Contractor	REA (PMU) POE (Site Engineer)	
	All materials with potential to result in dust emissions shall be covered during transport.	Inspection	Once before vehicle commences journey	Adherence to measures	EPC Contractor		
	Site roads and access roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Onsite vehicle speed on unhardened roads and surfaces shall be limited to about 15 – 20km/h so as to reduce dust generation.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Unnecessary engine idling shall be avoided.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Site roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		

Social Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Selection							
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 activities.	Implementation of NCDC guidelines	Prior to site clearing and construction	Adherence to measures	EPC Contractor	REA (PMU)	
	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 site clearing and construction	Adherence to measures	EPC Contractor	REA (PMU)	
Mobilization of Materials and Equipment to Site							
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU)	
	Site clearing shall be limited to the day time as much as possible.	Inspection	Daily	Daily time log	EPC Contractor	POE	
	Unregistered labourers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Increase in vehicular movement and traffic including potential for road accident	A TMP shall be developed by the EPC contractor and implemented	TMP implementation records	Daily	Benchmarks stated in the TMP	EPC Contractor		
	Appropriate signage and safety measures (barrier, formalized crossing points) to reduce the risk of accidents in the Project area shall be provided.	Safety signs and barriers	Before and during mobilization	Adherence to measures	EPC Contractor		
	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 Driver's licence	EPC Contractor		
	A procedure for recording traffic incidents/accidents associated with the Project shall be developed and implemented.	Incident forms	Daily	Completed incident forms	EPC Contractor		
	Employee violations of speed limit and other traffic rules will result in disciplinary action ranging from warning to dismissal.	Incident forms, GRM	Daily	Completed incident forms	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU) POE	
	Unregistered laborers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		

Environmental Management Plan for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Air quality impacts due to emission from construction equipment;	Regular maintenance and servicing of construction equipment /machinery shall be ensured.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor	REA-PMU POE	
Increase in dust from cleared land and windblown stockpiles	Routine water sprinkling shall be carried out to minimize dust generation during construction.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Increase in noise level	Construction activities shall be limited to day- time (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr).	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Construction machinery shall be turned off when not in use.	Inspection	Daily during Construction phase	Adherence to measures	EPC Contractor	POE	
	Construction equipment shall be properly maintained and serviced.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor		
	Noise complaints related to the construction activities shall be assessed and appropriately addressed.	Complaint records	Weekly during construction phase	GRM measures	EPC Contractor		
	Noise monitoring at locations with persistent noise complaints shall be maintained.	Noise monitoring records	Monthly during construction phase	FME _{env} Noise limit	EPC Contractor		
	Machinery/equipment to be used for construction work shall meet industry best standard in relation to noise attenuation	Inspection	Before commencement of construction phase	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
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 during excavation activities	Adherence to measures	EPC Contractor	REA-PMU POE	
	Stockpiles shall be appropriately covered to reduce soil loss as a result of wind or water erosion.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		
Loss of plant species as a result of introduction of alien plants; loss of fauna as a result of increased human activity and associated noise.	Construction workers shall be provided with appropriate training on ecological awareness, as appropriate to their work activities.	Training records	Once before start of construction phase	Certificates of Training	EPC Contractor	REA-PMU POE	
	All construction equipment shall be cleaned (mud and soil removed) at source before being brought to site to minimise introduction of alien species. If sand or other natural materials for building are required and brought onto site, the stored heaps will be monitored for the growth and germination of alien species and will be regularly cleared during construction.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		
	Regular monitoring 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		
Road damage, traffic and safety impacts	TMP shall be developed by the EPC Contractor and implemented.	TMP implementation records	Daily during construction phase	Benchmarks stated in the TMP	EPC Contractor	REA-PMU	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Speed limits for all construction-related vehicles shall be established and enforced.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	POE	
	Appropriate barriers and signage shall be provided to demarcate areas in which construction traffic is active.	Safety signs and barriers	Once before commencement of construction	Adherence to measures	EPC Contractor		
	Drivers' competency shall be assessed and where required training shall be provided.	Drivers' competency assessments; training records	Once before commencement of construction	Passing of competency assessment or training completion certificates	EPC Contractor		
	A procedure for recording all construction related traffic incidents/accidents shall be developed and implemented.	Incident forms	Daily during construction phase	Completed incident forms	EPC Contractor		
	The EPC contractor shall promptly repair damage to public infrastructure and repair or compensate for damage to private property.	Incident forms, GRM	Daily during construction phase	Completed incident forms	EPC Contractor		
Waste Disposal and Generation							

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
E-waste generation	The Waste Management Plan shall be implemented	Waste Management records	Weekly during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	POE	
	E-wastes generated shall be stored in appropriate locations prior to recycling and/or disposal	Waste consignment notes, waste receptacles on Site	Weekly during construction phase	Adherence to measures	EPC Contractor		
Soil contamination from solid and liquid construction waste streams.	Hazardous substances and materials shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Portable spill containment and clean-up kits shall be available onsite.					POE	
	Construction workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor		
Groundwater contamination	Training shall be provided for workers on safe storage, use and handling of	Training records	Once before commencement	Certificates of completion of trainings	EPC Contractor	REA-PMU	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
liquid construction waste streams.	hazardous materials (e.g. fuel, lubricating oil) on site.		t of construction			POE	
	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 during construction phase	Adherence to measures	EPC Contractor	FMEnv	
	Waste management plan (WMP) (Annex 3) shall be implemented.	WMP implementation records	Daily during construction phase	Benchmarks stated in WMP	EPC Contractor		

Social Management Measures for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Discrimination during employment and training opportunities	Employment of workers for construction activities shall be open and fair. However, no person under the age of 18 shall be engaged on the project sites.	Employment records	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented for the Project	Implementation by the EPC Contractor	Once before start of construction	Evidence to show implementation of EEP GBV action plan	EPC Contractor	REA-PMU POE	
	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	FMEnv	
	All workers on the project shall be required to sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of construction	Signed CoC forms	EPC Contractor	Federal Ministry of women affairs	
	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	GBV/SEA service providers	
	The EPC Contractor shall be required to hire a Gender/ GBV officer	Employ GRM Officer	Once before start of construction	Employment records and job description	EPC Contractor		
	Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be ensured	Engagement of GBV service provider	Once before start of construction	Records of ongoing engagement and consultation	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
				with GBV service providers			
	The EPC Contractor shall provide separate facilities for men and women and add GBV-free signage at the project site	Erection of separate convenience facilities and display of GBV signage	Once before start of construction	Inspection of facilities to ensure adequacy	EPC Contractor		
Influx of people increase in sexual transmitted diseases.	Construction workers (e.g. semi-skilled and unskilled craftsmen) shall be drawn from the local community as much as possible. and Labour management plan developed and implemented	Employment records and prepare a labour management plan	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	
	An induction and sensitization programme, including a Code of Conduct 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	Induction records and training on the code of conduct	Once before start of construction	Adherence to measures	EPC Contractor	FMEnv Federal Ministry of	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	worker interactions / fraternization with the local community.					women affairs/ GBV/SEA service provider	
	Awareness education about GBV/ SEA/ HIV/ AIDS and other sexually transmitted diseases shall be created among the workforce and local communities.	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	As required	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 records	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	Monthly during construction phase	GRM Measures	EPC Contractor		
Injury to construction workers during	Health and Safety Plan shall be developed and implemented.	Health and Safety plan implementation records	Daily during construction phase	Benchmarks stated in Health and Safety Plan	EPC Contractor	REA-PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
construction activities	Community members and 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 for all workers.	Daily toolbox records	Daily during construction phase for workers and monthly for communities as part of engagement	Benchmarks stated in Health and Safety Plan	EPC Contractor		
	Onsite safety officer shall be engaged to monitor the compliance of workers to safety rules.	Qualified and dedicated safety officer	Once before commencement of construction	Adherence to measures	EPC Contractor		
	PPE such as safety boot, coverall, eye google, safety helmets, reflective vests, etc. shall be provided to construction workers and the level of PPE compliance shall be monitored.	Availability of PPE	Daily during construction phase	PPE compliance	EPC Contractor		
	Safety training focused on safe working practices, information on specific hazards, first aid and fire- fighting shall be included in the induction programme for workers.	Training records	Before commencement of construction and weekly	Certificates of completion of trainings	EPC Contractor		
	A mechanism procedure for receiving and addressing the concerns of workers shall be put in place and implemented.	Completed grievance forms	Weekly during construction phase	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Influx of infected workers to the community. Exposure to infectious diseases (e.g. COVID-19) during construction	The EPC contractor shall implement the NCDC “Guidelines for employers and businesses in Nigeria” during construction works.	Implementation of NCDC guidelines	Prior to operations	Adherence to measures	EPC Contractor	REA-PMU POE	
	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 control measures	Continuous during operations	Adherence to measures			
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during construction.	Policies and procedures	Continuous during operations	Adherence to measures			

Environmental management for Commissioning phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Increase in ambient noise level due to Plant testing	Strict compliance to the Standard Operating Procedures (SOPs) shall be ensured.	SOPs	Once before commissioning	Adherence to measures	EPC Contractor	REA - PMU POE	
	The EPC contractor shall develop Standard Operating Procedures (SOPs) for the operational phase of the Project	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		
	The Power Plant components shall be installed in line with the pre-established standards and as per manufacturer recommendations	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		

Social Management Measures for Commissioning Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Occupational health and safety hazards (e.g. injuries,	Plant testing shall be carried out by experienced personnel.	Qualified and dedicated Engineer	Once before commissioning	Adherence to measures	EPC Contractor	PMU – REA	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
electrocution, etc.) as a result of any wrong electrical connection.	Adequate PPE shall be worn	Availability of PPE	Once before commissioning	Adherence to measures	EPC Contractor	POE	
	Prior to the Plant commissioning, appropriate emergency equipment.	Availability of emergency response equipment	Once before commissioning	Adherence to measures	EPC Contractor		
Wrong electrical connection leading to explosion/fire	Plant testing shall be carried out by experienced personnel.	Qualified and dedicated Engineer	Once before commissioning	Adherence to measures	EPC Contractor	PMU – REA POE	

Environmental Management Measures 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	PMU – REA POE	
	Regular maintenance of diesel generators shall be ensured as required by the manufacturer	Inspection	Monthly during operations	Adherence to Measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Dust accumulation on the solar panels	A cleaning schedule shall be developed and implemented for cleaning the panels installed at the project site during operations	Inspection	Monthly during operations	Adherence to measures		University Staff	
	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			
Noise from diesel generators and inverters during power generation and evacuation	Inverters shall be maintained as per manufacturer's recommendations and operated as per original specifications.	Inspection	Monthly during operations	Adherence to measures			
	The diesel generators shall be operated with the soundproof covers.	Inspection	Monthly during operations	Adherence to measures			
	Project personnel shall use appropriate PPE (e.g. ear muffs) to reduce exposure to noise impact.	Inspection	Monthly during operations	Adherence to Measures			
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			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Routine Maintenance, Waste Generation and Disposal							
E-waste generation and Disposal	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	At induction of new staff, and in annual refresher training	Certificates of completion of trainings	O&M Contractor	REA PMU POE	
	E-wastes generated shall be stored in appropriate locations prior to recycling; consignment notes will be maintained	Waste consignment notes, waste receptacles on Site	Continuous during operations	Adherence to measures	O&M Contractor	University Staff	
	Waste receptacles shall be provided within a secured area for collection of solid waste.	Waste consignment notes, waste receptacles on Site	Weekly during construction phase	Adherence to measures	O&M Contractor		
Soil contamination from spilled fuel, used oil, spent batteries and inverters	Waste that cannot be reused or recycled shall be disposed of at an approved dumpsite. Spent batteries and inverters shall be sent to manufacturers in line with the Extended Producer Responsibility (EPR) policy.	Consignment notes for spent batteries to manufacturers for recycling	Yearly	EHS Guidelines	O&M Contractor	REA PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	WMP shall be implemented.	WMP implementation records	Quarterly during operation phase	Benchmarks stated in WMP EHS Guidelines	O&M Contractor	FMEnv	
	Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.	Inspection	Continuously during operations phase	Adherence to measures EHS Guidelines	O&M Contractor		
	Portable spill containment and clean-up kits shall be available onsite.	Availability of spill response equipment	Quarterly during operation phase	Functional spill equipment Adherence to measures	O&M Contractor		
	Operation workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Quarterly during operation	Certificates of completion of trainings	O&M Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
			phase				
Electric shock injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA PMU POE	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures	O&M Contractor	FME Env	
Groundwater abstraction from cleaning of PV panels	Water management / conservation plan shall be implemented	Implementation records of water management plan	Quarterly during operations	Benchmarks in water conservation plan EHS Guidelines	O&M Contractor	REA PMU POE FME Env	

Social Management Measures for Operational Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Power Generation and Evacuation							
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented during operations	Implementation by the O&M Contractor	Continuously during operations	Evidence to show implementation of EEP GBV action plan	O&M Contractor	REA PMU University	
	All workers shall be required to undergo regular training and refreshers on GBV	Organize regular on-site training and refreshers	Monthly during operation phase	Records of attendance	O&M Contractor	GBV/SEA service provider	
	All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of operations	Signed CoC forms	O&M Contractor	POE	
	GBV sensitive channels for reporting in GRM shall be implemented for the Project	Establish GRM reporting channels	Once before start of operations	GRM records of	O&M Contractor		
	Separate facilities for men and women will be provided	Erection of separate convenience facilities	Once before start of operations	Inspection of facilities to ensure adequacy	O&M Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Health, safety and welfare of staff during operation	Provision of medical insurance scheme for employees shall be ensured.	Employment forms of employees	Quarterly during operations	Adherence measures	O&M Contractor	REA PMU	
	Appropriate safety signage shall be placed at strategic locations within the site.	Safety signs	Quarterly during operations	Adherence measures	O&M Contractor	University	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence measures	O&M Contractor	POE	
	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 measures	O&M Contractor		
Exposure to infectious diseases (e.g. COVID- 19)	The O&M contractor shall implement the Nigeria Centre for Disease Control (NCDC) safety Guidelines during operations.	Implementation of NCDC guidelines	Prior to operations	Adherence measures	O&M Contractor	REA PMU	
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during operations	Hygiene facility and implementation of infection prevention measures	Continuous during operations	Adherence measures	O&M Contractor	University	
						POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	A risk assessment of the occupational exposure to infectious diseases during construction shall be conducted, and appropriate control mechanisms shall be implemented.	Conduct risk assessment and implement controls	Continuous during operations	Adherence to measures	O&M Contractor		
	The O&M contractor shall develop policies and procedures for the identification and isolation of people with symptoms, as well as testing where appropriate.	Implementation of policies and procedures	Continuous during operations	Adherence to measures	O&M Contractor		
Routine Maintenance, Waste Generation and Disposal							
Electric shock injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA-PMU	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures		POE	

Environmental Monitoring Programme

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

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 (\$)
Atmosphere (Air Quality & Noise)	Project Site Power evacuation route	Air Quality Monitoring Equipment Sound level meter	TSP, CO, NOX, SOX, Noise Level (dBA)	FMEnv/ WHO/ AfDB	Monthly monitoring; Monthly reporting	EPC Contractor	Construction Phase	
Groundwater Quality	Borehole within the University	Thermometer, Water sampler, Turbidity meter, pH meter, AAS etc.	Temperature, salinity, conductivity, DO, BOD, TOC, COD, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals, TSS and Turbidity	FMEnv/ WHO/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Soil	Unpaved sections of the Plant	Composite soil samples collection for laboratory analysis.	pH, Moisture, TOC, THC, TPH, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals.	NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Solid Waste	Operational areas	Monitor the handling and disposal of solid wastes generated onsite; waste tracking documentation.	Operational solid wastes including used packaging waste.	FMEnv/ NESREA/ AfDB	Monthly monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

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 (\$)
Health and Safety	Workers and Operational areas	Observe compliance to PPE and unsafe working conditions	Health and Safety Plan	FMEnv/ NESREA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Training	Workers	Observe compliance with existing training plan	Training plan and records	FMEnv/ NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
General Housekeeping	Construction sheds and operational areas	Observe cleanliness and aesthetics of Plant	Cleanliness and aesthetics of Plant	FMEnv/ NESREA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Stakeholder Engagement	Local community Regulatory agencies	Observe evidence of stakeholder consultations	Stakeholder Engagement Plan	FMEnv/ NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

4.4.Environmental and Social Management Plan for Federal University Akure, Ondo State

Environmental Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
		Site Clearing and Preparation					
Vegetation loss; direct impacts on vegetation and soil-dwelling organisms; indirect impacts on fauna species	Vegetation clearing shall be limited to the areas within the site needed for the Project.	Inspection	Daily	Adherence to measures	EPC Contractor	REA (PMU) POE (Site Engineer)	
	Use of herbicides for clearing shall be avoided. Site clearing and preparation shall be done mechanically.						
	Bush burning shall be avoided.	Inspection	Daily	Adherence to measures			
	Any cleared areas which are not used will be re- vegetated using plants or seeds of locally occurring species.	Inspection	Monthly	Revegetated land			
	The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited.	Inspection	Monthly	Adherence to measures			
Hunting or deliberate killing of animals by workers shall be prohibited and monitored.	Inspection	Daily	Adherence to measures				

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Workers shall be sensitized on ecological protection						
Removal of topsoil and soil compaction; loss of top soil; increased erosion potential; reduction in structural stability and percolative ability of soil	Removal of vegetation and soil cover shall be restricted to the areas required for the Project. Soil conservation measures shall be implemented such as stockpiling topsoil or for the remediation of disturbed areas.	Inspection	Daily	Revegetated land			
	Use of silt traps or similar systems to reduce discharge of silt shall be ensured.	Inspection	Monthly	Adherence to measures			
Air quality impacts due to emission from site clearing equipment; increase in ambient noise levels	Site clearing equipment / machinery shall be operated and maintained under optimum fuel- efficient conditions.	Maintenance records; Fuel consumption records	Daily	Adherence to measures			
	Site clearing activities shall be carried out only during the daytime (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr)	Inspection	Daily	Adherence to measures			
Mobilization of Materials and Equipment to Site							
Air quality impacts from vehicular emissions;	Project vehicles with efficient engine performance and with minimal noise and air emissions shall be selected and used.	Inspection; Maintenance records	Once before vehicle	Adherence to measures	EPC Contractor	REA (PMU) POE (Site)	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Increase in ambient noise	This can be achieved through regular servicing and maintenance		commences journey			Engineer)	
	All materials with potential to result in dust emissions shall be covered during transport.	Inspection	Once before vehicle commences journey	Adherence to measures	EPC Contractor		
	Site roads and access roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Onsite vehicle speed on unhardened roads and surfaces shall be limited to about 15 – 20km/h so as to reduce dust generation.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Unnecessary engine idling shall be avoided.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Site roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		

Social Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Selection							
Loss of farmlands	Resettlement Action Plan (RAP/aRAP) shall be developed and implemented (in consistent with the requirements of OS 2, Involuntary Resettlement) to restore livelihood of the affected persons.	OS2, Involuntary Resettlement	Prior mobilization to site / site clearing and construction	Involuntary Resettlement (OS2)	FUTA Management	REA (PMU)	
	The affected persons shall be allowed to harvest their crops before commencement of construction activities.	Notification of project development to the affected persons	Prior mobilization to site/ site clearing and construction	Adherence to measures			
	All affected students shall be provided with alternative land within the University campus to continue their farm demonstration activities.	Inspection	Prior mobilization to site / site clearing and construction	Adherence to measures			
	The commitment for the provision of alternative land for the affected personnel shall be documented in a letter signed by the University's Vice Chancellor.	Signed letter of commitment from FUTA management	Prior mobilization to site / site clearing and construction	Adherence to measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Selection							
			construction				
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 activities.	Implementation of NCDC guidelines	Prior to mobilization to site / site clearing and construction	Adherence to measures	EPC Contractor	REA (PMU)	
	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			
Mobilization of Materials and Equipment to Site							
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU)	
	Site clearing shall be limited to the daytime as much as possible.	Inspection	Daily	Daily time log	EPC Contractor	POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Selection							
	Unregistered labourers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		
Increase in vehicular movement and traffic including potential for road accident	A TMP shall be developed by the EPC contractor and implemented	TMP implementation records	Daily	Benchmarks stated in the TMP	EPC Contractor		
	Appropriate signage and safety measures (barrier, formalized crossing points) to reduce the risk of accidents in the Project area shall be provided.	Safety signs and barriers	Before and during mobilization	Adherence to measures	EPC Contractor		
	Drivers' competency shall be assessed and where required; appropriate training shall be provided.	Drivers' competency assessments; training records	Once before commencement of mobilization	Passing competency assessment or training completion certificates Driver's licence	EPC Contractor		
	A procedure for recording traffic incidents/accidents associated with the	Incident forms	Daily	Completed incident forms	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Selection							
	Project shall be developed and implemented.						
	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		
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU) POE	
	Unregistered laborers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		

Environmental Management Plan for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Air quality impacts due to emission from construction equipment; Increase in dust from cleared land and windblown stockpiles	Regular maintenance and servicing of construction equipment /machinery shall be ensured.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor	REA-PMU POE	
	Routine water sprinkling shall be carried out to minimize dust generation during construction.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		
Increase in noise level	Construction activities shall be limited to day- time (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr).	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU POE	
	Construction machinery shall be turned off when not in use.	Inspection	Daily during Construction phase	Adherence to measures	EPC Contractor		
	Construction equipment shall be properly maintained and serviced.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor		
	Noise complaints related to the construction activities shall be assessed and appropriately addressed.	Complaint records	Weekly during construction phase	GRM measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Noise monitoring at locations with persistent noise complaints shall be maintained.	Noise monitoring records	Monthly during construction phase	FME _{env} Noise limit	EPC Contractor		
	Machinery/equipment to be used for construction work shall meet industry best standard in relation to noise attenuation	Inspection	Before commencement of construction phase	Adherence to measures	EPC Contractor		
Increased soil erosion potential; reduction in structural stability and percolative ability of soil	Excavation works shall not be executed under aggressive weather conditions.	Inspection	Daily during excavation activities	Adherence to measures	EPC Contractor	REA-PMU POE	
	Stockpiles shall be appropriately covered to reduce soil loss as a result of wind or water erosion.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		
Loss of plant species as a result of introduction of alien plants; loss of fauna as a result of increased human activity and associated noise.	Construction workers shall be provided with appropriate training on ecological awareness, as appropriate to their work activities.	Training records	Once before start of construction phase	Certificates of Training	EPC Contractor	REA-PMU POE	
	All construction equipment shall be cleaned (mud and soil removed) at source before being brought to site to minimise introduction of alien species. If sand or other natural materials for building are required and brought onto site, the stored heaps will be monitored for the growth	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	and germination of alien species and will be regularly cleared during construction.						
	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		
Road damage, traffic and safety impacts	TMP shall be developed by the EPC Contractor and implemented.	TMP implementation records	Daily during construction phase	Benchmarks stated in the TMP	EPC Contractor	REA-PMU POE	
	Speed limits for all construction-related vehicles shall be established and enforced.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		
	Appropriate barriers and signage shall be provided to demarcate areas in which construction traffic is active.	Safety signs and barriers	Once before commencement of construction	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Drivers' competency shall be assessed and where required training shall be provided.	Drivers' competency assessments; training records	Once before commencement of construction	Passing of competency assessment or training completion certificates	EPC Contractor		
	A procedure for recording all construction related traffic incidents/accidents shall be developed and implemented.	Incident forms	Daily during construction phase	Completed incident forms	EPC Contractor		
	The EPC contractor shall promptly repair damage to public infrastructure and repair or compensate for damage to private property.	Incident forms, GRM	Daily during construction phase	Completed incident forms	EPC Contractor		
Waste Disposal and Generation							
E-waste generation	A Waste Management Plan has been developed (Annex 3) and shall be reviewed and implemented	Waste Management records	Weekly during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	POE	
	E-wastes generated shall be stored in appropriate locations prior to recycling and/or disposal	Waste consignment notes, waste receptacles on	Weekly during construction phase	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
		Site					
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 during construction phase	Adherence to measures	EPC Contractor	REA-PMU POE	
	Construction workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor		
Groundwater contamination of liquid construction waste streams.	Training shall be provided for workers on safe storage, use and handling of hazardous materials (e.g. fuel, lubricating oil) on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	REA-PMU	
	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 during construction phase	Adherence to measures	EPC Contractor	POE FMEnv	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Waste management plan (WMP) shall be implemented.	WMP implementation records	Daily during construction phase	Benchmarks stated in WMP	EPC Contractor		

Social Management Measures for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Discrimination during employment and training opportunities	Employment of workers for construction activities shall be open and fair. However, no person under the age of 18 shall be engaged on the project sites.	Employment records	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented for the Project	Implementation by the EPC Contractor	Once before start of construction	Evidence to show implementation of EEP GBV action plan	EPC Contractor	REA-PMU POE	
	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	FME Env	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	All workers on the project shall be required to sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of construction	Signed CoC forms	EPC Contractor	Federal Ministry of women affairs GBV/SEA service providers	
	GBV sensitive channels for reporting in GRM shall be implemented for the Project	Establish accessible GRM reporting channels	Monthly during construction	GRM records	EPC Contractor		
	The EPC Contractor shall be required to hire a Gender/ GBV officer	Employ GRM Officer	Once before start of construction	Employment records and job description	EPC Contractor		
	Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be ensured	Engagement of GBV service provider	Once before start of construction	Records of ongoing engagement and consultation 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 convenience	Once before start of construction	Inspection of facilities to ensure adequacy	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
		facilities and display of GBV signage					
Influx of people increase in sexual transmitted diseases	Construction workers (e.g. semi-skilled and unskilled craftsmen) shall be drawn from the local community as much as possible. and Labour management plan developed and implemented	Employment records and prepared labour management plan	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	
	An induction and sensitization programme including a Code of Conduct, 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 / fraternization with the local community.	Induction records and training on the code of conduct	Once before start of construction	Adherence to measures	EPC Contractor	FMEnv Federal Ministry of women affairs/	
	Awareness education about GBV/ SEA/ HIV/ AIDS and other sexually transmitted diseases shall be created among the workforce and local communities.	Training records	Once before start of construction	Adherence to measures	EPC Contractor	GBV/SEA service provider	
	Public access shall be restricted to construction area via security fencing and appropriate signage.	Inspection	As required	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	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 records	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	Monthly during construction phase	GRM Measures	EPC Contractor		
Injury to construction workers during construction activities	Health and Safety Plan shall be developed and implemented.	Health and Safety plan implementation records	Daily during construction phase	Benchmarks stated in Health and Safety Plan	EPC Contractor	REA-PMU POE	
	Community members and 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 for all workers.	Daily toolbox records	Daily during construction phase for workers and monthly for communities as part of engagement	Benchmarks stated in Health and Safety Plan	EPC Contractor		
	Onsite safety officer shall be engaged to monitor the compliance of workers to safety rules.	Qualified and dedicated safety officer	Once before commencement of construction	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	PPE such as safety boot, coverall, eye google, safety helmets, reflective vests, etc. shall be provided to construction workers and the level of PPE compliance shall be monitored.	Availability of PPE	Daily during construction phase	PPE compliance	EPC Contractor		
	Safety training focused on safe working practices, information on specific hazards, first aid and fire- fighting shall be included in the induction programme for workers.	Training records	Before commencement of construction and weekly	Certificates of completion of trainings	EPC Contractor		
	A mechanism procedure for receiving and addressing the concerns of workers shall be put in place and implemented.	Completed grievance forms	Weekly during construction phase	Adherence to measures	EPC Contractor		
Influx of infected workers to the community. Exposure to infectious diseases (e.g. COVID-19) during construction	The EPC contractor shall implement the NCDC “Guidelines for employers and businesses in Nigeria” during construction works.	Implementation of NCDC guidelines	Prior to operations	Adherence to measures	EPC Contractor	REA-PMU	
	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		POE	
	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 control	Continuous during operations	Adherence to measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
		measures					
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during construction.	Policies and procedures	Continuous during operations	Adherence to measures			

Environmental management for Commissioning phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Increase in ambient noise level due to Plant testing	Strict compliance to the Standard Operating Procedures (SOPs) shall be ensured.	SOPs	Once before commissioning	Adherence to measures	EPC Contractor	REA - PMU	
	The EPC contractor shall develop Standard Operating Procedures (SOPs) for the operational phase of the Project	SOPs	Once before commissioning	Adherence to measures	EPC Contractor	POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	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		

Social Management Measures for Commissioning Phase

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

Environmental Management Measures 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	PMU – REA POE University Staff	
	Regular maintenance of diesel generators shall be ensured as required by the manufacturer	Inspection	Monthly during operations	Adherence to Measures			
Dust accumulation on the solar panels	A cleaning schedule shall be developed and implemented for cleaning the panels installed at the project site during operations	Inspection	Monthly during operations	Adherence to measures	O&M Contractor	PMU – REA POE University Staff	
	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			
Noise from diesel generators and inverters during power generation and evacuation	Inverters shall be maintained as per manufacturer’s recommendations and operated as per original specifications.	Inspection	Monthly during operations	Adherence to measures	O&M Contractor	PMU – REA POE University Staff	
	The diesel generators shall be operated with the soundproof covers.	Inspection	Monthly during	Adherence to measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
			operations				
	Project personnel shall use appropriate PPE (e.g. ear muffs) to reduce exposure to noise impact.	Inspection	Monthly during operations	Adherence to Measures			
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			
Routine Maintenance, Waste Generation and Disposal							
E-waste generation and Disposal	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	At induction of new staff, and in annual refresher training	Certificates of completion of trainings	O&M Contractor	REA PMU POE	
	E-wastes generated shall be stored in appropriate locations prior to recycling; consignment notes will be maintained	Waste consignment notes, waste receptacles on Site	Continuous during operations	Adherence to measures	O&M Contractor	University Staff	
	Waste receptacles shall be provided within a secured area for collection of solid waste.	Waste consignment notes, waste receptacles on	Weekly during construction phase	Adherence to measures	O&M Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
		Site					
Soil contamination from spilled fuel, used oil, spent batteries and inverters	Waste that cannot be reused or recycled shall be disposed of at an approved dumpsite. Spent batteries and inverters shall be sent to manufacturers in line with the Extended Producer Responsibility (EPR) policy.	Consignment notes for spent batteries to manufacturers for recycling	Yearly	EHS Guidelines	O&M Contractor	REA PMU POE	
	WMP shall be implemented.	WMP implementation records	Quarterly during operation phase	Benchmarks stated in WMP EHS Guidelines	O&M Contractor	FMEnv	
	Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.	Inspection	Continuously during operations phase	Adherence to measures EHS Guidelines	O&M Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Portable spill containment and clean-up kits shall be available onsite.	Availability of spill response equipment	Quarterly during operation phase	Functional spill equipment Adherence to measures	O&M Contractor		
	Operation workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Quarterly during operation phase	Certificates of completion of trainings	O&M Contractor		
Electric shock injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA PMU POE FMEnv	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures	O&M Contractor		
Groundwater abstraction from cleaning of PV panels	Water management / conservation plan shall be implemented	Implementation records of water management plan	Quarterly during operations	Benchmarks in water conservation plan	O&M Contractor	REA PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
				EHS Guidelines		FMEEnv	

Social Management Measures for Operational Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Power Generation and Evacuation							
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented during operations	Implementation by the O&M Contractor	Continuously during operations	Evidence to show implementation of EEP GBV action plan	O&M Contractor	REA PMU University	
	All workers shall be required to undergo regular training and refreshers on GBV	Organize regular on-site training and refreshers	Monthly during	Records of attendance	O&M Contractor	GBV/SEA	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
			operation phase			service provider	
	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 forms for workers	CoC for start of operations	Once before start of operations	Signed forms	CoC Contractor	POE
	GBV sensitive channels for reporting in GRM shall be implemented for the Project	Establish reporting channels	GRM	Once before start of operations	GRM records	O&M Contractor	
	Separate facilities for men and women will be provided	Erection of separate convenience facilities		Once before start of 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 measures to	O&M Contractor	REA PMU
	Appropriate safety signage shall be placed at strategic locations within the site.	Safety signs		Quarterly during operations	Adherence measures to	O&M Contractor	University
	Strict compliance to the SOPs shall be ensured.	SOPs		Quarterly during operations	Adherence measures to	O&M Contractor	POE

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	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. COVID- 19)	The O&M contractor shall implement the Nigeria Centre for Disease Control (NCDC) safety Guidelines during operations.	Implementation of NCDC guidelines	Prior to operations	Adherence to measures	O&M Contractor	REA PMU University	
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during operations	Hygiene facility and implementation of infection prevention measures	Continuous during operations	Adherence to measures	O&M Contractor	POE	
	A risk assessment of the occupational exposure to infectious diseases during construction shall be conducted, and appropriate control mechanisms shall be implemented.	Conduct risk assessment and implement controls	Continuous during operations	Adherence to measures	O&M Contractor		
	The O&M contractor shall develop policies and procedures for the identification and isolation of people with symptoms, as well as testing where appropriate.	Implementation of policies and procedures	Continuous during operations	Adherence to measures	O&M Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Routine Maintenance, Waste Generation and Disposal							
Electric shock, injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA-PMU	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures		POE	

Environmental Monitoring Programme

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

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 (\$)
Atmosphere (Air Quality & Noise)	Project Site Power evacuation route	Air Quality Monitoring Equipment Sound level meter	TSP, CO, NOX, SOX, Noise Level (dBA)	FMEnv/ WHO/ AfDB	Monthly monitoring; Monthly reporting	EPC Contractor	Construction Phase	
Groundwater Quality	Borehole within the University	Thermometer, Water sampler, Turbidity meter, pH meter, AAS etc.	Temperature, salinity, conductivity, DO, BOD, TOC, COD, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals, TSS and Turbidity	FMEnv/ WHO/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Soil	Unpaved sections of the Plant	Composite soil samples collection for laboratory analysis.	pH, Moisture, TOC, THC, TPH, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals.	NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Solid Waste	Operational areas	Monitor the handling and disposal of solid wastes generated onsite; waste	Operational solid wastes including used packaging waste.	FMEnv/ NESREA/ AfDB	Monthly monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

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 (\$)
		tracking documentation.						
Health and Safety	Workers and Operational areas	Observe compliance to PPE and unsafe working conditions	Health and Safety Plan	FMEnv/ NESREA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Training	Workers	Observe compliance with existing training plan	Training plan and records	FMEnv/ NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
General Housekeeping	Construction sheds and operational areas	Observe cleanliness and aesthetics of Plant	Cleanliness and aesthetics of Plant	FMEnv/ NESREA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Stakeholder Engagement	Local community Regulatory agencies	Observe evidence of stakeholder consultations	Stakeholder Engagement Plan	FMEnv/ NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

4.5.Environmental and Social Management Plan for University Lafia

Environmental Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Clearing and Preparation							
Vegetation loss; direct impacts on vegetation and soil-dwelling organisms; indirect impacts on fauna species	Vegetation clearing shall be limited to the areas within the site needed for the Project.	Inspection	Daily	Adherence to measures	EPC Contractor	REA (PMU) POE (Site Engineer)	
	Use of herbicides for clearing shall be avoided. Site clearing and preparation shall be done mechanically.						
	Bush burning shall be avoided.	Inspection	Daily	Adherence to measures			
	Any cleared areas which are not used will be re- vegetated using plants or seeds of locally occurring species.	Inspection	Monthly	Revegetated land			
	The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited.	Inspection	Monthly	Adherence measures to			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Hunting or deliberate killing of animals by workers shall be prohibited and monitored. Workers shall be sensitized on ecological protection	Inspection	Daily	Adherence to measures			
Removal of topsoil and soil compaction; loss of topsoil; increased erosion potential; reduction in structural stability and percolative ability of soil	Removal of vegetation and soil cover shall be restricted to the areas required for the Project. Soil conservation measures shall be implemented such as stockpiling topsoil or for the remediation of disturbed areas. Use of silt traps or similar systems to reduce discharge of silt shall be ensured.	Inspection	Daily	Revegetated land			
Air quality impacts due to emission from site clearing equipment; increase in ambient noise levels	Site clearing equipment / machinery shall be operated and maintained under optimum fuel- efficient conditions.	Maintenance records; Fuel consumption records	Daily	Adherence to measures			
	Site clearing activities shall be carried out only during the daytime (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr)	Inspection	Daily	Adherence to measures			
Mobilization of Materials and Equipment to Site							

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Air quality impacts from vehicular emissions; Increase in ambient noise	Project vehicles with efficient engine performance and with minimal noise and air emissions shall be selected and used. This can be achieved through regular servicing and maintenance	Inspection; Maintenance records	Once before vehicle commences journey	Adherence to measures	EPC Contractor	REA (PMU) POE (Site Engineer)	
	All materials with potential to result in dust emissions shall be covered during transport.	Inspection	Once before vehicle commences journey	Adherence to measures	EPC Contractor		
	Site roads and access roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Onsite vehicle speed on unhardened roads and surfaces shall be limited to about 15 – 20km/h so as to reduce dust generation.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Unnecessary engine idling shall be avoided.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Site roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		

Social Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Selection							
Loss of farmlands	Resettlement Action Plan (RAP/aRAP) shall be developed and implemented (in consistent with the requirements of OS 2, Involuntary Resettlement) to restore livelihood of the affected persons.	OS 2, Involuntary Resettlement	2. Prior to site clearing and construction	Involuntary Resettlement (OS 2)	FULafia Management	REA (PMU)	
	The affected persons shall be allowed to harvest their crops before commencement of construction activities.	Notification of project development to the affected persons	Prior to site clearing and construction	Adherence to measures			
	All affected students shall be provided with alternative land within the University campus to continue their farm demonstration activities.	Inspection	Prior to site clearing and construction	Adherence to measures			
	The commitment for the provision of alternative land for the affected personnel shall be documented in a letter signed by the University's Vice Chancellor.	Signed letter of commitment from FULafia management	Prior to site clearing and construction	Adherence to measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
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 activities.	Implementation of NCDC guidelines	Prior to site / site clearing and construction	Adherence to measures	EPC Contractor	REA (PMU)	
	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 site / site clearing and construction	Adherence to measures			
Mobilization of Materials and Equipment to Site							
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU)	
	Site clearing shall be limited to the daytime as much as possible.	Inspection	Daily	Daily time log	EPC Contractor	POE	
	Unregistered labourers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Increase in vehicular movement and traffic including potential for road accident	A TMP shall be developed by the EPC contractor and implemented	TMP implementation records	Daily	Benchmarks stated in the TMP	EPC Contractor		
	Appropriate signage and safety measures (barrier, formalized crossing points) to reduce the risk of accidents in the Project area shall be provided.	Safety signs and barriers	Before and during mobilization	Adherence to measures	EPC Contractor		
	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 Driver's licence	EPC Contractor		
	A procedure for recording traffic incidents/accidents associated with the Project shall be developed and implemented.	Incident forms	Daily	Completed incident forms	EPC Contractor		
	Employee violations of speed limit and other traffic rules will result in disciplinary action ranging from warning to dismissal.	Incident forms, GRM	Daily	Completed incident forms	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU) POE	
	Unregistered laborers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		

Environmental Management Plan for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Air quality impacts due to emission from construction equipment;	Regular maintenance and servicing of construction equipment /machinery shall be ensured.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor	REA-PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Increase in dust from cleared land and windblown stockpiles	Routine water sprinkling shall be carried out to minimize dust generation during construction.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		
Increase in noise level	Construction activities shall be limited to day- time (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr).	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Construction machinery shall be turned off when not in use.	Inspection	Daily during Construction phase	Adherence to measures	EPC Contractor	POE	
	Construction equipment shall be properly maintained and serviced.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor		
	Noise complaints related to the construction activities shall be assessed and appropriately addressed.	Complaint records	Weekly during construction phase	GRM measures	EPC Contractor		
	Noise monitoring at locations with persistent noise complaints shall be maintained.	Noise monitoring records	Monthly during construction phase	FME _{env} Noise limit	EPC Contractor		
	Machinery/equipment to be used for construction work shall meet industry best standard in relation to noise attenuation	Inspection	Before commencement of construction	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
			phase				
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 during excavation activities	Adherence to measures	EPC Contractor	REA-PMU POE	
	Stockpiles shall be appropriately covered to reduce soil loss because of wind or water erosion.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		
Loss of plant species because of introduction of alien plants; loss of fauna because of increased human activity and associated noise.	Construction workers shall be provided with appropriate training on ecological awareness, as appropriate to their work activities.	Training records	Once before start of construction phase	Certificates of Training	EPC Contractor	REA-PMU POE	
	All construction equipment shall be cleaned (mud and soil removed) at source before being brought to site to minimise introduction of alien species. If sand or other natural materials for building are required and brought onto site, the stored heaps will be monitored for the growth and germination of alien species and will be regularly cleared during construction.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	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		
Road damage, traffic and safety impacts	TMP shall be developed by the EPC Contractor and implemented.	TMP implementation records	Daily during construction phase	Benchmarks stated in the TMP	EPC Contractor	REA-PMU POE	
	Speed limits for all construction-related vehicles shall be established and enforced.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		
	Appropriate barriers and signage shall be provided to demarcate areas in which construction traffic is active.	Safety signs and barriers	Once before commencement of construction	Adherence to measures	EPC Contractor		
	Drivers' competency shall be assessed and where required training shall be provided.	Drivers' competency assessments; training records	Once before commencement of construction	Passing of competency assessment or training completion certificates	EPC Contractor		
	A procedure for recording all construction related traffic incidents/accidents shall be developed and implemented.	Incident forms	Daily during construction phase	Completed incident forms	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	The EPC contractor shall promptly repair damage to public infrastructure and repair or compensate for damage to private property.	Incident forms, GRM	Daily during construction phase	Completed incident forms	EPC Contractor		
Waste Disposal and Generation							
E-waste generation	Waste Management Plan (Annex 3) shall be implemented	Waste Management records	Weekly during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	POE	
	E-wastes generated shall be stored in appropriate locations prior to recycling and/or disposal	Waste consignment notes, waste receptacles on Site	Weekly during construction phase	Adherence to measures	EPC Contractor		
Soil contamination from solid and liquid Construction waste streams.	Hazardous substances and materials shall be stored in appropriate locations with impervious hardstanding and adequate secondary containment. Portable spill containment and clean-up kits shall be available onsite.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Construction workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor		
Groundwater contamination of liquid construction waste streams.	Training shall be provided for workers on safe storage, use and handling of hazardous materials (e.g. fuel, lubricating oil) on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	REA-PMU	
	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 during construction phase	Adherence to measures	EPC Contractor	POE	
	Waste management plan (WMP) shall be implemented.	WMP implementation records	Daily during construction phase	Benchmarks stated in WMP	EPC Contractor	FMEnv	

Social Management Measures for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Discrimination during employment and training opportunities	Employment of workers for construction activities shall be open and fair. However, no person under the age of 18 shall be engaged on the project sites.	Employment records	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented for the Project	Implementation by the EPC Contractor	Once before start of construction	Evidence to show implementation of EEP GBV action plan	EPC Contractor	REA-PMU POE	
	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	FMEnv	
	All workers on the project shall be required to sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of construction	Signed CoC forms	EPC Contractor	Federal Ministry of women affairs	
	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	GBV/SEA	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	The EPC Contractor shall be required to hire a Gender/ GBV officer	Employ GRM Officer	Once before start of construction	Employment of records and job description	EPC Contractor	service providers	
	Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be ensured	Engagement of GBV service provider	Once before start of construction	Records of ongoing engagement and consultation 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 convenience facilities and display of GBV signage	Once before start of construction	Inspection of facilities to ensure adequacy	EPC Contractor		
Influx of people increase in sexual transmitted diseases.	Construction workers (e.g. semi-skilled and unskilled craftsmen) shall be drawn from the local community as much as possible. and Labour management plan developed and implemented	Employment records and prepare a labour management plan	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	An induction and sensitization programme, including a Code of Conduct 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 / fraternization with the local community.	Induction records and training on the code of conduct	Once before start of construction	Adherence to measures	EPC Contractor	FMEnv Federal Ministry of women affairs/	
	Awareness education about GBV/ SEA/ HIV/ AIDS and other sexually transmitted diseases shall be created among the workforce and local communities.	Training records	Once before start of construction	Adherence to measures	EPC Contractor	GBV/SEA service provider	
	Public access shall be restricted to construction area via security fencing and appropriate signage.	Inspection	As required	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 records	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	Monthly during construction phase	GRM Measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Injury to construction workers during construction activities	Health and Safety Plan shall be developed and implemented.	Health and Safety plan implementation records	Daily during construction phase	Benchmarks stated in Health and Safety Plan	EPC Contractor	REA-PMU POE	
	Community members and 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 for all workers.	Daily toolbox records	Daily during construction phase for workers and monthly for communities as part of engagement	Benchmarks stated in Health and Safety Plan	EPC Contractor		
	Onsite safety officer shall be engaged to monitor the compliance of workers to safety rules.	Qualified and dedicated safety officer	Once before commencement of construction	Adherence to measures	EPC Contractor		
	PPE such as safety boot, coverall, eye google, safety helmets, reflective vests, etc. shall be provided to construction workers and the level of PPE compliance shall be monitored.	Availability of PPE	Daily during construction phase	PPE compliance	EPC Contractor		
	Safety training focused on safe working practices, information on specific hazards, first aid and fire- fighting shall be included in the induction programme for workers.	Training records	Before commencement of construction and weekly	Certificates of completion of trainings	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	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		
Influx of infected workers to the community. Exposure to infectious diseases (e.g. COVID-19) during construction	The EPC contractor shall implement the NCDC “Guidelines for employers and businesses in Nigeria” during construction works.	Implementation of NCDC guidelines	Prior to operations	Adherence to measures	EPC Contractor	REA-PMU POE	
	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 control measures	Continuous during operations	Adherence to measures			
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during construction.	Policies and procedures	Continuous during operations	Adherence to measures			

Environmental management for Commissioning phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Increase in ambient noise level due to Plant testing	Strict compliance to the Standard Operating Procedures (SOPs) shall be ensured.	SOPs	Once before commissioning	Adherence to measures	EPC Contractor	REA - PMU POE	
	The EPC contractor shall develop Standard Operating Procedures (SOPs) for the operational phase of the Project	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		
	The Power Plant components shall be installed in line with the pre-established standards and as per manufacturer recommendations	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		

Social Management Measures for Commissioning Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Occupational health and safety hazards (e.g. injuries, electrocution, etc.) as	Plant testing shall be carried out by experienced personnel.	Qualified and dedicated Engineer	Once before commissioning	Adherence to measures	EPC Contractor	PMU – REA POE	
	Adequate PPE shall be worn	Availability of PPE	Once before commissioning	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
a result of any wrong electrical connection.	Prior to the Plant commissioning, appropriate emergency equipment.	Availability of emergency response equipment	Once before commissioning	Adherence to measures	EPC Contractor		
Wrong electrical connection leading to explosion/fire	Plant testing shall be carried out by experienced personnel.	Qualified and dedicated Engineer	Once before commissioning	Adherence to measures	EPC Contractor	PMU – REA POE	

Environmental Management Measures 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	PMU – REA POE	
	Regular maintenance of diesel generators shall be ensured as required by the manufacturer	Inspection	Monthly during operations	Adherence to Measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Dust accumulation on the solar panels	A cleaning schedule shall be developed and implemented for cleaning the panels installed at the project site during operations	Inspection	Monthly during operations	Adherence to measures		University Staff	
	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			
Noise from diesel generators and inverters during power generation and evacuation	Inverters shall be maintained as per manufacturer's recommendations and operated as per original specifications.	Inspection	Monthly during operations	Adherence to measures			
	The diesel generators shall be operated with the soundproof covers.	Inspection	Monthly during operations	Adherence to measures			
	Project personnel shall use appropriate PPE (e.g. ear muffs) to reduce exposure to noise impact.	Inspection	Monthly during operations	Adherence to Measures			
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			
Routine Maintenance, Waste Generation and Disposal							

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
E-waste generation and Disposal	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	At induction of new staff, and in annual refresher training	Certificates of completion of trainings	O&M Contractor	REA PMU POE	
	E-wastes generated shall be stored in appropriate locations prior to recycling; consignment notes will be maintained	Waste consignment notes, waste receptacles on Site	Continuous during operations	Adherence to measures	O&M Contractor	University Staff	
	Waste receptacles shall be provided within a secured area for collection of solid waste.	Waste consignment notes, waste receptacles on Site	Weekly during construction phase	Adherence to measures	O&M Contractor		
Soil contamination from spilled fuel, used oil, spent batteries and inverters	Waste that cannot be reused or recycled shall be disposed of at an approved dumpsite. Spent batteries and inverters shall be sent to manufacturers in line with the Extended Producer Responsibility (EPR) policy.	Consignment notes for spent batteries to manufacturers for recycling	Yearly	EHS Guidelines	O&M Contractor	REA PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	WMP shall be implemented.	WMP implementation records	Quarterly during operation phase	Benchmarks stated in WMP EHS Guidelines	O&M Contractor	FMEnv	
	Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.	Inspection	Continuously during operations phase	Adherence to measures EHS Guidelines	O&M Contractor		
	Portable spill containment and clean-up kits shall be available onsite.	Availability of spill response equipment	Quarterly during operation phase	Functional spill equipment Adherence to measures	O&M Contractor		
	Operation workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Quarterly during operation phase	Certificates of completion of trainings	O&M Contractor		
	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during	Adherence to measures	O&M Contractor	REA PMU	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Electric shock, injuries to personnel during maintenance	Strict compliance to the SOPs shall be ensured.	SOPs	operations Quarterly during operations	Adherence to measures	O&M Contractor	POE FMEnv	
Groundwater abstraction from cleaning of PV panels	Water management / conservation plan shall be implemented	Implementation records of water management plan	Quarterly during operations	Benchmarks in water conservation plan EHS Guidelines	O&M Contractor	REA PMU POE FMEnv	

Social Management Measures for Operational Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Power Generation and Evacuation							
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented during operations	Implementation by the O&M Contractor	Continuously during operations	Evidence to show implementation of EEP GBV action plan	O&M Contractor	REA PMU University	
	All workers shall be required to undergo regular training and refreshers on GBV	Organize regular on-site training and refreshers	Monthly during operation phase	Records of attendance	O&M Contractor	GBV/SEA service provider	
	All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of operations	Signed CoC forms	O&M Contractor	POE	
	GBV sensitive channels for reporting in GRM shall be implemented for the Project	Establish GRM reporting channels	Once before start of operations	GRM records of	O&M Contractor		
	Separate facilities for men and women will be provided	Erection of separate convenience facilities	Once before start of operations	Inspection of facilities to ensure adequacy	O&M Contractor		
Health, safety and welfare of staff	Provision of medical insurance scheme for employees shall be ensured.	Employment forms of employees	Quarterly during operations	Adherence to measures	O&M Contractor	REA PMU	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
during operation	Plant	Appropriate safety signage shall be placed at strategic locations within the site.	Safety signs	Quarterly during operations	Adherence measures	O&M Contractor	University POE
		Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence measures	O&M Contractor	
		A grievance mechanism procedure for receiving and addressing the concerns of employee shall be put in place and implemented.	Completed grievance forms	Monthly during operations	Adherence measures	O&M Contractor	
Exposure to infectious diseases (e.g. COVID- 19)		The O&M contractor shall implement the Nigeria Centre for Disease Control (NCDC) safety Guidelines during operations.	Implementation of NCDC guidelines	Prior to operations	Adherence measures	O&M Contractor	REA PMU University POE
		Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during operations	Hygiene facility and implementation of infection prevention measures	Continuous during operations	Adherence measures	O&M Contractor	
		A risk assessment of the occupational exposure to infectious diseases during construction shall be conducted, and	Conduct risk assessment and implement	Continuous during operations	Adherence measures	O&M Contractor	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	appropriate control mechanisms shall be implemented.	controls					
	The O&M contractor shall develop policies and procedures for the identification and isolation of people with symptoms, as well as testing where appropriate.	Implementation of policies and procedures	Continuous during operations	Adherence to measures	O&M Contractor		
Routine Maintenance, Waste Generation and Disposal							
Electric shock injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA-PMU	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures		POE	

Environmental Monitoring Programme

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

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 (\$)
Atmosphere (Air Quality & Noise)	Project Site Power evacuation route	Air Quality Monitoring Equipment Sound level meter	TSP, CO, NOX, SOX, Noise Level (dBA)	FMEnv/WHO/ AfDB	Monthly monitoring; Monthly reporting	EPC Contractor	Construction Phase	
Groundwater Quality	Borehole within the University	Thermometer, Water sampler, Turbidity meter, pH meter, AAS etc.	Temperature, salinity, conductivity, DO, BOD, TOC, COD, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals, TSS and Turbidity	FMEnv/WHO/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Soil	Unpaved sections of the Plant	Composite soil samples collection for laboratory analysis.	pH, Moisture, TOC, THC, TPH, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals.	NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Solid Waste	Operational areas	Monitor the handling and disposal of solid wastes generated onsite; waste	Operational solid wastes including used packaging waste.	FMEnv/NESREA/ AfDB	Monthly monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

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 (\$)
		tracking documentation.						
Health and Safety	Workers and Operational areas	Observe compliance to PPE and unsafe working conditions	Health and Safety Plan	FMEnv/NESR/EA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Training	Workers	Observe compliance with existing training plan	Training plan and records	FMEnv/NESR/EA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
General Housekeeping	Construction sheds and operational areas	Observe cleanliness and aesthetics of Plant	Cleanliness and aesthetics of Plant	FMEnv/NESR/EA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Stakeholder Engagement	Local community Regulatory agencies	Observe evidence of stakeholder consultations	Stakeholder Engagement Plan	FMEnv/NESR/EA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

4.6.Environmental and Social Management Plan for University of Uyo

Environmental Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Clearing and Preparation							
Vegetation loss; direct impacts on vegetation and soil-dwelling organisms; indirect impacts on fauna species	Vegetation clearing shall be limited to the areas within the site needed for the Project.	Inspection	Daily	Adherence to measures	EPC Contractor	REA (PMU) POE (Site Engineer)	
	Use of herbicides for clearing shall be avoided. Site clearing and preparation shall be done mechanically.						
	Bush burning shall be avoided.	Inspection	Daily	Adherence to measures			
	Any cleared areas which are not used will be re- vegetated using plants or seeds of locally occurring species.	Inspection	Monthly	Revegetated land			
	The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited.	Inspection	Monthly	Adherence measures to			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Hunting or deliberate killing of animals by workers shall be prohibited and monitored. Workers shall be sensitized on ecological protection	Inspection	Daily	Adherence to measures			
Removal of topsoil and soil compaction; loss of top soil; increased erosion potential; reduction in structural stability and percolative ability of soil	Removal of vegetation and soil cover shall be restricted to the areas required for the Project. Soil conservation measures shall be implemented such as stockpiling topsoil or for the remediation of disturbed areas. Use of silt traps or similar systems to reduce discharge of silt shall be ensured.	Inspection	Daily	Revegetated land			
Air quality impacts due to emission from site clearing equipment; increase in ambient noise levels	Site clearing equipment / machinery shall be operated and maintained under optimum fuel- efficient conditions.	Maintenance records; Fuel consumption records	Daily	Adherence to measures			
	Site clearing activities shall be carried out only during the daytime (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr)	Inspection	Daily	Adherence to measures			
Mobilization of Materials and Equipment to Site							

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Air quality impacts from vehicular emissions; Increase in ambient noise	Project vehicles with efficient engine performance and with minimal noise and air emissions shall be selected and used. This can be achieved through regular servicing and maintenance	Inspection; Maintenance records	Once before vehicle commences journey	Adherence to measures	EPC Contractor	REA (PMU) POE (Site Engineer)	
	All materials with potential to result in dust emissions shall be covered during transport.	Inspection	Once before vehicle commences journey	Adherence to measures	EPC Contractor		
	Site roads and access roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Onsite vehicle speed on unhardened roads and surfaces shall be limited to about 15 – 20km/h so as to reduce dust generation.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Unnecessary engine idling shall be avoided.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Site roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		

Social Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Selection							
Loss of farmlands	Resettlement Action Plan (RAP/aRAP) shall be developed and implemented (in consistent with the requirements of OS 2, Involuntary Resettlement) to restore livelihood of the affected persons.	OS2, Involuntary Resettlement	Prior to mobilization to site / site clearing and construction	Involuntary Resettlement (OS 2)	UniUyo Management	REA (PMU)	
	The affected persons shall be allowed to harvest their crops before commencement of construction activities.	Notification of project development to the affected persons	Prior to mobilization to site/ site clearing and construction	Adherence to 100 measures			
	All affected students shall be provided with alternative land within the University campus to continue their farm demonstration activities.	Inspection	Prior to mobilization to site / site clearing and construction	Adherence to measures			
	The commitment for the provision of alternative land for the affected personnel shall be documented in a letter signed by the University's Vice Chancellor.	Signed letter of commitment from UniUyo management	Prior to mobilization to site / site clearing and construction	Adherence to measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
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 activities.	Implementation of NCDC guidelines	Prior to site / site clearing and construction	Adherence to measures	EPC Contractor	REA (PMU)	
	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 site / site clearing and construction	Adherence to measures			
Mobilization of Materials and Equipment to Site							
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU)	3,500
	Site clearing shall be limited to the daytime as much as possible.	Inspection	Daily	Daily time log	EPC Contractor	POE	
	Unregistered labourers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Increase in vehicular movement and traffic including potential for road accident	A TMP shall be developed by the EPC contractor and implemented	TMP implementation records	Daily	Benchmarks stated in the TMP	EPC Contractor		
	Appropriate signage and safety measures (barrier, formalized crossing points) to reduce the risk of accidents in the Project area shall be provided.	Safety signs and barriers	Before and during mobilization	Adherence to measures	EPC Contractor		
	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 Driver's licence	EPC Contractor		
	A procedure for recording traffic incidents/accidents associated with the Project shall be developed and implemented.	Incident forms	Daily	Completed incident forms	EPC Contractor		
	Employee violations of speed limit and other traffic rules will result in disciplinary action ranging from warning to dismissal.	Incident forms, GRM	Daily	Completed incident forms	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU) POE	
	Unregistered laborers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		

Environmental Management Plan for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Air quality impacts due to emission from construction equipment;	Regular maintenance and servicing of construction equipment /machinery shall be ensured.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor	REA-PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Increase in dust from cleared land and windblown stockpiles	Routine water sprinkling shall be carried out to minimize dust generation during construction.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		
Increase in noise level	Construction activities shall be limited to day- time (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr).	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Construction machinery shall be turned off when not in use.	Inspection	Daily during Construction phase	Adherence to measures	EPC Contractor	POE	
	Construction equipment shall be properly maintained and serviced.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor		
	Noise complaints related to the construction activities shall be assessed and appropriately addressed.	Complaint records	Weekly during construction phase	GRM measures	EPC Contractor		
	Noise monitoring at locations with persistent noise complaints shall be maintained.	Noise monitoring records	Monthly during construction phase	FMEnv Noise limit	EPC Contractor		
	Machinery/equipment to be used for construction work shall meet industry best standard in relation to noise attenuation		Inspection	Before commencement of construction	Adherence to measures	EPC Contractor	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
			phase				
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 during excavation activities	Adherence to measures	EPC Contractor	REA-PMU	
	Stockpiles shall be appropriately covered to reduce soil loss as a result of wind or water erosion.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor	POE	
Loss of plant species as a result of introduction of alien plants; loss of fauna as a result of increased human activity and associated noise.	Construction workers shall be provided with appropriate training on ecological awareness, as appropriate to their work activities.	Training records	Once before start of construction phase	Certificates of Training	EPC Contractor	REA-PMU	
	All construction equipment shall be cleaned (mud and soil removed) at source before being brought to site to minimise introduction of alien species. If sand or other natural materials for building are required and brought onto site, the stored heaps will be monitored for the growth and germination of alien species and will be regularly cleared during construction.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	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		
Road damage, traffic and safety impacts	TMP shall be developed by the EPC Contractor and implemented.	TMP implementation records	Daily during construction phase	Benchmarks stated in the TMP	EPC Contractor	REA-PMU POE	
	Speed limits for all construction-related vehicles shall be established and enforced.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		
	Appropriate barriers and signage shall be provided to demarcate areas in which construction traffic is active.	Safety signs and barriers	Once before commencement of construction	Adherence to measures	EPC Contractor		
	Drivers' competency shall be assessed and where required training shall be provided.	Drivers' competency assessments; training records	Once before commencement of construction	Passing of competency assessment or training completion certificates	EPC Contractor		
	A procedure for recording all construction related traffic incidents/accidents shall be developed and implemented.	Incident forms	Daily during construction phase	Completed incident forms	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	The EPC contractor shall promptly repair damage to public infrastructure and repair or compensate for damage to private property.	Incident forms, GRM	Daily during construction phase	Completed incident forms	EPC Contractor		
Waste Disposal and Generation							
E-waste generation	A Waste Management Plan shall be developed/ updated and implemented	Waste Management records	Weekly during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	POE	
	E-wastes generated shall be stored in appropriate locations prior to recycling and/or disposal	Waste consignment notes, waste receptacles on Site	Weekly during construction phase	Adherence to measures	EPC Contractor		
Soil contamination from solid and liquid construction waste streams.	Hazardous substances and materials shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Portable spill containment and clean-up kits shall be available onsite.					POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Construction workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor		
Groundwater contamination of liquid construction waste streams.	Training shall be provided for workers on safe storage, use and handling of hazardous materials (e.g. fuel, lubricating oil) on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	REA-PMU	
	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 during construction phase	Adherence to measures	EPC Contractor	POE	
	Waste management plan (WMP) shall be developed/ updated and implemented.	WMP implementation records	Daily during construction phase	Benchmarks stated in WMP	EPC Contractor	FMEnv	

Social Management Measures for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Discrimination during employment and training opportunities	Employment of workers for construction activities shall be open and fair. However, no person under the age of 18 shall be engaged on the project sites.	Employment records	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented for the Project	Implementation by the EPC Contractor	Once before start of construction	Evidence to show implementation of EEP GBV action plan	EPC Contractor	REA-PMU POE	
	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	FMEnv	
	All workers on the project shall be required to sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of construction	Signed CoC forms	EPC Contractor	Federal Ministry of women affairs	
	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	GBV/SEA	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	The EPC Contractor shall be required to hire a Gender/ GBV officer	Employ GRM Officer	Once before start of construction	Employment records and job description	EPC Contractor	service providers	
	Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be ensured	Engagement of GBV service provider	Once before start of construction	Records of ongoing engagement and consultation 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 convenience facilities and display of GBV signage	Once before start of construction	Inspection of facilities to ensure adequacy	EPC Contractor		
Influx of people increase in sexual transmitted diseases.	Construction workers (e.g. semi-skilled and unskilled craftsmen) shall be drawn from the local community as much as possible. and Labour management plan developed and implemented	Employment records and prepare a labour management plan	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	An induction and sensitization programme, including a Code of Conduct 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 / fraternization with the local community.	Induction records and training on the code of conduct	Once before start of construction	Adherence to measures	EPC Contractor	FMEnv Federal Ministry of women affairs/	
	Awareness education about GBV/ SEA/ HIV/ AIDS and other sexually transmitted diseases shall be created among the workforce and local communities.	Training records	Once before start of construction	Adherence to measures	EPC Contractor	GBV/SEA service provider	
	Public access shall be restricted to construction area via security fencing and appropriate signage.	Inspection	As required	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 records	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	Monthly during construction phase	GRM Measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Injury to construction workers during construction activities	Health and Safety Plan shall be developed and implemented.	Health and Safety plan implementation records	Daily during construction phase	Benchmarks stated in Health and Safety Plan	EPC Contractor	REA-PMU POE	
	Community members and 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 for all workers.	Daily toolbox records	Daily during construction phase for workers and monthly for communities as part of engagement	Benchmarks stated in Health and Safety Plan	EPC Contractor		
	Onsite safety officer shall be engaged to monitor the compliance of workers to safety rules.	Qualified and dedicated safety officer	Once before commencement of construction	Adherence to measures	EPC Contractor		
	PPE such as safety boot, coverall, eye google, safety helmets, reflective vests, etc. shall be provided to construction workers and the level of PPE compliance shall be monitored.	Availability of PPE	Daily during construction phase	PPE compliance	EPC Contractor		
	Safety training focused on safe working practices, information on specific hazards, first aid and fire- fighting shall be included in the induction programme for workers.	Training records	Before commencement of construction and weekly	Certificates of completion of trainings	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	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		
Influx of infected workers to the community. Exposure to infectious diseases (e.g. COVID-19) during construction	The EPC contractor shall implement the NCDC “Guidelines for employers and businesses in Nigeria” during construction works.	Implementation of NCDC guidelines	Prior to operations	Adherence to measures	EPC Contractor	REA-PMU POE	
	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 control measures	Continuous during operations	Adherence to measures			
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during construction.	Policies and procedures	Continuous during operations	Adherence to measures			

Environmental management for Commissioning phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Increase in ambient noise level due to Plant testing	Strict compliance to the Standard Operating Procedures (SOPs) shall be ensured.	SOPs	Once before commissioning	Adherence to measures	EPC Contractor	REA - PMU POE	
	The EPC contractor shall develop Standard Operating Procedures (SOPs) for the operational phase of the Project	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		
	The Power Plant components shall be installed in line with the pre-established standards and as per manufacturer recommendations	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		

Social Management Measures for Commissioning Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Occupational health and safety hazards (e.g. injuries, electrocution, etc.) as	Plant testing shall be carried out by experienced personnel.	Qualified and dedicated Engineer	Once before commissioning	Adherence to measures	EPC Contractor	PMU – REA POE	
	Adequate PPE shall be worn	Availability of PPE	Once before commissioning	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
a result of any wrong electrical connection.	Prior to the Plant commissioning, appropriate emergency equipment.	Availability of emergency response equipment	Once before commissioning	Adherence to measures	EPC Contractor		
Wrong electrical connection leading to explosion/fire	Plant testing shall be carried out by experienced personnel.	Qualified and dedicated Engineer	Once before commissioning	Adherence to measures	EPC Contractor	PMU – REA POE	

Environmental Management Measures 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	PMU – REA POE	
	Regular maintenance of diesel generators shall be ensured as required by the manufacturer	Inspection	Monthly during operations	Adherence to Measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Dust accumulation on the solar panels	A cleaning schedule shall be developed and implemented for cleaning the panels installed at the project site during operations	Inspection	Monthly during operations	Adherence to measures		University Staff	
	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			
Noise from diesel generators and inverters during power generation and evacuation	Inverters shall be maintained as per manufacturer's recommendations and operated as per original specifications.	Inspection	Monthly during operations	Adherence to measures			
	The diesel generators shall be operated with the soundproof covers.	Inspection	Monthly during operations	Adherence to measures			
	Project personnel shall use appropriate PPE (e.g. ear muffs) to reduce exposure to noise impact.	Inspection	Monthly during operations	Adherence to Measures			
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			
Routine Maintenance, Waste Generation and Disposal							

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
E-waste generation and Disposal	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	At induction of new staff, and in annual refresher training	Certificates of completion of trainings	O&M Contractor	REA PMU POE	
	E-wastes generated shall be stored in appropriate locations prior to recycling; consignment notes will be maintained	Waste consignment notes, waste receptacles on Site	Continuous during operations	Adherence to measures	O&M Contractor	University Staff	
	Waste receptacles shall be provided within a secured area for collection of solid waste.	Waste consignment notes, waste receptacles on Site	Weekly during construction phase	Adherence to measures	O&M Contractor		
Soil contamination from spilled fuel, used oil, spent batteries and inverters	Waste that cannot be reused or recycled shall be disposed of at an approved dumpsite. Spent batteries and inverters shall be sent to manufacturers in line with the Extended Producer Responsibility (EPR) policy.	Consignment notes for spent batteries to manufacturers for recycling	Yearly	EHS Guidelines	O&M Contractor	REA PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	WMP shall be implemented.	WMP implementation records	Quarterly during operation phase	Benchmarks stated in WMP EHS Guidelines	O&M Contractor	FMEnv	
	Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.	Inspection	Continuously during operations phase	Adherence to measures EHS Guidelines	O&M Contractor		
	Portable spill containment and clean-up kits shall be available onsite.	Availability of spill response equipment	Quarterly during operation phase	Functional spill equipment Adherence to measures	O&M Contractor		
	Operation workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Quarterly during operation phase	Certificates of completion of trainings	O&M Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Electric shock, injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA PMU POE	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures	O&M Contractor	FMEEnv	
Groundwater abstraction from cleaning of PV panels	Water management / conservation plan shall be implemented	Implementation records of water management plan	Quarterly during operations	Benchmarks in water conservation plan EHS Guidelines	O&M Contractor	REA PMU POE FMEEnv	

Social Management Measures for Operational Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Power Generation and Evacuation							
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented during operations	Implementation by the O&M Contractor	Continuously during operations	Evidence to show implementation of EEP GBV action plan	O&M Contractor	REA PMU University	
	All workers shall be required to undergo regular training and refreshers on GBV	Organize regular on-site training and refreshers	Monthly during operation phase	Records of attendance	O&M Contractor	GBV/SEA service provider	
	All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of operations	Signed CoC forms	O&M Contractor	POE	
	GBV sensitive channels for reporting in GRM shall be implemented for the Project	Establish GRM reporting channels	Once before start of operations	GRM records of	O&M Contractor		
	Separate facilities for men and women will be provided	Erection of separate convenience facilities	Once before start of operations	Inspection of facilities to ensure adequacy	O&M Contractor		
Health, safety and welfare of staff	Provision of medical insurance scheme for employees shall be ensured.	Employment forms of employees	Quarterly during operations	Adherence to measures	O&M Contractor	REA PMU	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
during operation	Plant	Appropriate safety signage shall be placed at strategic locations within the site.	Safety signs	Quarterly during operations	Adherence measures	O&M Contractor	University POE
		Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence measures	O&M Contractor	
		A grievance mechanism procedure for receiving and addressing the concerns of employee shall be put in place and implemented.	Completed grievance forms	Monthly during operations	Adherence measures	O&M Contractor	
Exposure to infectious diseases (e.g. COVID- 19)		The O&M contractor shall implement the Nigeria Centre for Disease Control (NCDC) safety Guidelines during operations.	Implementation of NCDC guidelines	Prior to operations	Adherence measures	O&M Contractor	REA PMU University POE
		Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during operations	Hygiene facility and implementation of infection prevention measures	Continuous during operations	Adherence measures	O&M Contractor	
		A risk assessment of the occupational exposure to infectious diseases during construction shall be conducted, and	Conduct risk assessment and implement	Continuous during operations	Adherence measures	O&M Contractor	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	appropriate control mechanisms shall be implemented.	controls					
	The O&M contractor shall develop policies and procedures for the identification and isolation of people with symptoms, as well as testing where appropriate.	Implementation of policies and procedures	Continuous during operations	Adherence to measures	O&M Contractor		
Routine Maintenance, Waste Generation and Disposal							
Electric shock injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA-PMU	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures		POE	

Environmental Monitoring Programme

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

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 (\$)
Atmosphere (Air Quality & Noise)	Project Site Power evacuation route	Air Quality Monitoring Equipment Sound level meter	TSP, CO, NOX, SOX, Noise Level (dBA)	FMEnv/ WHO/ AfDB	Monthly monitoring; Monthly reporting	EPC Contractor	Construction Phase	
Groundwater Quality	Borehole within the University	Thermometer, Water sampler, Turbidity meter, pH meter, AAS etc.	Temperature, salinity, conductivity, DO, BOD, TOC, COD, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals, TSS and Turbidity	FMEnv/ WHO/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Soil	Unpaved sections of the Plant	Composite soil samples collection for laboratory analysis.	pH, Moisture, TOC, THC, TPH, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals.	NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Solid Waste	Operational areas	Monitor the handling and disposal of solid wastes generated onsite; waste	Operational solid wastes including used packaging waste.	FMEnv/ NESREA/ AfDB	Monthly monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

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 (\$)
		tracking documentation.						
Health and Safety	Workers and Operational areas	Observe compliance to PPE and unsafe working conditions	Health and Safety Plan	FMEnv/ NESREA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Training	Workers	Observe compliance with existing training plan	Training plan and records	FMEnv/ NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
General Housekeeping	Construction sheds and operational areas	Observe cleanliness and aesthetics of Plant	Cleanliness and aesthetics of Plant	FMEnv/ NESREA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Stakeholder Engagement	Local community Regulatory agencies	Observe evidence of stakeholder consultations	Stakeholder Engagement Plan	FMEnv/ NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

4.7.Environmental and Social Management Plan for Federal University of Technology, Owerri

Environmental Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Clearing and Preparation							
Vegetation loss; direct impacts on vegetation and soil-dwelling organisms; indirect impacts on fauna species	Vegetation clearing shall be limited to the areas within the site needed for the Project.	Inspection	Daily	Adherence to measures	EPC Contractor	REA (PMU) POE (Site Engineer)	
	Use of herbicides for clearing shall be avoided. Site clearing and preparation shall be done mechanically.						
	Bush burning shall be avoided.	Inspection	Daily	Adherence to measures			
	Any cleared areas which are not used will be re- vegetated using plants or seeds of locally occurring species.	Inspection	Monthly	Revegetated land			
	The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited.	Inspection	Monthly	Adherence to measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Hunting or deliberate killing of animals by workers shall be prohibited and monitored. Workers shall be sensitized on ecological protection	Inspection	Daily	Adherence to measures			
Removal of topsoil and soil compaction; loss of top soil; increased erosion potential; reduction in structural stability and percolative ability of soil	Removal of vegetation and soil cover shall be restricted to the areas required for the Project. Soil conservation measures shall be implemented such as stockpiling topsoil or for the remediation of disturbed areas. Use of silt traps or similar systems to reduce discharge of silt shall be ensured.	Inspection	Daily	Revegetated land			
Air quality impacts due to emission from site clearing equipment; increase in ambient noise levels	Site clearing equipment / machinery shall be operated and maintained under optimum fuel- efficient conditions.	Maintenance records; Fuel consumption records	Daily	Adherence to measures			
	Site clearing activities shall be carried out only during the daytime (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr)	Inspection	Daily	Adherence to measures			
Mobilization of Materials and Equipment to Site							

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Air quality impacts from vehicular emissions; Increase in ambient noise	Project vehicles with efficient engine performance and with minimal noise and air emissions shall be selected and used. This can be achieved through regular servicing and maintenance	Inspection; Maintenance records	Once before vehicle commences journey	Adherence to measures	EPC Contractor	REA (PMU) POE (Site Engineer)	
	All materials with potential to result in dust emissions shall be covered during transport.	Inspection	Once before vehicle commences journey	Adherence to measures	EPC Contractor		
	Site roads and access roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Onsite vehicle speed on unhardened roads and surfaces shall be limited to about 15 – 20km/h so as to reduce dust generation.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Unnecessary engine idling shall be avoided.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Site roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		

Social Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Selection							
Loss of farmlands	Resettlement Action Plan (RAP/aRAP) shall be developed and implemented (in consistent with the requirements of OS 2, Involuntary Resettlement) to restore livelihood of the affected persons.	OS2, Involuntary Resettlement	Prior to mobilization to site / site clearing and construction	Involuntary Resettlement (OS 2)	FUTO Management	REA (PMU)	
	The affected persons shall be allowed to harvest their crops before commencement of construction activities.	Notification of project development to the affected persons	Prior to mobilization to site/ site clearing and construction	Adherence to measures			
	All affected students shall be provided with alternative land within the University campus to continue their farm demonstration activities.	Inspection	Prior to mobilization to site / site clearing and construction	Adherence to measures			
	The commitment for the provision of alternative land for the affected personnel shall be documented in a letter signed by the University's Vice Chancellor.	Signed letter of commitment from FUTO management	Prior to mobilization to site / site clearing and construction	Adherence to measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
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 activities.	Implementation of NCDC guidelines	Prior to site / site clearing and construction	Adherence to measures	EPC Contractor	REA (PMU)	
	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 site / site clearing and construction	Adherence to measures			
Mobilization of Materials and Equipment to Site 3500							
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU)	
	Site clearing shall be limited to the day time as much as possible.	Inspection	Daily	Daily time log	EPC Contractor	POE	
	Unregistered labourers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Increase in vehicular movement and traffic including potential for road accident	A TMP shall be developed by the EPC contractor and implemented	TMP implementation records	Daily	Benchmarks stated in the TMP	EPC Contractor		
	Appropriate signage and safety measures (barrier, formalized crossing points) to reduce the risk of accidents in the Project area shall be provided.	Safety signs and barriers	Before and during mobilization	Adherence to measures	EPC Contractor		
	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 Driver's licence	EPC Contractor		
	A procedure for recording traffic incidents/accidents associated with the Project shall be developed and implemented.	Incident forms	Daily	Completed incident forms	EPC Contractor		
	Employee violations of speed limit and other traffic rules will result in disciplinary action ranging from warning to dismissal.	Incident forms, GRM	Daily	Completed incident forms	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU) POE	
	Unregistered laborers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		

Environmental Management Plan for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Air quality impacts due to emission from construction equipment;	Regular maintenance and servicing of construction equipment /machinery shall be ensured.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor	REA-PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Increase in dust from cleared land and windblown stockpiles	Routine water sprinkling shall be carried out to minimize dust generation during construction.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		
Increase in noise level	Construction activities shall be limited to day- time (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr).	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Construction machinery shall be turned off when not in use.	Inspection	Daily during Construction phase	Adherence to measures	EPC Contractor	POE	
	Construction equipment shall be properly maintained and serviced.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor		
	Noise complaints related to the construction activities shall be assessed and appropriately addressed.	Complaint records	Weekly during construction phase	GRM measures	EPC Contractor		
	Noise monitoring at locations with persistent noise complaints shall be maintained.	Noise monitoring records	Monthly during construction phase	FMEnv Noise limit	EPC Contractor		
	Machinery/equipment to be used for construction work shall meet industry best standard in relation to noise attenuation	Inspection	Before commencement of construction	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
			phase				
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 during excavation activities	Adherence to measures	EPC Contractor	REA-PMU	
	Stockpiles shall be appropriately covered to reduce soil loss as a result of wind or water erosion.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor	POE	
Loss of plant species as a result of introduction of alien plants; loss of fauna as a result of increased human activity and associated noise.	Construction workers shall be provided with appropriate training on ecological awareness, as appropriate to their work activities.	Training records	Once before start of construction phase	Certificates of Training	EPC Contractor	REA-PMU	
	All construction equipment shall be cleaned (mud and soil removed) at source before being brought to site to minimise introduction of alien species. If sand or other natural materials for building are required and brought onto site, the stored heaps will be monitored for the growth and germination of alien species and will be regularly cleared during construction.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	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		
Road damage, traffic and safety impacts	TMP shall be developed by the EPC Contractor and implemented.	TMP implementation records	Daily during construction phase	Benchmarks stated in the TMP	EPC Contractor	REA-PMU POE	
	Speed limits for all construction-related vehicles shall be established and enforced.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		
	Appropriate barriers and signage shall be provided to demarcate areas in which construction traffic is active.	Safety signs and barriers	Once before commencement of construction	Adherence to measures	EPC Contractor		
	Drivers' competency shall be assessed and where required training shall be provided.	Drivers' competency assessments; training records	Once before commencement of construction	Passing of competency assessment or training completion certificates	EPC Contractor		
	A procedure for recording all construction related traffic incidents/accidents shall be developed and implemented.	Incident forms	Daily during construction phase	Completed incident forms	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	The EPC contractor shall promptly repair damage to public infrastructure and repair or compensate for damage to private property.	Incident forms, GRM	Daily during construction phase	Completed incident forms	EPC Contractor		
Waste Disposal and Generation							
E-waste generation	A Waste Management Plan shall be developed and implemented	Waste Management records	Weekly during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	POE	
	E-wastes generated shall be stored in appropriate locations prior to recycling and/or disposal	Waste consignment notes, waste receptacles on Site	Weekly during construction phase	Adherence to measures	EPC Contractor		
Soil contamination from solid and liquid construction waste streams.	Hazardous substances and materials shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU	
	Portable spill containment and clean-up kits shall be available onsite.					POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	Construction workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor		
Groundwater contamination of liquid construction waste streams.	Training shall be provided for workers on safe storage, use and handling of hazardous materials (e.g. fuel, lubricating oil) on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	REA-PMU	
	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 during construction phase	Adherence to measures	EPC Contractor	POE	
	Waste management plan (WMP) shall be developed and implemented.	WMP implementation records	Daily during construction phase	Benchmarks stated in WMP	EPC Contractor	FMEnv	

Social Management Measures for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Discrimination during employment and training opportunities	Employment of workers for construction activities shall be open and fair. However, no person under the age of 18 shall be engaged on the project sites.	Employment records	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented for the Project	Implementation by the EPC Contractor	Once before start of construction	Evidence to show implementation of EEP GBV action plan	EPC Contractor	REA-PMU POE	
	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	FMEnv	
	All workers on the project shall be required to sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of construction	Signed CoC forms	EPC Contractor	Federal Ministry of women affairs	
	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	GBV/SEA	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	The EPC Contractor shall be required to hire a Gender/ GBV officer	Employ GRM Officer	Once before start of construction	Employment records and job description	EPC Contractor	service providers	
	Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be ensured	Engagement of GBV service provider	Once before start of construction	Records of ongoing engagement and consultation 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 convenience facilities and display of GBV signage	Once before start of construction	Inspection of facilities to ensure adequacy	EPC Contractor		
Influx of people increase in sexual transmitted diseases.	Construction workers (e.g. semi-skilled and unskilled craftsmen) shall be drawn from the local community as much as possible. and Labour management plan developed and implemented	Employment records and prepare a labour management plan	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	An induction and sensitization programme, including a Code of Conduct 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 / fraternization with the local community.	Induction records and training on the code of conduct	Once before start of construction	Adherence to measures	EPC Contractor	FMEnv Federal Ministry of women affairs/	
	Awareness education about GBV/ SEA/ HIV/ AIDS and other sexually transmitted diseases shall be created among the workforce and local communities.	Training records	Once before start of construction	Adherence to measures	EPC Contractor	GBV/SEA service provider	
	Public access shall be restricted to construction area via security fencing and appropriate signage.	Inspection	As required	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 records	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	Monthly during construction phase	GRM Measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Injury to construction workers during construction activities	Health and Safety Plan shall be developed and implemented.	Health and Safety plan implementation records	Daily during construction phase	Benchmarks stated in Health and Safety Plan	EPC Contractor	REA-PMU POE	
	Community members and 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 for all workers.	Daily toolbox records	Daily during construction phase for workers and monthly for communities as part of engagement	Benchmarks stated in Health and Safety Plan	EPC Contractor		
	Onsite safety officer shall be engaged to monitor the compliance of workers to safety rules.	Qualified and dedicated safety officer	Once before commencement of construction	Adherence to measures	EPC Contractor		
	PPE such as safety boot, coverall, eye google, safety helmets, reflective vests, etc. shall be provided to construction workers and the level of PPE compliance shall be monitored.	Availability of PPE	Daily during construction phase	PPE compliance	EPC Contractor		
	Safety training focused on safe working practices, information on specific hazards, first aid and fire- fighting shall be included in the induction programme for workers.	Training records	Before commencement of construction and weekly	Certificates of completion of trainings	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	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		
Influx of infected workers to the community. Exposure to infectious diseases (e.g. COVID-19) during construction	The EPC contractor shall implement the NCDC “Guidelines for employers and businesses in Nigeria” during construction works.	Implementation of NCDC guidelines	Prior to operations	Adherence to measures	EPC Contractor	REA-PMU POE	
	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 control measures	Continuous during operations	Adherence to measures			
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during construction.	Policies and procedures	Continuous during operations	Adherence to measures			

Environmental management for Commissioning phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Increase in ambient noise level due to Plant testing	Strict compliance to the Standard Operating Procedures (SOPs) shall be ensured.	SOPs	Once before commissioning	Adherence to measures	EPC Contractor	REA - PMU POE	
	The EPC contractor shall develop Standard Operating Procedures (SOPs) for the operational phase of the Project	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		
	The Power Plant components shall be installed in line with the pre-established standards and as per manufacturer recommendations	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		

Social Management Measures for Commissioning Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Occupational health and safety hazards (e.g. injuries, electrocution, etc.) as	Plant testing shall be carried out by experienced personnel.	Qualified and dedicated Engineer	Once before commissioning	Adherence to measures	EPC Contractor	PMU – REA POE	
	Adequate PPE shall be worn	Availability of PPE	Once before commissioning	Adherence to measures	EPC Contractor		

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
a result of any wrong electrical connection.	Prior to the Plant commissioning, appropriate emergency equipment.	Availability of emergency response equipment	Once before commissioning	Adherence to measures	EPC Contractor		
Wrong electrical connection leading to explosion/fire	Plant testing shall be carried out by experienced personnel.	Qualified and dedicated Engineer	Once before commissioning	Adherence to measures	EPC Contractor	PMU – REA POE	

Environmental Management Measures 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	PMU – REA POE	
	Regular maintenance of diesel generators shall be ensured as required by the manufacturer	Inspection	Monthly during operations	Adherence to Measures			

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Dust accumulation on the solar panels	A cleaning schedule shall be developed and implemented for cleaning the panels installed at the project site during operations	Inspection	Monthly during operations	Adherence to measures		University Staff	
	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			
Noise from diesel generators and inverters during power generation and evacuation	Inverters shall be maintained as per manufacturer's recommendations and operated as per original specifications.	Inspection	Monthly during operations	Adherence to measures			
	The diesel generators shall be operated with the soundproof covers.	Inspection	Monthly during operations	Adherence to measures			
	Project personnel shall use appropriate PPE (e.g. ear muffs) to reduce exposure to noise impact.	Inspection	Monthly during operations	Adherence to Measures			
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			
Routine Maintenance, Waste Generation and Disposal							

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
E-waste generation and Disposal	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	At induction of new staff, and in annual refresher training	Certificates of completion of trainings	O&M Contractor	REA PMU POE	
	E-wastes generated shall be stored in appropriate locations prior to recycling; consignment notes will be maintained	Waste consignment notes, waste receptacles on Site	Continuous during operations	Adherence to measures	O&M Contractor	University Staff	
	Waste receptacles shall be provided within a secured area for collection of solid waste.	Waste consignment notes, waste receptacles on Site	Weekly during construction phase	Adherence to measures	O&M Contractor		
Soil contamination from spilled fuel, used oil, spent batteries and inverters	Waste that cannot be reused or recycled shall be disposed of at an approved dumpsite. Spent batteries and inverters shall be sent to manufacturers in line with the Extended Producer Responsibility (EPR) policy.	Consignment notes for spent batteries to manufacturers for recycling	Yearly	EHS Guidelines	O&M Contractor	REA PMU POE	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	WMP shall be implemented.	WMP implementation records	Quarterly during operation phase	Benchmarks stated in WMP EHS Guidelines	O&M Contractor	FMEnv	
	Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.	Inspection	Continuously during operations phase	Adherence to measures EHS Guidelines	O&M Contractor		
	Portable spill containment and clean-up kits shall be available onsite.	Availability of spill response equipment	Quarterly during operation phase	Functional spill equipment Adherence to measures	O&M Contractor		
	Operation workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Quarterly during operation phase	Certificates of completion of trainings	O&M Contractor		
	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during	Adherence to measures	O&M Contractor	REA PMU	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Electric shock, injuries to personnel during maintenance	Strict compliance to the SOPs shall be ensured.	SOPs	operations Quarterly during operations	Adherence to measures	O&M Contractor	POE FMEnv	
Groundwater abstraction from cleaning of PV panels	Water management / conservation plan shall be implemented	Implementation records of water management plan	Quarterly during operations	Benchmarks in water conservation plan EHS Guidelines	O&M Contractor	REA PMU POE FMEnv	

Social Management Measures for Operational Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Power Generation and Evacuation							
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented during operations	Implementation by the O&M Contractor	Continuously during operations	Evidence to show implementation of EEP GBV action plan	O&M Contractor	REA PMU University	
	All workers shall be required to undergo regular training and refreshers on GBV	Organize regular on-site training and refreshers	Monthly during operation phase	Records of attendance	O&M Contractor	GBV/SEA service provider	
	All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of operations	Signed CoC forms	O&M Contractor	POE	
	GBV sensitive channels for reporting in GRM shall be implemented for the Project	Establish GRM reporting channels	Once before start of operations	GRM records	O&M Contractor		
	Separate facilities for men and women will be provided	Erection of separate convenience facilities	Once before start of operations	Inspection of facilities to ensure adequacy	O&M Contractor		
Health, safety and welfare of staff	Provision of medical insurance scheme for employees shall be ensured.	Employment forms of employees	Quarterly during operations	Adherence measures	O&M Contractor	REA PMU	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
during operation	Plant	Appropriate safety signage shall be placed at strategic locations within the site.	Safety signs	Quarterly during operations	Adherence measures	O&M Contractor	University POE
		Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence measures	O&M Contractor	
		A grievance mechanism procedure for receiving and addressing the concerns of employee shall be put in place and implemented.	Completed grievance forms	Monthly during operations	Adherence measures	O&M Contractor	
Exposure to infectious diseases (e.g. COVID- 19)		The O&M contractor shall implement the Nigeria Centre for Disease Control (NCDC) safety Guidelines during operations.	Implementation of NCDC guidelines	Prior to operations	Adherence measures	O&M Contractor	REA PMU University POE
		Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during operations	Hygiene facility and implementation of infection prevention measures	Continuous during operations	Adherence measures	O&M Contractor	
		A risk assessment of the occupational exposure to infectious diseases during construction shall be conducted, and	Conduct risk assessment and implement	Continuous during operations	Adherence measures	O&M Contractor	

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
	appropriate control mechanisms shall be implemented.	controls					
	The O&M contractor shall develop policies and procedures for the identification and isolation of people with symptoms, as well as testing where appropriate.	Implementation of policies and procedures	Continuous during operations	Adherence to measures	O&M Contractor		
Routine Maintenance, Waste Generation and Disposal							
Electric shock, injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA-PMU POE	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures			

Environmental Monitoring Programme

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

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 (\$)
Atmosphere (Air Quality & Noise)	Project Site Power evacuation route	Air Quality Monitoring Equipment Sound level meter	TSP, CO, NOX, SOX, Noise Level (dBA)	FMEnv/WHO/ AfDB	Monthly monitoring; Monthly reporting	EPC Contractor	Construction Phase	
Groundwater Quality	Borehole within the University	Thermometer, Water sampler, Turbidity meter, pH meter, AAS etc.	Temperature, salinity, conductivity, DO, BOD, TOC, COD, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals, TSS and Turbidity	FMEnv/WHO/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Soil	Unpaved sections of the Plant	Composite soil samples collection for laboratory analysis.	pH, Moisture, TOC, THC, TPH, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals.	NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Solid Waste	Operational areas	Monitor the handling and disposal of solid wastes generated onsite; waste	Operational solid wastes including used packaging waste.	FMEnv/NESREA/ AfDB	Monthly monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

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 (\$)
		tracking documentation.						
Health and Safety	Workers and Operational areas	Observe compliance to PPE and unsafe working conditions	Health and Safety Plan	FMEnv/NESR/EA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Training	Workers	Observe compliance with existing training plan	Training plan and records	FMEnv/NESR/EA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
General Housekeeping	Construction sheds and operational areas	Observe cleanliness and aesthetics of Plant	Cleanliness and aesthetics of Plant	FMEnv/NESR/EA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Stakeholder Engagement	Local community Regulatory agencies	Observe evidence of stakeholder consultations	Stakeholder Engagement Plan	FMEnv/NESR/EA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

4.8 Environmental and Social Management Plan for University of Port Harcourt

Environmental Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Clearing and Preparation							
Vegetation loss; direct impacts on vegetation and soil-dwelling organisms; indirect impacts on fauna species	Vegetation clearing shall be limited to the areas within the site needed for the Project. Use of herbicides for clearing shall be avoided. Site clearing and preparation shall be done mechanically. Other Opportunities include, but are not limited to the (1) utilization of degraded lands, (2) co-location of solar panels with agriculture, (3) hybrid power systems, (4) floatovoltaics, and (5) novel panel architecture and design that serves to concomitantly conserve water and land resources such as indicated in plate. 6.1	Inspection	Daily	Adherence to measures	EPC Contractor	REA (PMU) POE (Site Engineer)	
	The total number of trees cleared shall be planted elsewhere as allocated by the Director planning using plants or seeds of locally occurring species.	Inspection	Daily	Adherence to measures			
	Bush burning shall be avoided.	Inspection	Daily	Adherence to measures			
	Any cleared areas which are not used will be re-vegetated using plants or seeds of locally occurring species.	Inspection	Monthly	Revegetated land			
	The extent of vegetation to be cleared shall be clearly identified and appropriately demarcated. Clearing exceeding the approved working corridor shall be prohibited.	Inspection	Monthly	Adherence measures To			

	Hunting or deliberate killing of animals by workers shall be prohibited and monitored. Workers shall be sensitized on ecological protection	Inspection	Daily	Adherence to measures			
Removal of top soil and soil compaction; loss of top soil; increased erosion potential; reduction in structural stability and percolative ability of soil	Removal of vegetation and soil cover shall be restricted to the areas required for the Project. Soil conservation measures shall be implemented such as stockpiling topsoil or for the remediation of disturbed areas.	Inspection	Daily	Revegetated land			
	Use of silt traps or similar systems to reduce discharge of silt shall be ensured.	Inspection	Monthly	Adherence to measures			
Air quality impacts due to emission from site clearing equipment; increase in ambient noise levels	Site clearing equipment / machinery shall be operated and maintained under optimum fuel- efficient conditions.	Maintenance records; Fuel consumption records	Daily	Adherence to measures			
	Site clearing activities shall be carried out only during the daytime (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr)	Inspection	Daily	Adherence to measures			
Mobilization of Materials and Equipment to Site							
Air quality impacts from vehicular emissions; Increase in ambient noise	Project vehicles with efficient engine performance and with minimal noise and air emissions shall be selected and used. This can be achieved through regular servicing and maintenance	Inspection; Maintenance records	Once before vehicle Commences journey	Adherence to measures	EPC Contractor	REA (PMU) POE (Site Engineer)	
	All materials with potential to result in dust emissions shall be covered during transport.	Inspection	Once before vehicle Commences journey	Adherence to measures	EPC Contractor		
	Site roads and access roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Onsite vehicle speed on unhardened roads and surfaces shall be limited to about 15 – 20km/h so as to reduce dust generation.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Unnecessary engine idling shall be avoided.	Inspection	Daily	Adherence to measures	EPC Contractor		
	Site roads shall be sprinkled as needed to prevent dust entrainment.	Inspection	Daily	Adherence to measures	EPC Contractor		

Social Management Plan for Pre-Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Site Selection							
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 activities.	Implementation of NCDC guidelines	Prior to mobilization to site / site clearing and construction	Adherence to measures	EPC Contractor	REA (PMU)	
	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			
Mobilization of Materials and Equipment to Site							
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU) POE	
	Site clearing shall be limited to the day time as much as possible.	Inspection	Daily	Daily time log			
	Unregistered labourers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act			
Increase in vehicular movement and traffic including potential for road accident	A TMP shall be developed by the EPC contractor and implemented	TMP implementation records	Daily	Benchmarks stated in the TMP	EPC Contractor		
	Appropriate signage and safety measures (barrier, formalized crossing points) to reduce the risk of accidents in the Project area shall be provided.	Safety signs and barriers	Before and during mobilization	Adherence to measures	EPC Contractor		

	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 Driver's licence	EPC Contractor		
	A procedure for recording traffic incidents/accidents associated with the Project shall be developed and implemented.	Incident forms	Daily	Completed incident forms	EPC Contractor		
	Employee violations of speed limit and other traffic rules will result in disciplinary action ranging from warning to dismissal.	Incident forms, GRM	Daily	Completed incident forms	EPC Contractor		
Injuries and accidents to workers during loading and off-loading construction materials.	Provision of adequate PPE especially gloves, safety shoes, and hard hats to workers shall be ensured. All employees will be required to wear the appropriate PPE whilst performing their duties.	Availability of PPE	Daily	PPE compliance	EPC Contractor	REA (PMU) POE	
	Unregistered laborers and touts shall not be engaged for off-loading materials.	Employment records of all staff on site	Once before commencement of mobilization	Labour Act	EPC Contractor		

Environmental Management Plan for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Air quality impacts due to emission from construction equipment;	Regular maintenance and servicing of construction equipment /machinery shall be ensured.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor	REA-PMU POE	
Increase in dust from cleared land and windblown stockpiles	Routine water sprinkling shall be carried out to minimize dust generation during construction.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		
Increase in noise level	Construction activities shall be limited to day- time (08.00hr to 17.00hr during weekdays; and weekends 09.00hr-13.00hr).	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU	

	Construction machinery shall be turned off when not in use.	Inspection	Daily during Construction phase	Adherence to measures	EPC Contractor	POE	
	Construction equipment shall be properly maintained and serviced.	Maintenance records	Monthly during construction phase	Adherence to measures	EPC Contractor		
	Noise complaints related to the construction activities shall be assessed and appropriately addressed.	Complaint records	Weekly during construction phase	GRM measures	EPC Contractor		
	Noise monitoring at locations with persistent noise complaints shall be maintained.	Noise monitoring records	Monthly during construction phase	FMEnv Noise limit	EPC Contractor		
	Machinery/equipment to be used for construction work shall meet industry best standard in relation to noise attenuation	Inspection	Before commencement of construction phase	Adherence to measures	EPC Contractor		
Increased soil erosion potential; reduction in structural stability and percolative ability of soil	Excavation works shall not be executed under aggressive weather conditions.	Inspection	Daily during excavation activities	Adherence to measures	EPC Contractor	REA-PMU	POE
	Stockpiles shall be appropriately covered to reduce soil loss as a result of wind or water erosion.	Inspection	Daily during civil work activities	Adherence to measures	EPC Contractor		
Loss of plant species as a result of introduction of alien plants; loss of fauna as a result of increased human activity and associated noise.	Construction workers shall be provided with appropriate training on ecological awareness, as appropriate to their work activities.	Training records	Once before start of construction phase	Certificates of Training	EPC Contractor	REA-PMU	POE
	All construction equipment shall be cleaned (mud and soil removed) at source before being brought to site to minimise introduction of alien species. If sand or other natural materials for building are required and brought onto site, the stored heaps will be monitored for the growth and	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		

	germination of alien species and will be regularly cleared during construction.						
	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		
Road damage, traffic and safety impacts	TMP shall be developed by the EPC Contractor and implemented.	TMP implementation records	Daily during construction phase	Benchmarks stated in the TMP	EPC Contractor	REA-PMU POE	
	Speed limits for all construction-related vehicles shall be established and enforced.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor		
	Appropriate barriers and signage shall be provided to demarcate areas in which construction traffic is active.	Safety signs and barriers	Once before commencement of construction	Adherence to measures	EPC Contractor		
	Drivers' competency shall be assessed and where required training shall be provided.	Drivers' competency assessments; training records	Once before commencement of construction	Passing of competency assessment or training completion certificates	EPC Contractor		
	A procedure for recording all construction related traffic incidents/ accidents shall be developed and implemented.	Incident forms	Daily during construction phase	Completed incident forms	EPC Contractor		
	The EPC contractor shall promptly repair damage to public infrastructure and repair or compensate for damage to private property.	Incident forms, GRM	Daily during construction phase	Completed incident forms	EPC Contractor		
Waste Disposal and Generation							
E-waste generation	A Waste Management Plan shall be developed and implemented	Waste Management records	Weekly during construction phase	Adherence to measures	EPC Contractor	REA-PMU	

	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	POE
	E-wastes generated shall be stored in appropriate locations prior to recycling and/or disposal	Waste consignment notes, waste receptacles on Site	Weekly during construction phase	Adherence to measures	EPC Contractor	
Soil contamination from solid and liquid construction waste streams.	Hazardous substances and materials shall be stored in appropriate locations with impervious hardstanding and adequate secondary containment. Portable spill containment and clean-up kits shall be available onsite.	Inspection	Daily during construction phase	Adherence to measures	EPC Contractor	REA-PMU POE
	Construction workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	
Groundwater contamination of liquid construction waste streams.	Training shall be provided for workers on safe storage, use and handling of hazardous materials (e.g. fuel, lubricating oil) on site.	Training records	Once before commencement of construction	Certificates of completion of trainings	EPC Contractor	REA-PMU
	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 during construction phase	Adherence to measures	EPC Contractor	POE FMEnv
	Waste management plan (WMP) shall be developed and implemented.	WMP implementation records	Daily during construction phase	Benchmarks stated in WMP	EPC Contractor	

Social Management Measures for Construction Phase of the proposed Project

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Civil and Electrical Works/ Installation Activities							
Discrimination during employment and training opportunities	Employment of workers for construction activities shall be open and fair. However, no person under the age of 18 shall be engaged on the project sites.	Employment records	Once before start of Construction	Adherence to measures	EPC Contractor	REA-PMU POE	
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented for the Project	Implementation by the EPC Contractor	Once before start of Construction	Evidence to show implementation of EEP GBV action plan	EPC Contractor	REA-PMU POE	
	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	FMEnv Federal Ministry of women affairs	
	All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of construction	Signed CoC forms	EPC Contractor	GBV/SEA service providers	
	GBV sensitive channels for reporting in GRM shall be implemented for the Project	Establish accessible GRM reporting channels	Monthly during construction	GRM records	EPC Contractor		
	The EPC Contractor shall be required to hire a Gender/ GBV officer	Employ GRM Officer	Once before start of construction	Employment records and job description	EPC Contractor		
	Collaboration with appropriate government institutions or GBV service providers on potential GBV case management shall be ensured	Engagement of GBV service provider	Once before start of construction	Records of ongoing engagement and consultation 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 convenience facilities and display of GBV Signage	Once before start of construction	Inspection of facilities to ensure adequacy	EPC Contractor		
Influx of people, increase in sexual transmitted diseases.	Construction workers (e.g. semi-skilled and unskilled craftsmen) shall be drawn from the local community as much as possible. and Labour management plan developed and implemented	Employment records and prepare a labour management plan	Once before start of construction	Adherence to measures	EPC Contractor	REA-PMU POE	
	An induction and sensitization programme, including a Code of Conduct, 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 / fraternization with the local community.	Induction records and training on the code of conduct	Once before start of construction	Adherence to measures	EPC Contractor	FMEnv Federal Ministry of women affairs/ GBV/SEA service provider	
	Awareness education about GBV/ SEA/ HIV/ AIDS and other sexually transmitted diseases shall be created among the workforce and local communities.	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	As required	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 records	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	Monthly during construction phase	GRM Measures	EPC Contractor		
Injury to construction workers during construction activities	Health and Safety Plan shall be developed and implemented.	Health and Safety plan implementation Records	Daily during construction Phase	Benchmarks stated in Health and Safety Plan	EPC Contractor	REA-PMU POE	
	Community members and 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 for all workers.	Daily toolbox records	Daily during construction phase for workers and monthly for communities as part of engagement	Benchmarks stated in Health and Safety Plan	EPC Contractor		
	Onsite safety officer shall be engaged to monitor the compliance of workers to safety rules.	Qualified and dedicated safety officer	Once before commencement of construction	Adherence to measures	EPC Contractor		
	PPE such as safety boot, coverall, eye google, safety helmets, reflective vests, etc. shall be provided to construction workers and the level of PPE compliance shall be monitored.	Availability of PPE	Daily during construction phase	PPE compliance	EPC Contractor		
	Safety training focused on safe working practices, information on specific hazards, first aid and fire- fighting shall be included in the induction programme for workers.	Training records	Before commencement of construction and weekly	Certificates of completion of trainings	EPC Contractor		
	A mechanism procedure for receiving and addressing the concerns of workers shall be put in place and implemented.	Completed grievance forms	Weekly during construction phase	Adherence to measures	EPC Contractor		
Influx of infected workers to the community. Exposure to infectious diseases	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 POE	

(e.g. COVID-19) during construction	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 control measures	Continuous during operations	Adherence to measures			
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during construction.	Policies and procedures	Continuous during operations	Adherence to measures			

Environmental Management for Commissioning Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Plant testing							
Increase in ambient noise level due to Plant testing	Strict compliance to the Standard Operating Procedures (SOPs) shall be ensured.	SOPs	Once before commissioning	Adherence to measures	EPC Contractor	REA – PMU POE	
	The EPC contractor shall develop Standard Operating Procedures (SOPs) for the operational phase of the Project	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		
	The Power Plant components shall be installed in line with the pre-established standards and as per manufacturer recommendations	SOPs	Once before commissioning	Adherence to measures	EPC Contractor		

Social Management Measures for Commissioning Phase

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

Environmental Management Measures 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 operations and maintenance shall be ensured.	Inspection	Monthly during operations	Adherence to measures	O&M Contractor	PMU – REA	
	Regular maintenance of diesel generators shall be ensured as required by the manufacturer	Inspection	Monthly during operations	Adherence to Measures		University Staff	
Dust accumulation on the solar panels	A cleaning schedule shall be developed and implemented for cleaning the panels installed at the project site during operations	Inspection	Monthly during operations	Adherence to measures			
	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			

Noise from diesel generators and inverters during power generation and evacuation	Inverters shall be maintained as per manufacturer's recommendations and operated as per original specifications.	Inspection	Monthly during operations	Adherence to measures			
	The diesel generators shall be operated with the sound proof covers at all times.	Inspection	Monthly during operations	Adherence to measures			
	Project personnel shall use appropriate PPE (e.g. ear muffs) to reduce exposure to noise impact.	Inspection	Monthly during operations	Adherence to Measures			
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			
Routine Maintenance, Waste Generation and Disposal							
E-waste generation and Disposal	Training shall be provided for workers on safe storage, use and handling of e-waste on site.	Training records	At induction of new staff, and in annual refresher training	Certificates of completion of trainings	O&M Contractor	REA PMU POE University Staff	
	E-wastes generated shall be stored in appropriate locations prior to recycling; consignment notes will be maintained	Waste consignment notes, waste receptacles on Site	Continuous during operations	Adherence to measures	O&M Contractor		
	Waste receptacles shall be provided within a secured area for collection of solid waste.	Waste consignment notes, waste receptacles on Site	Weekly during construction phase	Adherence to measures	O&M Contractor		
Soil contamination from spilled fuel, used oil, spent batteries and inverters	Waste that cannot be reused or recycled shall be disposed of at an approved dumpsite. Spent batteries and inverters shall be sent to	Consignment notes for spent batteries	Yearly	EHS Guidelines	O&M Contractor	REA PMU POE	

	manufacturers in line with the Extended Producer Responsibility (EPR) policy.	to manufacturers for recycling				FMEnv	
	WMP shall be implemented.	WMP implementation records	Quarterly during operation phase	Benchmarks stated in WMP EHS Guidelines	O&M Contractor		
	Hazardous substances and materials (e.g. fuel, lubricating oil, etc.) shall be stored in appropriate locations with impervious hard standing and adequate secondary containment.	Inspection	Continuously during operations phase	Adherence to measures EHS Guidelines	O&M Contractor		
	Portable spill containment and clean-up kits shall be available onsite.	Availability of spill response equipment	Quarterly during operation phase	Functional spill equipment Adherence to measures	O&M Contractor		
	Operation workers shall be provided with adequate training on use, storage and handling of hazardous substances.	Training records	Quarterly during operation phase	Certificates of completion of trainings	O&M Contractor		
Electric shock, injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA PMU	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures	O&M Contractor	POE FMEnv	
Groundwater abstraction from cleaning of PV panels	Water management / conservation plan shall be implemented	Implementation records of water	Quarterly during operations	Benchmarks in water	O&M Contractor	REA PMU POE	

		management plan		conservation plan EHS Guidelines		FMEEnv	
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Social Management Measures for Operational Phase

Summary of Potential Impact	Mitigation Measures	Monitoring			Responsible Party		Cost (US Dollars)
		Requirements / Parameters	Frequency	Performance Indicator	Implementation	Monitoring	
Power Generation and Evacuation							
GBV (sexual harassment, intimate partner violence, poor working conditions)	The EEP GBV Action Plan shall be implemented during operations	Implementation by the O&M Contractor	Continuously during operations	Evidence to show implementation of EEP GBV action plan	O&M Contractor	REA PMU University	
	All workers shall be required to undergo regular training and refreshers on GBV	Organize regular on-site training and refreshers	Monthly during operation phase	Records of attendance	O&M Contractor	GBV/SEA service provider	
	All workers on the project shall be required sign a code of conduct to prohibit any form of Gender Based Violence/ Sexual Exploitation and Abuse (GBV/ SEA)	Develop CoC forms for workers	Once before start of operations	Signed CoC forms	O&M Contractor	POE	
	GBV sensitive channels for reporting in GRM shall be implemented for the Project	Establish GRM reporting channels	Once before start of operations	GRM records	O&M Contractor		
	Separate facilities for men and women will be provided	Erection of separate convenience facilities	Once before start of 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 measures	O&M Contractor	REA PMU University	

	Appropriate safety signage shall be placed at strategic locations within the site.	Safety signs	Quarterly during operations	Adherence to measures	O&M Contractor	POE	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	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. COVID-19)	The O&M contractor shall implement the Nigeria Centre for Disease Control (NCDC) safety Guidelines during operations.	Implementation of NCDC guidelines	Prior to operations	Adherence to measures	O&M Contractor	REA PMU	
	Provision of functional hygiene facilities, wearing of nose masks and implementation of basic infection prevention measures during operations	Hygiene facility and implementation of infection prevention measures	Continuous during operations	Adherence to measures	O&M Contractor	POE	
	A risk assessment of the occupational exposure to infectious diseases during construction shall be conducted, and appropriate control mechanisms shall be implemented.	Conduct risk assessment implement controls	Continuous during operations	Adherence to measures	O&M Contractor		
	The O&M contractor shall develop policies and procedures for the identification and isolation of people with symptoms, as well as testing where appropriate.	Implementation of policies and procedures	Continuous during operations	Adherence to measures	O&M Contractor		
Routine Maintenance, Waste Generation and Disposal							
Electric shock, injuries to personnel during maintenance	Appropriate PPE shall be provided for workers.	Availability of PPE	Quarterly during operations	Adherence to measures	O&M Contractor	REA-PMU	
	Strict compliance to the SOPs shall be ensured.	SOPs	Quarterly during operations	Adherence to measures		POE	

Environmental Monitoring Programme

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

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 (\$)
Atmosphere (Air Quality & Noise)	Project Site Power evacuation route	Air Quality Monitoring Equipment Sound level meter	TSP, CO, NOX, SOX, Noise Level (dBA)	FMEnv/ WHO/ AfDB	Monthly monitoring; Monthly reporting	EPC Contractor	Construction Phase	
Groundwater Quality	Borehole within the University	Thermometer, Water sampler, Turbidity meter, pH meter, AAS etc.	Temperature, pH, salinity, TDS, conductivity, DO, BOD, TOC, COD, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals, TSS and Turbidity	FMEnv/ WHO/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Soil	Unpaved sections of the Plant	Composite soil samples collection for laboratory analysis.	pH, Moisture, TOC, THC, TPH, NO3, PO4, Chloride, sulphate, Microbiology, Heavy metals.	NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Solid Waste	Operational areas	Monitor the handling and disposal of solid wastes generated onsite; waste tracking documentation.	Operational solid wastes including used packaging waste.	FMEnv/ NESREA/ AfDB	Monthly monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

Health and Safety	Workers and Operational areas	Observe compliance to PPE and unsafe working conditions	Health and Safety Plan	FMEnv/ NESREA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Training	Workers	Observe compliance with existing training plan	Training plan and records	FMEnv/ NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
General Housekeeping	Construction sheds and operational areas	Observe cleanliness and aesthetics of Plant	Cleanliness and aesthetics of Plant	FMEnv/ NESREA/ AfDB	Daily monitoring; Quarterly reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	
Stakeholder Engagement	Local community Regulatory agencies	Observe evidence of stakeholder consultations	Stakeholder Engagement Plan	FMEnv/ NESREA/ AfDB	Quarterly monitoring and reporting	EPC Contractor O&M Contractor	Construction Phase Operations Phase	

At this bidding phase, to demonstrate experience of compliance with the best environmental and social safeguard standards, the bidder shall be required to meet the following eligibility standards:

1. Provision of its Environmental and Social Management System which demonstrates management's procedures and commitment in identifying and addressing E&S issues. The ESMS must incorporate the following key elements:
 - Organizational Environmental & Social Policy
 - Identification of Environmental & Social Risks and Impacts
 - Organizational Responsibilities, Capacity and Competence
 - Occupational Health and Safety Plans
 - Emergency Preparedness and Response
 - Stakeholders Engagement & Grievance Redress Mechanism
 - Training Plans
 - Monitoring and Reporting

2. Provide information on past E&S performance including proven clean track record on E&S compliance by the provision of Environmental and Social certifications or approvals on previous projects/ assignments. Such information could include but not be limited to past violations of E&S regulations; worker accident and injury rates; reports of sexual harassment or discrimination and how those reports were addressed; lists of accidents and incidents involving workers; awards for safe working conditions or environmental performance; environmental incidents in previous projects or services; E&S training records, including training on anti-sexual harassment; any SEA or GBV-driven contract cancellations, suspensions, or calling of bid bonds; and material sanctions or fines from labour, health, safety, and/or environmental authorities.

3. Inclusion of qualified EHS and Social safeguards in its team to oversee the implementation of the HSE plan, environmental and social safeguard instrument (ESMP), and the monitoring programmes as in the ESMP. To this effect, at least an Environmental, Health and Safety Officer, and a Gender Based Violence Officer should form part of the team composition.

4. The bidder shall prepare and provide as part of its submissions the following environmental and social related document:
 - a. Its contractors Environmental and Social Management Plan (c-ESMP);
 - b. An Occupational Health and Safety (OHS) Plan including emergency preparedness,
 - c. Traffic Management Plan (TMP)
 - d. Waste Management Plan including e-wastes.
 - e. Code of conduct to include -
 - i. Employee code of conduct for direct staff and sub-contractors, and
 - ii. Preventing Sexual Exploitation and Abuse (SEA), Gender Based Violence (GBV) and Violence against children (VAC) code of conduct.

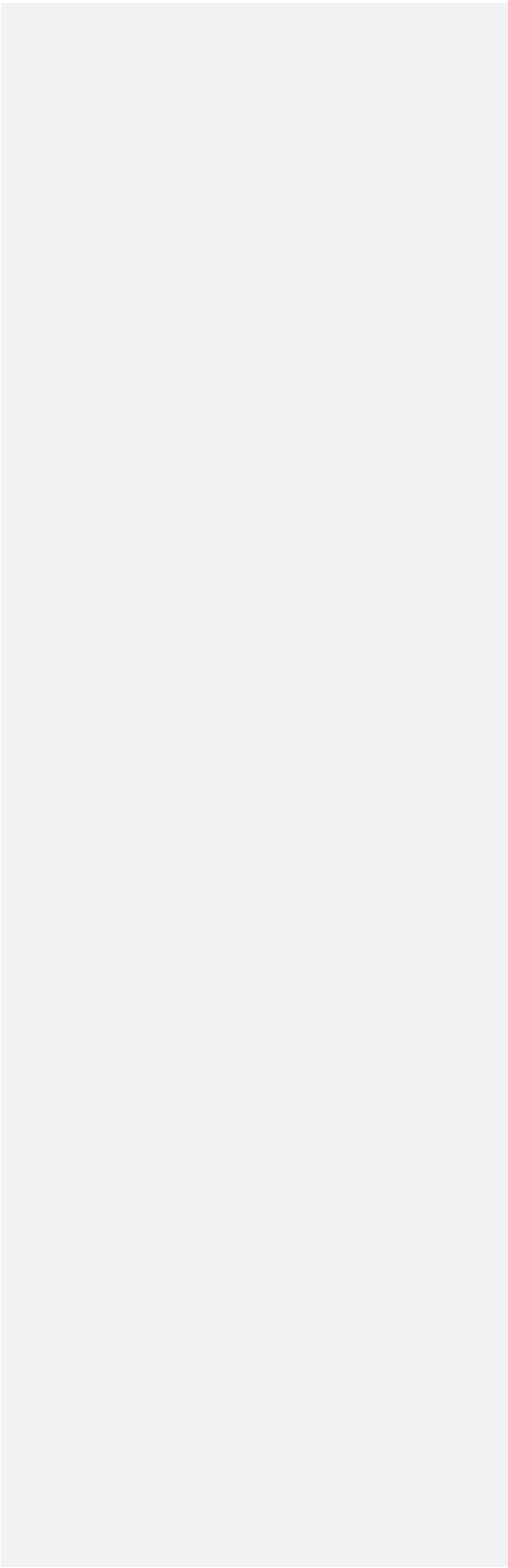
- f. Stakeholder’s engagement and Grievance Redress Mechanism.
- g. Other relevant existing E&S Policies and capacities. This may include any policies related to sustainability, biodiversity, waste management, stakeholder engagement, HR (including workplace anti-sexual harassment policies), codes of conduct which should include specific provisions against SEA and GBV for the contracting company and the contractor’s managers and direct and subcontract employees, grievance processes, etc.
- h. Provide client references, which shall be checked to validate claims regarding E&S performance.

The following is a non-exhaustive list of Sub-Clauses of the Conditions of Contract that make reference to ES matters stated in the Specification.

GCC	Sub-Clause/Clause	Remarks
9.10	<i>Training of Contractor’s Personnel</i>	<p>All workers shall be required to undergo regular training and refreshers on Gender Based Violence (GBV).</p> <p>Training shall be provided for workers on safe storage, use and handling of e-waste on site.</p>

GCC	Sub-Clause/Clause	Remarks
20	<i>Design and Engineering</i>	<p>The EPC should use a combination of enabling technologies; Hardware, Software or practices that collectively make the electric power infrastructure environment friendly, safe, secure, reliable, efficient and sustainable thus working towards achieving the objectives of the power plant.</p> <p>All buildings to be used by persons working on or visiting the project sites MUST be universal (must be accessible and usable by everyone, including people with disabilities).</p> <p>All buildings to be used by persons working on or visiting the project sites MUST be universal (must be accessible and usable by everyone, including people with disabilities).</p> <p>The EPC MUST put in place appropriate measures to warn the public of the various hazards associated with the proposed construction activities and as well establish protocols to adequately mitigate these risks. The proposed mitigation measures MUST:</p> <ul style="list-style-type: none"> • Anticipate and avoid adverse impacts on the health and safety of project-affected communities during the project life cycle from both routine and non-routine circumstances • Promote quality and safety, and considerations relating to climate change, in the design and construction of infrastructure. • Avoid or minimize community exposure to project-related traffic and road safety risks, diseases and hazardous materials.

GCC	Sub-Clause/Clause	Remarks
		<p>Have in place effective measures to address emergency events.</p> <ul style="list-style-type: none"> • Ensure that the safeguarding of personnel and property is carried out in a manner that avoids or minimizes risks to the project-affected communities. In doing this the EPC should consider the following aspects: <ul style="list-style-type: none"> • Infrastructure and equipment design and safety • Safety of services • Traffic and road safety • Ecosystem services • Community exposure to health issues • Management and safety of hazardous materials • Emergency preparedness and response • Security personnel <p>The EPC should promptly and effectively:</p> <ul style="list-style-type: none"> • Communicate the identified hazardous event to the community through a means and language clearly understood by them. • Use of warning signs and symbols at strategic locations to label equipment/work sites deserving of such attention.

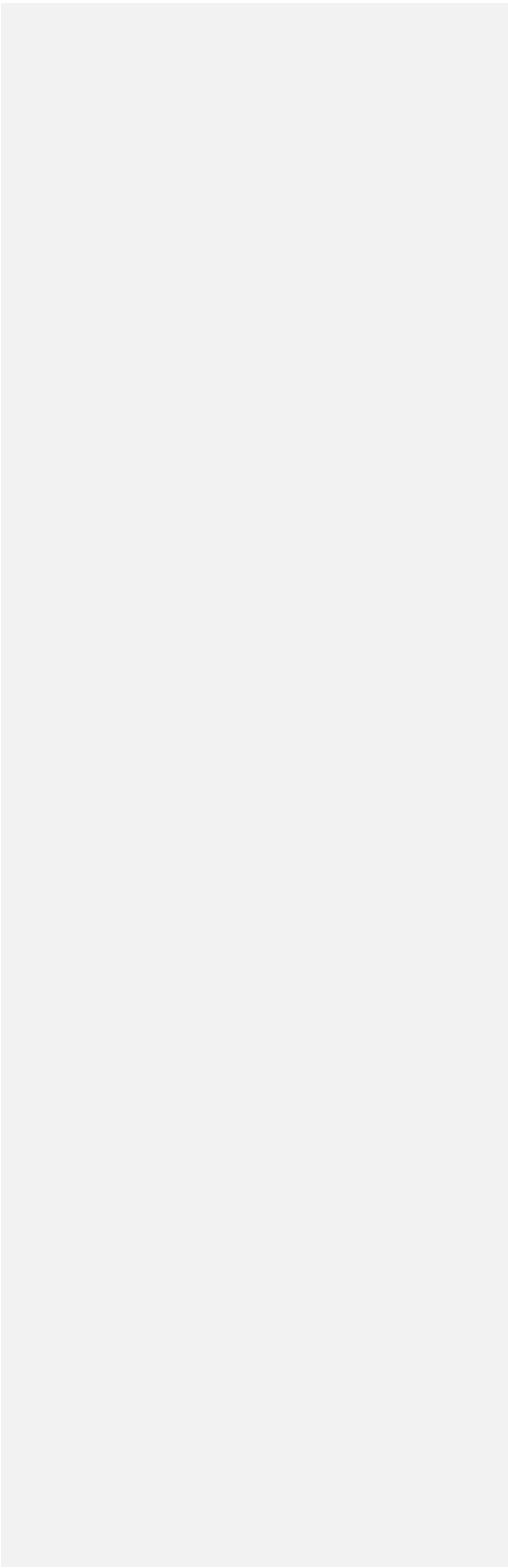


GCC	Sub-Clause/Clause	Remarks
22.2.4	<i>Rates of wages and conditions of labor</i>	<p>The EPC shall pay rates of wages, and observe conditions of labor, which are not lower than those established for the trade or industry where the work is carried out.</p> <p>Child labour and/or exploitation is prohibited in the project site.</p> <p>Labour force should be sourced from the hosting community and/or through the University works department to limit influx of workers which advertently increases SEA/GBV.</p> <p>Gender equity should be considered during hiring of labour force to encourage female participation and decrease economic disadvantages.</p> <p>If no established rates or conditions are applicable, the EPC shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by employers whose trade or industry is similar to that of the Contractor.</p> <p>Occupational Health and Safety, considerations should be made for:</p> <ul style="list-style-type: none"> • Working in confined spaces: • Adequate lighting in dark working areas. • Working from heights. • Proper use of PPEs. • Electricity wiring and shocks. <p>Conservation of energy in the workplace:</p> <ul style="list-style-type: none"> • Installation of white energy saver bulbs/flood lamps.

GCC	Sub-Clause/Clause	Remarks
		<ul style="list-style-type: none"> • Working environment must be safe at all times. • Use of nose masks when working in areas where smoke/dust is generated. <p>When working at height:</p> <ul style="list-style-type: none"> • Erection of scaffolds • Use of Harness • Use of safety hats • Provision of safety net <p>Working Surfaces: The employer must ensure:</p> <ul style="list-style-type: none"> • All places of employment, passageways, storerooms, service rooms, and walking-working surfaces are kept in a clean, orderly, and sanitary condition. • The floor of each workroom is maintained in a clean and, to the extent feasible, in a dry condition. • When wet processes are used, drainage must be maintained and, to the extent feasible, dry standing places, such as false floors, platforms, and mats must be provided. • Walking-working surfaces are maintained free of hazards such as sharp or protruding objects, loose boards, corrosion, leaks and spills. • The employer must ensure that each walking-working surface can support the maximum intended load for that surface. <p>Inspection, maintenance, and repair. The employer must ensure:</p>

GCC	Sub-Clause/Clause	Remarks
		<ul style="list-style-type: none"> • Walking-working surfaces are inspected regularly. • Hazardous conditions on walking, working surfaces are corrected or repaired before an employee uses the walking-working surface again. If the correction or repair cannot be made immediately, the hazard must be guarded to prevent employees from using the walking-working surface until the hazard is corrected or repaired; and when any correction or repair involves the structural integrity of the walking-working surface, a qualified person performs or supervises the correction or repair.

GCC	Sub-Clause/Clause	Remarks
22.2.6	<i>Facilities for Staff and Labor</i>	<p>The EPC should provide at least decent standards of the following facilities wherever its staff will be working:</p> <ul style="list-style-type: none"> • Living and office Accommodations Sanitary and toilet facilities • Washing facilities, hand, surface and air sanitizers • Working and disposable hand gloves • Drinking water • Changing rooms and lockers • Rest Facilities • Canteen <p>Note: No living quarters is permitted within the project site.</p> <p>Sanitary and toilet facilities must be provided adequate for the number of staff to be employed, and recognizing different facilities for male and female staff.</p>



GCC	Sub-Clause/Clause	Remarks
22.8	<i>Security of the Site</i>	<p>In providing security at the various sites the EPC MUST:</p> <p>a. Assess risks posed by these security arrangements to those within and outside the project site.</p> <p>The EPC MUST be guided by the principles of proportionality and Good International Industry Practice (GIIP), and by applicable law, in relation to hiring, rules of conduct, training, equipping, and monitoring of such security workers.</p> <p>The EPC will seek to ensure that government security personnel deployed to provide security services act in a manner consistent with paragraph c above, and encourage the relevant authorities to disclose the security arrangements for the EPC’s work sites to the public, subject to overriding security concerns.</p> <p>The EPC will: (i) make reasonable inquiries to verify that the direct or contracted workers retained by the it to provide security are not implicated in past abuses; (ii) train them adequately (or determine that they are properly trained) in the use of force (and where applicable, firearms), and appropriate conduct toward workers and affected communities; and (iii) require them to act within the applicable law and any requirements.</p> <p>The EPC will review all allegations of unlawful or abusive acts of security personnel, take action (or urge appropriate parties to take action) to prevent recurrence and, where necessary, report unlawful and abusive acts to the relevant authorities.</p>

GCC	Sub-Clause/Clause	Remarks
22.9	<i>Protection of the Environment</i>	<p>The EPC MUST comply with the FMEnv permissible limits for all environmental media including air and noise quality, soil quality, water quality as outlined in the ESIA.</p> <p>All activities at the different phases of the project must be conducted within a standard promoting environmental sustainability.</p> <p>Proper account must be made for all felled trees. Trees felled during site clearing must be replanted at a ratio of 1:10, at appropriate locations established by the University.</p>

GCC	Sub-Clause/Clause	Remarks
22.11	<i>Cultural Heritage Findings</i>	<p>The EPC is required to report all items relating to cultural heritage in the form of:</p> <ul style="list-style-type: none"> a) Tangible cultural heritage, which includes movable or immovable objects, sites, structures, groups of structures, and natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance; and b) Intangible cultural heritage, which includes practices, representations, expressions, knowledge, and skills—as well as the instruments, objects, artifacts, and cultural spaces associated therewith—that communities and groups recognize as part of their cultural heritage, as transmitted from generation to generation and constantly recreated by them in response to their environment, their interaction with nature, and their history. <p>Items of cultural heritage include all items that fit (a) and (b) above, regardless of whether or not it has been legally protected or previously identified or disturbed</p>

Management and Safety of Hazardous Materials

The bidder shall develop an e-waste management plan for safe end-of-life disposal of equipment from the solar plant with the University in line with the Environmental and Social Management Framework (ESMF) and the approved ESIA.

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.

The Extended Producer Responsibility (EPR) Programme is expected to be implemented by successful bidders. Also, the bidder is expected to adopt the ESMP of the ESIA for their waste management plan.

Resource Efficiency and Pollution Prevention and Management

- **Management of chemicals and hazardous materials:**

EPC shall adhere to the National Policy, Guidelines and Regulation S.1.9 National Environmental Protection (Abatement in industries and facilities generating waste) Regulations, 1991, S.1.15 National Environmental Protection (Management of Solid and Hazardous wastes) Regulations, 1991. The NESREA's regulation S.1.28 National Environmental (Sanitation and waste control) Regulations, 2009 and Implementation of the EPR programme.

- **Biodiversity Conservation and Sustainable Management of Living Natural Resources:**

EPC shall comply with the National Environmental (Protection of Endangered Species in International Trade) Regulations, S.1.11,2011.

Refer to the ESIA for full details.

5 Workshop and Training Centre Training Curriculum

The following is a summary of the proposed Training Curriculum to be used in the Workshop and Training Centre in the eight (8) universities:

MODULE	TOPICS	TIME (HRS)
Module 1:	Introduction to Renewable Energy	4
	Definition of energy	
	Classification of energy (fossil and non-fossil energy)	
	Renewable and non-renewable energy source	
	Classification of renewable energy source (convectional and emerging)	
	Convectional renewable energy source: solar thermal, solar PV, wind, hydro, biomass	
	Emerging renewable source: tidal, geothermal, hydrogen fuel	
	Energy storage system	
Module 2:	Energy and Environment	4
	Introduction to Environment	
	Type of environment: physical, biotic	
	Environmental health	
	Pollution	
	Type of pollution: air, land, water, light, noise, visual, thermal	
	Pollutant	
	Composition of the atmosphere: nitrogen, oxygen, argon, carbon dioxide, water vapour, trace elements	
	Units of measurement of air pollution: air pollution index (API), respirable suspended particulate (RSP)	

MODULE	TOPICS	TIME (HRS)
Module 3:	Solar Energy Fundamentals	8
	Introduction sunlight and it properties	
	Understanding of solar terminology <ul style="list-style-type: none"> · Solar radiation · Solar irradiance · Solar irradiation · Solar insolation · Solar constant · Solar Time 	
	Radiation and its sources	
	Solar Azimuth angle	
	Atmospheric effects	
	Effect of earth movement on radiation	
	Type of radiation <ul style="list-style-type: none"> · Direct · Reflected · Diffuse 	
Module 4:	Basic Electricity	20
	Meaning of basic electrical parameters <ul style="list-style-type: none"> · Electrical charge · Current, voltage · Resistance · Power 	
	Relating them with their hydraulic analogies (volume, flow, pressure, hydraulic power and friction)	
	Difference between electrical power (rate of work performed) and energy (total work performed)	
	Function and purpose of common electrical system components <ul style="list-style-type: none"> · Conductors · Conduits/raceways and enclosures · Over-current devices · Diodes and rectifiers · Switchgear · Transformers · Terminals and connectors · Resistors, inductors, capacitors 	

MODULE	TOPICS	TIME (HRS)
	Basic electrical test equipment and its purpose <ul style="list-style-type: none"> · Voltmeters · Ammeters · Ohmmeters · Watt-hour meters. 	
	Application of Ohm's law in analyzing simple electrical circuits, and to calculate voltage, current, resistance or power given any other two parameters	
	Fundamentals of electric utility system operations, including generation, transmission, distribution, and typical electrical service supplies to buildings and facilities	
Module 5:	PV Cell and Module Technology	26
	Basic concept of semiconductor	
	Fundamentals of solar cell	
	Basic semiconductor physics: holes and electrons in semiconductor, doping, n-type and p-type semiconductor, holes and electrons movement, photo carrier generation and recombination	
	Junctions; p-n, p-I-n and metal semiconductor contacts, band bending, Ohmic and	
	<ul style="list-style-type: none"> · AC output (watt) · DC input voltage from battery · AC output voltage · Frequency · Waveform type 	
Module 6:	Charge Controller	10
	Introduction	
	Principle of operation of charge controller	
	Types of charge controllers <ul style="list-style-type: none"> · Shunt controllers 	

MODULE	TOPICS	TIME (HRS)
	<ul style="list-style-type: none"> · Single-stage series controllers · Diversion controllers · Pulse width modulation (PWM) controllers 	
	Features of charge controller: <ul style="list-style-type: none"> § Maximum power point tracking § Voltage step down § LED lights § Meter display § Low voltage disconnect § Low voltage warning beeper § Load circuit breaker § Generator start control § Load timers 	
	Stages of charging <ul style="list-style-type: none"> · Bulk · Absorption · Float 	
Module 7:	Battery	12
	Introduction of Energy Storage Systems	
	General background on alternative energy sources and sustainability	
	Principle of operation of battery	
	Battery performance (SOC, SOH, etc)	
	Methods of measuring state of charge (SOC) of battery by: <ul style="list-style-type: none"> · specific gravity · voltage label 	
	Type of Battery <ul style="list-style-type: none"> · Lead acid · Sodium-battery · Magnesium battery · Aluminium battery 	
	<ul style="list-style-type: none"> · Silicon battery · Nickel Metal Hydride Battery 	

MODULE	TOPICS	TIME (HRS)
	<ul style="list-style-type: none"> · Advance lead-acid batteries · Lithium – ion 	
Module 8:	Energy Auditing and System sizing	16
	Meaning of energy audit	
	Type of energy audit <ul style="list-style-type: none"> · Preliminary/walk through · Detail · Target · Energy audit for investment 	
	Developing load profile	
	Working out inverter size	
	Significance of days of autonomy Calculation of battery size	
	Working out PV module size	
	Working out charge controller size	
Module 9:	Connection of PV System (Series and Parallel Circuit)	20
	Series and parallel Circuits	
	Combining Series & Parallel Circuits	
	PV module string connection	
	Battery string connection	
	Module and string testing using multimeter /clamp meter	
Module 10:	Solar Power Plant Overview	24

MODULE	TOPICS	TIME (HRS)
	Type of Solar Power Plant	
	Off-Grid / roof top solar power plant	
	Grid interactive solar power plant	
	Grid Connected solar Power Plant	
	Hybrid and storage power plant	
Module 11:	Overview of Drawings and Schematic Diagram	16
	Read and Interpret the manufacturing data specification sheets of different equipment and components	
	Circuit layout and understanding of basic electrical symbols	
	Basic introduction of AC /DC single line diagram and its importance	
Module 12:	Type of cables and its application	10
	Cable technical parameter understanding and data sheet	
	<ul style="list-style-type: none"> · Silicon battery · Nickel Metal Hydride Battery · Advance lead-acid batteries · Lithium – ion 	
	Reading	
	Understanding of cable testing and equipment used	
	Cable termination and its accessories	
Module 13:	Introduction to transformer and its uses	8
	Transformer and HT Switchgear	
	Classification of transformer based on <ul style="list-style-type: none"> · Size: distribution and power transformer 	

MODULE	TOPICS	TIME (HRS)
	<ul style="list-style-type: none"> · Purpose: step-down and step-up transformer · No of windings: primary, secondary and tertiary transformer 	
	Transforming testing <ul style="list-style-type: none"> · Insulation resistance · Short circuit 	
	Mode of transformer cooling <ul style="list-style-type: none"> · ONAN · ONAF 	
	Overview of HT switchgear and its application <ul style="list-style-type: none"> · Isolator · Circuit breaker 	
	Metering system and type of meters	
Module 14:	Earthing and Lightning protection of Solar Power plant	8
	Overview of different type of earthing and its application	
	Types of earthing strip/ground conductor	
	Importance of earthing and lightning of solar power plant	
	Type of lightning arrester	
	Basic Consideration for Protection	
Module 15:	Overview of Weather Monitoring Station and SCADA monitoring	10
	Basic components of plant monitoring and its application	
	Weather station and equipment overview	
Module 16:	PV Plant Operation and Maintenance	10
	Different tools and method used for specific purpose in an installation and maintenance of solar PV and	

MODULE	TOPICS	TIME (HRS)
	electrical system	
	Identify tools & method used for civil/mechanical installation	
	Understand the Typical faults, their causes and resolution for all components	
	Reading continuity checks, polarity check, Voltage, Current, DC and AC Power	
	Measurement of electrical quantities and other O&M activities	
	Overview of personal and site safety	
	Understand the DO's and Don'ts of material handling	
	Potential risk in solar PV plant and its individual component	
	Understand occupational health, safety standards and regulations for installation of solar PV system	
Module 17:	Practical	18
	Design and simulation of Solar Hybrid Power Plant using Homer Pro, PV Syst and other simulation software	
	Case Study 1: DC-Coupled System Design Case Study 2: AC-Coupled System Design Performing Energy Yield Analysis Performing Shading Analysis Production of site layout drawings and Bill of Quantities	
Module 18:	Site Visitation	6
		240 hours

6 Contractor’s Representative and Key Personnel

Item No.	Position/specialization	Relevant academic qualifications	Minimum years of relevant work experience
1	Project Manager	Bachelor’s Degree in Engineering, sciences, or Social Sciences and with Project Management certification (PMP) or equivalent	Ten (10) years of general experience and five (5) years of experience in managing utility scale solar hybrid power project construction and operations and maintenance.
2.	Site Manager	Bachelor’s Degree in Electrical Engineering	Six (6) years of general experience and three (3) years of experience in solar power hybrid design projects. He shall have an experience as a team leader with experience of at least two (2) solar Power Hybrid project of installed capacity of 2 MW and above., also with operations and maintenance experience in power plants.

Item No.	Position/specialization	Relevant academic qualifications	Minimum years of relevant work experience
3	Site Supervisor	Bachelor's Degree in Electrical Engineering	Six (6) years post qualification experience in solar hybrid power plant construction projects & Medium and Low voltage (MV/LV) works, must be registered member of Professional bodies e.g., Nigeria Society of Engineers (NSE), Council for the Regulation of Engineering in Nigeria (COREN) or equivalent in the Power industry.
4	Health, Safety, Security and Environmental (HSSE) Officer	Bachelor's Degree in Engineering Sciences, must have certification with related professional bodies.	Five (5) years post qualification experience in HSSE with at least three (3) years of experience in Power projects environment.
5.	Gender Based Violence (GBV) Officer	Bachelor's Degree in Social Sciences or Sciences	Four (4) years post qualification experience and knowledge of gender issues in development particularly GBV, with at least two (2) years' experiences in GBV (especially in areas of sexual exploitation and abuse, and sexual harassment).

Item No.	Position/specialization	Relevant academic qualifications	Minimum years of relevant work experience
6	Civil Engineer	Bachelor's Degree in Civil Engineering	Five (5) years post qualification experience in design & supervision of foundations, Structures and at least two (2) years' experience working at a utility scale Solar hybrid photovoltaic project. Must be registered with professional bodies e. g NSE, COREN or equivalent.
7.	Quality Assurance and Control Officer	Bachelor's Degree in Engineering	Five (5) years post qualification experience in design & supervision of foundations, Structures and at least two (2) years' experiences working at a utility scale Solar hybrid photovoltaic project. Must be registered with professional bodies e. g NSE, COREN or equivalent

7 Forms and Procedures

8 Forms of Completion Certificate

Form of Completion Certificate

Date:

Loan/Credit N°:

RFP N°:

To: _____

Dear Ladies and/or Gentlemen,

Pursuant to GCC Clause 24 (Completion of the Facilities) of the General Conditions of the Contract entered into between yourselves and the Employer dated _____, relating to the _____, we hereby notify you that the following part(s) of the Facilities was (were) complete on the date specified below, and that, in accordance with the terms of the Contract, the Employer hereby takes over the said part(s) of the Facilities, together with the responsibility for care and custody and the risk of loss thereof on the date mentioned below.

1. Description of the Facilities or part thereof:
2. Date of Completion: _____

However, you are required to complete the outstanding items listed in the attachment hereto as soon as practicable.

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

Title

(Project Manager)

Form of Operational/Provisional Acceptance Certificate

Date:

Loan/Credit N°:

IFB N°:

To: _____ Dear Ladies and/or Gentlemen,

Pursuant to GCC Sub-Clause 25.3 (Operational Acceptance) of the General Conditions of the Contract entered into between yourselves and the Employer dated _____, relating to the _____, we hereby notify you that the Functional Guarantees of the following part(s) of the Facilities were satisfactorily attained on the date specified below.

1. Description of the Facilities or part thereof:
2. Date of Operational Acceptance: _____

This letter does not relieve you of your obligation to complete the execution of the Facilities in accordance with the Contract nor of your obligations during the Defect Liability Period.

Very truly yours,

Title

(Project Manager)

9 Change Order Procedure and Forms

Date:

Loan/Credit N°:

_____ IFB N°:

CONTENTS

1. General
2. Change Order Log
3. References for Changes

ANNEXES

- Annex 1 Request for Change Proposal
- Annex 2 Estimate for Change Proposal
- Annex 3 Acceptance of Estimate
- Annex 4 Change Proposal
- Annex 5 Change Order
- Annex 6 Pending Agreement Change Order
- Annex 7 Application for Change Proposal

10 Change Order Procedure

General

This section provides samples of procedures and forms for implementing changes in the Facilities during the performance of the Contract in accordance with GCC Clause 39 (Change in the Facilities) of the General Conditions.

Change Order Log

The Contractor shall keep an up-to-date Change Order Log to show the current status of Requests for Change and Changes authorized or pending, as Annex 8. Entries of the Changes in the Change Order Log shall be made to ensure that the log is up-to-date. The Contractor shall attach a copy of the current Change Order Log in the monthly progress report to be submitted to the Employer.

References for Changes

- 1) Request for Change as referred to in GCC Clause 39 shall be serially numbered CR-X-nnn.
- 2) The Estimate for Change Proposal as referred to in GCC Clause 39 shall be serially numbered CN-X-nnn.
- 3) Acceptance of Estimates as referred to in GCC Clause 39 shall be serially numbered CA-X-nnn.
- 4) Change Proposal as referred to in GCC Clause 39 shall be serially numbered CP-X-nnn.
- 5) Change Order as referred to in GCC Clause 39 shall be serially numbered CO-X-nnn.

Note: (a) Requests for Change issued from the Employer's Home Office and the Site representatives of the Employer shall have the following respective references:

Home	
Office	CR-H-nnn Site CR-S-nnn

- (b) The above number "nnn" is the same for Request for Change, Estimate for Change Proposal, Acceptance of Estimate, Change Proposal and Change Order.

10.4 Annex 1. Request for Change Proposal

10.5 Annex 2. Estimate for Change Proposal

10.6 Annex 3. Acceptance of Estimate

10.7 Annex 4. Change Proposal

10.8 Annex 5. Change Order

10.9 Annex 6. Pending Agreement Change Order

10.10 Annex 7. Application for Change Proposal

11 Drawings

The relevant conceptual drawings for the beneficiary universities can be seen in the hyperlinks below. Please note that all drawings are indicative, and the bidders are expected to submit detailed drawings based on their actual design.

[CONCEPTUAL DRAWINGS FOR FUDMA](#)

[CONCEPTUAL DRAWINGS FOR FULAFIA](#)

[CONCEPTUAL DRAWINGS FOR FULOKOJA](#)

[CONCEPTUAL DRAWINGS FOR FUTA](#)

[CONCEPTUAL DRAWINGS FOR FUTO](#)

[CONCEPTUAL DRAWINGS FOR UNIPORT & UPTH](#)

[CONCEPTUAL DRAWINGS FOR UNIUYO](#)

[CONCEPTUAL DRAWINGS FOR MAU](#)

12 Supplementary Information – Unpriced Bill of Quantities

The links to the unpriced Bill of quantities for all the beneficiary institutions are provided below. The quantities are indicative, and the bidders can modify the BOQ based on the capacities and the quantities from the bidder's design.

[UNPRICED BILL OF QUANTITIES FOR FUDMA](#)

[UNPRICED BILL OF QUANTITIES FOR FULAFIA](#)

[UNPRICED BILL OF QUANTITIES FOR FULOKOJA](#)

[UNPRICED BILL OF QUANTITIES FOR FUTA](#)

[UNPRICED BILL OF QUANTITIES FOR FUTO](#)

[UNPRICED BILL OF QUANTITIES FOR UNIPORT & UPTH](#)

[UNPRICED BILL OF QUANTITIES FOR UNIUYO](#)

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PART 3 – Conditions of Contract and Contract Forms

Section VIII - General Conditions of Contract

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General Conditions of Contract

A. Contract and Interpretation

1. **Definitions** 1.1 The following words and expressions shall have the meanings hereby assigned to them:

“Contract” means the Contract Agreement entered into between the Employer and the Contractor, together with the Contract Documents referred to therein; they shall constitute the Contract, and the term “the Contract” shall in all such documents be construed accordingly.

“Contract Documents” means the documents listed in Article 1.1 (Contract Documents) of the Contract Agreement (including any amendments thereto).

“GCC” means the General Conditions of Contract hereof.

“PCC” means the Particular Conditions of Contract.

“day” means calendar day.

“year” means 365 days.

“month” means calendar month.

“Party” means the Employer or the Contractor, as the context requires, and “Parties” means both of them.

“Employer” means the person **named as such in the PCC** and includes the legal successors or permitted assigns of the Employer.

“Project Manager” means the person appointed by the Employer in the manner provided in GCC Sub-Clause 17.1 (Project Manager) hereof and **named as such in the PCC** to perform the duties delegated by the Employer.

“Contractor” means the person(s) whose Bid to perform the Contract has been accepted by the Employer and is named as Contractor in the Contract Agreement, and includes the legal successors or permitted assigns of the Contractor.

“Contractor’s Representative” means any person nominated by the Contractor and approved by the Employer in the manner

provided in GCC Sub-Clause 17.2 (Contractor's Representative and Construction Manager) hereof to perform the duties delegated by the Contractor.

"Construction Manager" means the person appointed by the Contractor's Representative in the manner provided in GCC Sub-Clause 17.2.4.

"Subcontractor," including manufacturers, means any person to whom execution of any part of the Facilities, including preparation of any design or supply of any Plant, is sub-contracted directly or indirectly by the Contractor, and includes its legal successors or permitted assigns.

"Dispute Board" (DB) means the person or persons named as such in the PCC appointed by agreement between the Employer and the Contractor to make a decision with respect to any dispute or difference between the Employer and the Contractor referred to him or her by the Parties pursuant to GCC Sub-Clause 46.1 (Dispute Board) hereof.

"The Bank" means the financing institution **named in the PCC.**

"Contract Price" means the sum specified in Article 2.1 (Contract Price) of the Contract Agreement, subject to such additions and adjustments thereto or deductions therefrom, as may be made pursuant to the Contract.

"Facilities" means the Plant to be supplied and installed, as well as all the Installation Services to be carried out by the Contractor under the Contract.

"Plant" means permanent plant, equipment, machinery, apparatus, materials, articles and things of all kinds to be provided and incorporated in the Facilities by the Contractor under the Contract (including the spare parts to be supplied by the Contractor under GCC Sub-Clause 7.3 hereof), but does not include Contractor's Equipment.

"Installation Services" means all those services ancillary to the supply of the Plant for the Facilities, to be provided by the Contractor under the Contract, such as transportation and provision of marine or other similar insurance, inspection, expediting, site preparation works (including the provision and use of Contractor's Equipment and the supply of all construction

materials required), installation, testing, precommissioning, commissioning, operations, maintenance, the provision of operations and maintenance manuals, training, etc... as the case may require.

“Contractor’s Equipment” means all facilities, equipment, machinery, tools, apparatus, appliances or things of every kind required in or for installation, completion and maintenance of Facilities that are to be provided by the Contractor, but does not include Plant, or other things intended to form or forming part of the Facilities.

“Country of Origin” means the countries and territories eligible under the rules of the Bank as further **elaborated in the PCC**.

“Site” means the land and other places upon which the Facilities are to be installed, and such other land or places as may be specified in the Contract as forming part of the Site.

“Effective Date” means the date of fulfillment of all conditions stated in Article 3 (Effective Date) of the Contract Agreement, from which the Time for Completion shall be counted.

“Time for Completion” means the time within which Completion of the Facilities as a whole (or of a part of the Facilities where a separate Time for Completion of such part has been prescribed) is to be attained, as referred to in GCC Clause 8 and in accordance with the relevant provisions of the Contract.

“Completion” means that the Facilities (or a specific part thereof where specific parts are specified in the Contract) have been completed operationally and structurally and put in a tight and clean condition, that all work in respect of Precommissioning of the Facilities or such specific part thereof has been completed, and that the Facilities or specific part thereof are ready for Commissioning as provided in GCC Clause 24 (Completion) hereof.

“Precommissioning” means the testing, checking and other requirements specified in the Employer’s Requirements that are to be carried out by the Contractor in preparation for Commissioning as provided in GCC Clause 24 (Completion) hereof.

“Commissioning” means operation of the Facilities or any part thereof by the Contractor following Completion, which operation is to be carried out by the Contractor as provided in GCC Sub-Clause 25.1 (Commissioning) hereof, for the purpose of carrying out Guarantee Test(s).

“Guarantee Test(s)” means the test(s) specified in the Employer’s Requirements to be carried out to ascertain whether the Facilities or a specified part thereof is able to attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, in accordance with the provisions of GCC Sub-Clause 25.2 (Guarantee Test) hereof.

“Operational Acceptance” means the acceptance by the Employer of the Facilities (or any part of the Facilities where the Contract provides for acceptance of the Facilities in parts), which certifies the Contractor’s fulfillment of the Contract in respect of Functional Guarantees of the Facilities (or the relevant part thereof) in accordance with the provisions of GCC Clause 28 (Functional Guarantees) hereof and shall include deemed acceptance in accordance with GCC Clause 25 (Commissioning and Operational Acceptance) hereof.

“Defect Liability Period” means the period of validity of the warranties given by the Contractor commencing at Completion of the Facilities or a part thereof, during which the Contractor is responsible for defects with respect to the Facilities (or the relevant part thereof) as provided in GCC Clause 27 (Defect Liability) hereof.

“ES” means Environmental and Social (including Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH)).

“Sexual Exploitation and Abuse” “(SEA)” means the following:

Sexual Exploitation is defined as any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another.

Sexual Abuse is defined as the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions;

“Sexual Harassment” “(SH)” is defined as unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature by the Contractor’s Personnel with other Contractor’s Personnel or Employer’s Personnel.

“Contractor’s Personnel” means all personnel whom the Contractor utilizes in the execution of the Contract, including the staff, labor and other employees of the Contractor and each Subcontractor; and any other personnel assisting the Contractor in the execution of the Contract; and

“Employer’s Personnel” means all staff, labor and other employees of the Project Manager and of the Employer engaged in fulfilling the Employer’s obligations under the Contract; and any other personnel identified as Employer’s Personnel, by a notice from the Employer to the Contractor.

2. Contract Documents 2.1 Subject to Article 1.2 (Order of Precedence) of the Contract Agreement, all documents forming part of the Contract (and all parts thereof) are intended to be correlative, complementary and mutually explanatory. The Contract shall be read as a whole.

3. Interpretation 3.1 In the Contract, except where the context requires otherwise:

- (a) words indicating one gender include all genders;
- (b) words indicating the singular also include the plural and words indicating the plural also include the singular;
- (c) provisions including the word “agree,” “agreed,” or “agreement” require the agreement to be recorded in writing;
- (d) the word “tender” is synonymous with “Bid,” “tenderer,” with “Bidder,” and “tender documents” with “Bidding Document,” and
- (e) “written” or “in writing” means hand-written, type-written, printed or electronically made, and resulting in a permanent record.

The marginal words and other headings shall not be taken into consideration in the interpretation of these Conditions.

3.2 Incoterms

Unless inconsistent with any provision of the Contract, the meaning of any trade term and the rights and obligations of Parties thereunder shall be as prescribed by *Incoterms*.

Incoterms means international rules for interpreting trade terms published by the International Chamber of Commerce (latest edition), 38 Cours Albert 1^{er}, 75008 Paris, France.

3.3 Entire Agreement

Subject to GCC Sub-Clause 16.4 hereof, the Contract constitutes the entire agreement between the Employer and Contractor with respect to the subject matter of Contract and supersedes all communications, negotiations and agreements (whether written or oral) of Parties with respect thereto made prior to the date of Contract.

3.4 Amendment

No amendment or other variation of the Contract shall be effective unless it is in writing, is dated, expressly refers to the Contract, and is signed by a duly authorized representative of each Party hereto.

3.5 Independent Contractor

The Contractor shall be an independent contractor performing the Contract. The Contract does not create any agency, partnership, joint venture or other joint relationship between the Parties hereto. Subject to the provisions of the Contract, the Contractor shall be solely responsible for the manner in which the Contract is performed. All employees, representatives or Subcontractors engaged by the Contractor in connection with the performance of the Contract shall be under the complete control of the Contractor and shall not be deemed to be employees of the Employer, and nothing contained in the Contract or in any subcontract awarded by the Contractor shall be construed to create any contractual relationship between any such employees, representatives or Subcontractors and the Employer.

3.6 Non-Waiver

3.6.1 Subject to GCC Sub-Clause 3.6.2 below, no relaxation, forbearance, delay or indulgence by either Party in

enforcing any of the terms and conditions of the Contract or the granting of time by either Party to the other shall prejudice, affect or restrict the rights of that Party under the Contract, nor shall any waiver by either Party of any breach of Contract operate as waiver of any subsequent or continuing breach of Contract.

3.6.2 Any waiver of a Party's rights, powers or remedies under the Contract must be in writing, must be dated and signed by an authorized representative of the Party granting such waiver, and must specify the right and the extent to which it is being waived.

3.7 Severability

If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.

3.8 Country of Origin

"Origin" means the place where the plant and component parts thereof are mined, grown, produced or manufactured, and from which the services are provided. Plant components are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that is substantially in its basic characteristics or in purpose or utility from its components.

**4. Communica-
tions**

4.1 Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices, requests and discharges, these communications shall be:

- (a) in writing and delivered against receipt; and
- (b) delivered, sent or transmitted to the address for the recipient's communications as stated in the Contract Agreement.

When a certificate is issued to a Party, the certifier shall send a copy to the other Party. When a notice is issued to a Party, by the other Party or the Project Manager, a copy shall be sent to the Project Manager or the other Party, as the case may be.

- 5. Law and Language**
- 5.1 The Contract shall be governed by and interpreted in accordance with laws of the country **specified in the PCC.**
 - 5.2 The ruling language of the Contract shall be that **stated in the PCC.**
 - 5.3 The language for communications shall be the ruling language unless otherwise **stated in the PCC.**
- 6. Fraud and Corruption; and Eligibility**
- 6.1 The Bank requires compliance with the Integrity Framework comprising the African Development Bank Group’s Sanctions Procedures, the Bank’s Whistleblowing and Complaints Policy, the Bank’s Procurement Policy under the Procurement Framework and any other applicable Policies and Procedures including their updates, as set forth in Appendix B to the GCC.
 - 6.2 The Employer requires the Contractor to disclose any commissions or fees that may have been paid or are to be paid to agents or any other party with respect to the Bidding process or execution of the Contract. The information disclosed must include at least the name and address of the agent or other party, the amount and currency, and the purpose of the commission, gratuity or fee.
 - 6.3 The Contractor and its Subcontractor or Suppliers shall have the nationality of an eligible country of the Bank in accordance with the Bank’s Procurement Policy for the Bank Group Funded Operation described under the Bank’s Procurement Framework, and as listed in Section V, Eligible Countries. The Contractor shall be deemed to have the nationality of a country if the Contractor is constituted, incorporated or registered in and operates in conformity with the provisions of the laws of that country, as evidenced by its articles of incorporation (or equivalent documents of constitution or association) and its registration documents, as the case may be. This criterion also shall apply to the determination of the nationality of proposed subcontractors or subconsultants for any part of the Contract including related Services. All materials, equipment and services to be supplied under the Contract shall have their country of origin in an eligible country of the Bank in accordance with the Bank’s Procurement Policy for Bank Group Funded Operations described under the Bank’s Procurement Framework, and as listed in Section V, Eligible Countries under Appendix D.

B. Subject Matter of Contract

7. Scope of Facilities

- 7.1 Unless otherwise expressly limited in the Employer's Requirements, the Contractor's obligations cover the provision of all Plant and the performance of all Installation Services required for the design, and the manufacture (including procurement, quality assurance, construction, installation, associated civil works, Precommissioning and delivery) of the Plant, and the installation, completion and commissioning of the Facilities in accordance with the plans, procedures, specifications, drawings, codes and any other documents as specified in the Section, Employer's Requirements. Such specifications include, but are not limited to, the provision of supervision and engineering services; the supply of labor, materials, equipment, spare parts (as specified in GCC Sub-Clause 7.3 below) and accessories; Contractor's Equipment; construction utilities and supplies; temporary materials, structures and facilities; transportation (including, without limitation, unloading and hauling to, from and at the Site); and storage, except for those supplies, works and services that will be provided or performed by the Employer, as set forth in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer.
- 7.2 The Contractor shall, unless specifically excluded in the Contract, perform all such work and/or supply all such items and materials not specifically mentioned in the Contract but that can be reasonably inferred from the Contract as being required for attaining Completion of the Facilities as if such work and/or items and materials were expressly mentioned in the Contract.
- 7.3 In addition to the supply of Mandatory Spare Parts included in the Contract, the Contractor agrees to supply spare parts required for the operation and maintenance of the Facilities for the period **specified in the PCC** and the provisions, if any, **specified in the PCC**. However, the identity, specifications and quantities of such spare parts and the terms and conditions relating to the supply thereof are to be agreed between the Employer and the Contractor, and the price of such spare parts shall be that given in Price Schedule No. 6, which shall be added to the Contract Price. The price of such spare parts shall include the purchase price therefor and other costs and expenses

(including the Contractor's fees) relating to the supply of spare parts.

8. Time for Commencement and Completion

8.1 The Contractor shall commence work on the Facilities within the period **specified in the PCC** and without prejudice to GCC Sub-Clause 26.2 hereof, the Contractor shall thereafter proceed with the Facilities in accordance with the time schedule specified in the Appendix to the Contract Agreement titled Time Schedule.

8.2 The Contractor shall attain Completion of the Facilities or of a part where a separate time for Completion of such part is specified in the Contract, within the time **stated in the PCC** or within such extended time to which the Contractor shall be entitled under GCC Clause 40 hereof.

9. Contractor's Responsibilities

9.1 The Contractor shall design, manufacture including associated purchases and/or subcontracting, install and complete the Facilities in accordance with the Contract. When completed, the Facilities should be fit for the purposes for which they are intended as defined in the Contract.

9.2 The Contractor confirms that it has entered into this Contract on the basis of a proper examination of the data relating to the Facilities including any data as to boring tests provided by the Employer, and on the basis of information that the Contractor could have obtained from a visual inspection of the Site if access thereto was available and of other data readily available to it relating to the Facilities as of the date twenty-eight (28) days prior to Bid submission. The Contractor acknowledges that any failure to acquaint itself with all such data and information shall not relieve its responsibility for properly estimating the difficulty or cost of successfully performing the Facilities.

9.3 The Contractor shall acquire and pay for all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country where the Site is located which such authorities or undertakings require the Contractor to obtain in its name and which are necessary for the performance of the Contract, including, without limitation, visas for the Contractor's and

Subcontractor's personnel and entry permits for all imported Contractor's Equipment. The Contractor shall acquire all other permits, approvals and/or licenses that are not the responsibility of the Employer under GCC Sub-Clause 10.3 hereof and that are necessary for the performance of the Contract.

- 9.4 The Contractor shall comply with all laws in force in the country where the Facilities are to be implemented. The laws will include all local, state, national or other laws that affect the performance of the Contract and bind upon the Contractor. The Contractor shall indemnify and hold harmless the Employer from and against any and all liabilities, damages, claims, fines, penalties and expenses of whatever nature arising or resulting from the violation of such laws by the Contractor or its personnel, including the Subcontractors and their personnel, but without prejudice to GCC Sub-Clause 10.1 hereof.
- 9.5 Any Plant and Installation Services that will be incorporated in or be required for the Facilities and other supplies shall have their origin as specified under GCC Clause 1 (Country of Origin). Any subcontractors retained by the Contractor shall be from a country as specified in GCC Clause 1 (Country of Origin).
- 9.6 (a) If the Contractor is a joint venture, or association (JV) of two or more persons, all such persons shall be jointly and severally bound to the Employer for the fulfillment of the provisions of the Contract unless otherwise specified **in the PCC**; (b) The JV shall designate one of such persons to act as a leader with authority to bind the JV; (c) The composition or the constitution of the JV shall not be altered without the prior consent of the Employer; (d) As specified **in the PCC**, there is a limit on the number of members in a JV; and (e) Participation by value of the contract as share of each of the JV partner (member) shall not be less than the percentage specified **in the PCC**.
- 9.7 Pursuant to paragraph 2.2 e. of Appendix B to the General Conditions the Contractor shall permit and shall cause its subcontractors and subconsultants to permit, the Bank and/or persons appointed by the Bank to inspect the Site and/or the accounts and records relating to the procurement process, selection and/or contract execution, and to have such accounts and records audited by auditors appointed by the Bank if

requested by the Bank. The Contractor's and its Subcontractors' and subconsultants' attention is drawn to Sub-Clause 6.1 which provides, inter alia, that acts intended to materially impede the exercise of the Bank's inspection and audit rights constitute a prohibited practice subject to contract termination (as well as to a determination of ineligibility pursuant to the Bank's prevailing sanctions procedures).

9.8 The Contractor shall conform to the sustainable procurement contractual provisions, if and as specified in the PCC.

9.9 Contractor's Environmental and Social Management Plan (C-ESMP)

The Contractor shall not carry out mobilization to Site unless the Project Manager gives approval, an approval that shall not be unreasonably delayed, to the measures the Contractor proposes to address environmental and social risks and impacts including the code of conduct, in accordance with GCC Sub-Clause 22.4.

The Contractor shall submit, to the Project Manager for Review, any additional Management Strategies and Implementation Plans as are necessary to manage the ES risks and impacts of the Facilities. These Management Strategies and Implementation Plans collectively comprise the Contractor's Environmental and Social Management Plan (C-ESMP).

The Contractor shall review the C-ESMP, periodically (but not less than every six (6) months), and update it as required to ensure that it contains measures appropriate to the Facilities. The updated C-ESMP shall be submitted to the Project Manager for its approval.

9.10 Training of Contractor's Personnel

The Contractor shall provide appropriate training to relevant Contractor's Personnel on ES aspects of the Contract, including appropriate sensitization on prohibition of SEA and health and safety training referred to in GCC Sub-Clause 22.2.7.

As stated in the Employer's Requirements or as instructed by the Project Manager, the Contractor shall also allow appropriate opportunities for the relevant Contractor's

Personnel to be trained on ES aspects of the Contract by the Employer's personnel and/or other personnel assigned by the Employer.

9.11 Stakeholder engagements

The Contractor shall provide relevant contract-related information, as the Employer and/or Project Manager may reasonably request to conduct contract stakeholder engagement. "Stakeholder" refers to individuals or groups who:

- (a) are affected or likely to be affected by the Contract;
and
- (b) may have an interest in the Contract.

The Contractor may also directly participate in contract stakeholder engagements, as the Employer and/or Project Manager may reasonably request.

9.12 Forced Labor

The Contractor, including its Subcontractors, shall not employ or engage forced labour. Forced labour consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements.

No persons shall be employed or engaged who have been subject to trafficking. Trafficking in persons is defined as the recruitment, transportation, transfer, harbouring or receipt of persons by means of the threat or use of force or other forms of coercion, abduction, fraud, deception, abuse of power, or of a position of vulnerability, or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purposes of exploitation.

The Contractor shall also take measures to require its suppliers (other than Subcontractors) not to employ or engage forced labour including trafficked persons. If forced labour/trafficking cases are identified, the Contractor shall take measures to require the suppliers to take appropriate steps to remedy them. Where the supplier does not remedy the situation, the

Contractor shall within a reasonable period substitute the supplier with a supplier that is able to manage such risks.

9.13 Child Labor

The Contractor, including its Subcontractors, shall not employ or engage a child under the age of 14 unless the national law specifies a higher age (the minimum age).

The Contractor, including its Subcontractors, shall not employ or engage a child between the minimum age and the age of 18 in a manner that is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development.

The Contractor including its Subcontractors, shall only employ or engage children between the minimum age and the age of 18 after an appropriate risk assessment has been conducted by the Contractor with the Engineer's consent. The Contractor shall be subject to regular monitoring by the Project Manager that includes monitoring of health, working conditions and hours of work.

Work considered hazardous for children is work that, by its nature or the circumstances in which it is carried out, is likely to jeopardize the health, safety, or morals of children. Such work activities prohibited for children include work:

- (a) with exposure to physical, psychological or sexual abuse;
- (b) underground, underwater, working at heights or in confined spaces;
- (c) with dangerous machinery, equipment or tools, or involving handling or transport of heavy loads;
- (d) in unhealthy environments exposing children to hazardous substances, agents, or processes, or to temperatures, noise or vibration damaging to health; or
- (e) under difficult conditions such as work for long hours, during the night or in confinement on the premises of the employer.

The Contractor shall also take measures to require its suppliers (other than Subcontractors) not to employ or engage child

labor. If child labor cases are identified, the Contractor shall take measures to require the suppliers to take appropriate steps to remedy them. Where the supplier does not remedy the situation, the Contractor shall within a reasonable period substitute the supplier with a supplier that is able to manage such risks.

9.14 Serious Safety Issues

The Contractor, including its Subcontractors, shall comply with all applicable safety obligations. The Contractor shall also take measures to require its suppliers (other than Subcontractors) to adopt procedures and mitigation measures adequate to address safety issues related to their personnel. If serious safety issues are identified, the Contractor shall take measures to require the suppliers to take appropriate steps to remedy them. Where the supplier does not remedy the situation, the Contractor shall within a reasonable period substitute the supplier with a supplier that is able to manage such risks.

9.15 Obtaining natural resource materials

The Contractor shall obtain natural resource materials from suppliers that can demonstrate, through compliance with the applicable verification and/ or certification requirements, that obtaining such materials is not contributing to the risk of significant conversion or significant degradation of natural or critical habitats such as unsustainably harvested wood products, gravel or sand extraction from river beds or beaches.

If a supplier cannot continue to demonstrate that obtaining such materials is not contributing to the risk of significant conversion or significant degradation of natural or critical habitats, the Contractor shall within a reasonable period substitute the supplier with a supplier that is able to demonstrate that they are not significantly adversely impacting the habitats.

10. Employer's Responsibilities

10.1 All information and/or data to be supplied by the Employer as described in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, shall be deemed to be accurate, except when the Employer expressly states otherwise.

- 10.2 The Employer shall be responsible for acquiring and providing legal and physical possession of the Site and access thereto, and for providing possession of and access to all other areas reasonably required for the proper execution of the Contract, including all requisite rights of way, as specified in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer. The Employer shall give full possession of and accord all rights of access thereto on or before the date(s) specified in that Appendix.
- 10.3 The Employer shall acquire and pay for all permits, approvals and/or licenses from all local, state or national government authorities or public service undertakings in the country where the Site is located which (a) such authorities or undertakings require the Employer to obtain in the Employer's name, (b) are necessary for the execution of the Contract, including those required for the performance by both the Contractor and the Employer of their respective obligations under the Contract, and (c) are specified in the Appendix (Scope of Works and Supply by the Employer).
- 10.4 If requested by the Contractor, the Employer shall use its best endeavors to assist the Contractor in obtaining in a timely and expeditious manner all permits, approvals and/or licenses necessary for the execution of the Contract from all local, state or national government authorities or public service undertakings that such authorities or undertakings require the Contractor or Subcontractors or the personnel of the Contractor or Subcontractors, as the case may be, to obtain.
- 10.5 Unless otherwise specified in the Contract or agreed upon by the Employer and the Contractor, the Employer shall provide sufficient, properly qualified operating and maintenance personnel; shall supply and make available all raw materials, utilities, lubricants, chemicals, catalysts, other materials and facilities; and shall perform all work and services of whatsoever nature, including those required by the Contractor to properly carry out Precommissioning, Commissioning and Guarantee Tests, all in accordance with the provisions of the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, at or before the time specified in the program

furnished by the Contractor under GCC Sub-Clause 18.2 hereof and in the manner thereupon specified or as otherwise agreed upon by the Employer and the Contractor.

- 10.6 The Employer shall be responsible for the continued operation of the Facilities after Completion, in accordance with GCC Sub-Clause 24.8, and shall be responsible for facilitating the Guarantee Test(s) for the Facilities, in accordance with GCC Sub-Clause 25.2.
- 10.7 All costs and expenses involved in the performance of the obligations under this GCC Clause 10 shall be the responsibility of the Employer, save those to be incurred by the Contractor with respect to the performance of Guarantee Tests, in accordance with GCC Sub-Clause 25.2.
- 10.8 In the event that the Employer shall be in breach of any of his obligations under this Clause, the additional cost incurred by the Contractor in consequence thereof shall be determined by the Project Manager and added to the Contract Price.

C. Payment

- 11. Contract Price**
 - 11.1 The Contract Price shall be as specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement.
 - 11.2 Unless an adjustment clause is **provided for in the PCC**, the Contract Price shall be a firm lump sum not subject to any alteration, except in the event of a Change in the Facilities or as otherwise provided in the Contract.
 - 11.3 Subject to GCC Sub-Clauses 9.2, 10.1 and 35 hereof, the Contractor shall be deemed to have satisfied itself as to the correctness and sufficiency of the Contract Price, which shall, except as otherwise provided for in the Contract, cover all its obligations under the Contract.
- 12. Terms of Payment**
 - 12.1 The Contract Price shall be paid as specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement and in the Appendix to the Contract Agreement titled Terms and Procedures of Payment, which also outlines

the procedures to be followed in making application for and processing payments.

- 12.2 No payment made by the Employer herein shall be deemed to constitute acceptance by the Employer of the Facilities or any part(s) thereof.
- 12.3 In the event that the Employer fails to make any payment by its respective due date or within the period set forth in the Contract, the Employer shall pay to the Contractor interest on the amount of such delayed payment at the rate(s) shown in the Appendix to the Contract Agreement titled Terms and Procedures of Payment, for the period of delay until payment has been made in full, whether before or after judgment or arbitration award.
- 12.4 The currency or currencies in which payments are made to the Contractor under this Contract shall be specified in the Appendix to the Contract Agreement titled Terms and Procedures of Payment, subject to the general principle that payments will be made in the currency or currencies in which the Contract Price has been stated in the Contractor's Bid.

13. Securities

13.1 Issuance of Securities

The Contractor shall provide the securities specified below in favor of the Employer at the times, and in the amount, manner and form specified below.

13.2 Advance Payment Security

13.2.1 The Contractor shall, within twenty-eight (28) days of the notification of contract award, provide a security in an amount equal to the advance payment calculated in accordance with the Appendix to the Contract Agreement titled Terms and Procedures of Payment, and in the same currency or currencies.

13.2.2 The security shall be in the form provided in the Bidding documents or in another form acceptable to the Employer. The amount of the security shall be reduced in proportion to the value of the Facilities executed by and paid to the Contractor from time to time, and shall automatically become null and void when the full amount

of the advance payment has been recovered by the Employer. The security shall be returned to the Contractor immediately after its expiration.

13.3 Performance Security

13.3.1 The Contractor shall, within twenty-eight (28) days of the notification of contract award, provide a security for the due performance of the Contract in the amount **specified in the PCC.**

13.3.2 The Performance Security shall be denominated in the currency or currencies of the Contract, or in a freely convertible currency acceptable to the Employer, and shall be in the form provided in Section X, Contract Forms, corresponding to the type of bank guarantee stipulated by the Employer in the PCC, or in another form acceptable to the Employer.

13.3.3 Unless otherwise specified in the PCC, the security shall be reduced by half on the date of the Operational Acceptance. The Security shall become null and void, or shall be reduced pro rata to the Contract Price of a part of the Facilities for which a separate Time for Completion is provided, five hundred and forty (540) days after Completion of the Facilities or three hundred and sixty five (365) days after Operational Acceptance of the Facilities, whichever occurs first; provided, however, that if the Defects Liability Period has been extended on any part of the Facilities pursuant to GCC Sub-Clause 27.8 hereof, the Contractor shall issue an additional security in an amount proportionate to the Contract Price of that part. The security shall be returned to the Contractor immediately after its expiration, provided, however, that if the Contractor, pursuant to GCC Sub-Clause 27.10, is liable for an extended defect liability obligation, the Performance Security shall be extended for the period specified in the PCC pursuant to GCC Sub-Clause 27.10 and up to the amount specified in the PCC.

13.3.4 The Employer shall not make a claim under the Performance Security, except for amounts to which the Employer is entitled under the Contract. The Employer

shall indemnify and hold the Contractor harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from a claim under the Performance Security to the extent to which the Employer was not entitled to make the claim.

14. Taxes and Duties

- 14.1 Except as otherwise specifically provided in the Contract, the Contractor shall bear and pay all taxes, duties, levies and charges assessed on the Contractor, its Subcontractors or their employees by all municipal, state or national government authorities in connection with the Facilities in and outside of the country where the Site is located.
- 14.2 Notwithstanding GCC Sub-Clause 14.1 above, the Employer shall bear and promptly pay
- (a) all customs and import duties for the Plant specified in Price Schedule No. 1; and
 - (b) other domestic taxes such as, sales tax and value added tax (VAT) on the Plant specified in Price Schedules No. 1 and No. 2 and that is to be incorporated into the Facilities, and on the finished goods, imposed by the law of the country where the Site is located.
- 14.3 If any tax exemptions, reductions, allowances or privileges may be available to the Contractor in the country where the Site is located, the Employer shall use its best endeavors to enable the Contractor to benefit from any such tax savings to the maximum allowable extent.
- 14.4 For the purpose of the Contract, it is agreed that the Contract Price specified in Article 2 (Contract Price and Terms of Payment) of the Contract Agreement is based on the taxes, duties, levies and charges prevailing at the date twenty-eight (28) days prior to the date of Bid submission in the country where the Site is located (hereinafter called "Tax" in this GCC Sub-Clause 14.4). If any rates of Tax are increased or decreased, a new Tax is introduced, an existing Tax is abolished, or any change in interpretation or application of any Tax occurs in the course of the performance of Contract, which was or will be assessed on the Contractor, Subcontractors or their employees

in connection with performance of the Contract, an equitable adjustment of the Contract Price shall be made to fully take into account any such change by addition to the Contract Price or deduction therefrom, as the case may be, in accordance with GCC Clause 36 hereof.

D. Intellectual Property

- 15. License/Use of Technical Information**
- 15.1 For the operation and maintenance of the Plant, the Contractor hereby grants a non-exclusive and non-transferable license (without the right to sub-license) to the Employer under the patents, utility models or other industrial property rights owned by the Contractor or by a third Party from whom the Contractor has received the right to grant licenses thereunder, and shall also grant to the Employer a non-exclusive and non-transferable right (without the right to sub-license) to use the know-how and other technical information disclosed to the Employer under the Contract. Nothing contained herein shall be construed as transferring ownership of any patent, utility model, trademark, design, copyright, know-how or other intellectual property right from the Contractor or any third Party to the Employer.
- 15.2 The copyright in all drawings, documents and other materials containing data and information furnished to the Employer by the Contractor herein shall remain vested in the Contractor or, if they are furnished to the Employer directly or through the Contractor by any third Party, including suppliers of materials, the copyright in such materials shall remain vested in such third Party.
- 16. Confidential Information**
- 16.1 The Employer and the Contractor shall keep confidential and shall not, without the written consent of the other Party hereto, divulge to any third Party any documents, data or other information furnished directly or indirectly by the other Party hereto in connection with the Contract, whether such information has been furnished prior to, during or following termination of the Contract. Notwithstanding the above, the Contractor may furnish to its Subcontractor(s) such documents, data and other information it receives from the Employer to the extent required for the Subcontractor(s) to

perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this GCC Clause 16.

- 16.2 The Employer shall not use such documents, data and other information received from the Contractor for any purpose other than the operation and maintenance of the Facilities. Similarly, the Contractor shall not use such documents, data and other information received from the Employer for any purpose other than the design, procurement of Plant, construction or such other work and services as are required for the performance of the Contract.
- 16.3 The obligation of a Party under GCC Sub-Clauses 16.1 and 16.2 above, however, shall not apply to that information which
- (a) now or hereafter enters the public domain through no fault of that Party
 - (b) can be proven to have been possessed by that Party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other Party hereto
 - (c) otherwise lawfully becomes available to that Party from a third Party that has no obligation of confidentiality.
- 16.4 The above provisions of this GCC Clause 16 shall not in any way modify any undertaking of confidentiality given by either of the Parties hereto prior to the date of the Contract in respect of the Facilities or any part thereof.
- 16.5 The provisions of this GCC Clause 16 shall survive termination, for whatever reason, of the Contract.

E. Execution of the Facilities

17. Representatives 17.1 Project Manager

If the Project Manager is not named in the Contract, then within fourteen (14) days of the Effective Date, the Employer shall appoint and notify the Contractor in writing of the name of the Project Manager. The Employer may from time to time appoint some other

person as the Project Manager in place of the person previously so appointed, and shall give a notice of the name of such other person to the Contractor without delay. No such appointment shall be made at such a time or in such a manner as to impede the progress of work on the Facilities. Such appointment shall only take effect upon receipt of such notice by the Contractor. The Project Manager shall represent and act for the Employer at all times during the performance of the Contract. All notices, instructions, orders, certificates, approvals and all other communications under the Contract shall be given by the Project Manager, except as herein otherwise provided.

All notices, instructions, information and other communications given by the Contractor to the Employer under the Contract shall be given to the Project Manager, except as herein otherwise provided.

17.2 Contractor's Representative & Construction Manager

17.2.1 If the Contractor's Representative is not named in the Contract, then within fourteen (14) days of the Effective Date, the Contractor shall appoint the Contractor's Representative and shall request the Employer in writing to approve the person so appointed. If the Employer makes no objection to the appointment within fourteen (14) days, the Contractor's Representative shall be deemed to have been approved. If the Employer objects to the appointment within fourteen (14) days giving the reason therefor, then the Contractor shall appoint a replacement within fourteen (14) days of such objection, and the foregoing provisions of this GCC Sub-Clause 17.2.1 shall apply thereto.

17.2.2 The Contractor's Representative shall represent and act for the Contractor at all times during the performance of the Contract and shall give to the Project Manager all the Contractor's notices,

instructions, information and all other communications under the Contract.

All notices, instructions, information and all other communications given by the Employer or the Project Manager to the Contractor under the Contract shall be given to the Contractor's Representative or, in its absence, its deputy, except as herein otherwise provided.

The Contractor shall not revoke the appointment of the Contractor's Representative without the Employer's prior written consent, which shall not be unreasonably withheld. If the Employer consents thereto, the Contractor shall appoint some other person as the Contractor's Representative, pursuant to the procedure set out in GCC Sub-Clause 17.2.1.

17.2.3 The Contractor's Representative may, subject to the approval of the Employer which shall not be unreasonably withheld, at any time delegate to any person any of the powers, functions and authorities vested in him or her. Any such delegation may be revoked at any time. Any such delegation or revocation shall be subject to a prior notice signed by the Contractor's Representative, and shall specify the powers, functions and authorities thereby delegated or revoked. No such delegation or revocation shall take effect unless and until a copy thereof has been delivered to the Employer and the Project Manager.

Any act or exercise by any person of powers, functions and authorities so delegated to him or her in accordance with this GCC Sub-Clause 17.2.3 shall be deemed to be an act or exercise by the Contractor's Representative.

17.2.4 From the commencement of installation of the Facilities at the Site until Completion, the Contractor's Representative shall appoint a suitable person as the Construction Manager. The Construction Manager shall supervise all work done at the Site by the Contractor and shall be present at the Site throughout normal working hours except when on leave, sick or absent for reasons

connected with the proper performance of the Contract. Whenever the Construction Manager is absent from the Site, a suitable person shall be appointed to act as the Construction Manager's deputy.

17.2.5 The Project Manager may require the Contractor to remove (or cause to be removed) the Contractor's Representative or any other person employed by the Contractor in the execution of the Contract, who:

- (a) persists in any misconduct or lack of care;
- (b) carries out duties incompetently or negligently;
- (c) fails to comply with any provision of the Contract;
- (d) persists in any conduct which is prejudicial to safety, health, or the protection of the environment;
- (e) based on reasonable evidence, is determined to have engaged in Fraud and Corruption during the execution of the Contract;
- (f) has been recruited from the Employer's Personnel in breach of GCC Sub-Clause 22.2.2;
- (g) undertakes behaviour which breaches the Code of Conduct (ES), as applicable;

If appropriate, the Contractor shall then promptly appoint (or cause to be appointed) a suitable replacement with equivalent skills and experience.

Notwithstanding any requirement from the Project Manager to remove or cause to remove any person, the Contractor shall take immediate action as appropriate in response to any violation of (a) through (g) above. Such immediate action shall include removing (or causing to be removed) from the Site or other places where the Contract is being executed, any Contractor's Personnel who engages in (a), (b), (c), (d), (e) or (g) above or has been recruited as stated in (f) above

17.2.6. If any representative or person employed by the Contractor is removed in accordance with GCC Sub-Clause 17.2.5, the Contractor shall, where required, promptly appoint a replacement.

18. Work Program 18.1 Contractor's Organization

The Contractor shall supply to the Employer and the Project Manager a chart showing the proposed organization to be established by the Contractor for carrying out work on the Facilities within twenty-one (21) days of the Effective Date. The chart shall include the identities of the key personnel and the curricula vitae of such key personnel to be employed shall be supplied together with the chart. The Contractor shall promptly inform the Employer and the Project Manager in writing of any revision or alteration of such an organization chart.

18.2 Program of Performance

Within twenty-eight (28) days after the Effective Date, the Contractor shall submit to the Project Manager a detailed program of performance of the Contract, made in a form acceptable to the Project Manager and showing the sequence in which it proposes to design, manufacture, transport, assemble, install and precommission the Facilities, as well as the date by which the Contractor reasonably requires that the Employer shall have fulfilled its obligations under the Contract so as to enable the Contractor to execute the Contract in accordance with the program and to achieve Completion, Commissioning and Acceptance of the Facilities in accordance with the Contract. The program so submitted by the Contractor shall accord with the Time Schedule included in the Appendix to the Contract Agreement titled Time Schedule, and any other dates and periods specified in the Contract. The Contractor shall update and revise the program as and when appropriate or when required by the Project Manager, but without modification in the Times for Completion specified in the PCC pursuant to Sub-Clause 8.2 and any extension granted in accordance with GCC Clause 40, and shall submit all such revisions to the Project Manager.

18.3 Progress Report

The Contractor shall monitor progress of all the activities specified in the program referred to in GCC Sub-Clause 18.2 above, and supply a progress report to the Project Manager every month.

The progress report shall be in a form acceptable to the Project Manager and shall indicate: (a) percentage completion achieved compared with the planned percentage completion for each activity; and (b) where any activity is behind the program, giving comments and likely consequences and stating the corrective action being taken.

Unless otherwise stated in the Specifications, each progress report shall include the Environmental and Social (ES) metrics set out in Appendix C.

In addition to the progress reports, the Contractor shall inform the Project Manager immediately of any allegation, incident or accident in the Site, which has or is likely to have a significant adverse effect on the environment, the affected communities, the public, Employer's Personnel or Contractor's Personnel. This includes, but is not limited to, any incident or accident, causing fatality or serious injury; significant adverse effects or damage to private property; or any allegation of SEA and/or SH. In case of SEA and/or SH, while maintaining confidentiality as appropriate, the type of allegation (sexual exploitation, sexual abuse or sexual harassment), gender and age of the person who experienced the alleged incident should be included in the information.

The Contractor, upon becoming aware of the allegation, incident or accident, shall also immediately inform the Project Manager of any such incident or accident on the Subcontractors' or suppliers' premises relating to the Facilities which has or is likely to have a significant adverse effect on the environment, the affected communities, the public, Employer's Personnel, or Contractor's, its Subcontractors' and suppliers' personnel. The notification shall provide sufficient detail regarding such incidents or accidents. The Contractor shall provide full details of such

incidents or accidents to the Project Manager within the timeframe agreed with the Project Manager.

The Contractor shall require its Subcontractors and suppliers to immediately notify the Contractor of any incidents or accidents referred to in this Subclause.

18.4 Progress of Performance

If at any time the Contractor's actual progress falls behind the program referred to in GCC Sub-Clause 18.2, or it becomes apparent that it will so fall behind, the Contractor shall, at the request of the Employer or the Project Manager, prepare and submit to the Project Manager a revised program, taking into account the prevailing circumstances, and shall notify the Project Manager of the steps being taken to expedite progress so as to attain Completion of the Facilities within the Time for Completion under GCC Sub-Clause 8.2, any extension thereof entitled under GCC Sub-Clause 40.1, or any extended period as may otherwise be agreed upon between the Employer and the Contractor.

18.5 Procedures

The Contract shall be executed in accordance with the Contract Documents including the procedures given in the Forms and Procedures of the Employer's Requirements.

The Contractor may execute the Contract in accordance with its own standard project execution plans and procedures to the extent that they do not conflict with the provisions contained in the Contract.

- 19. Subcontracting** 19.1 The Appendix to the Contract Agreement titled List of Major Items of Plant and Installation Services and List of Approved Subcontractors, specifies major items of supply or services and a list of approved Subcontractors against each item, including manufacturers. Insofar as no Subcontractors are listed against any such item, the Contractor shall prepare a list of Subcontractors for such item for inclusion in such list. The Contractor may from

time to time propose any addition to or deletion from any such list. The Contractor shall submit any such list or any modification thereto to the Employer for its approval in sufficient time so as not to impede the progress of work on the Facilities. Such approval by the Employer for any of the Subcontractors shall not relieve the Contractor from any of its obligations, duties or responsibilities under the Contract.

- 19.2 The Contractor shall select and employ its Subcontractors for such major items from those listed in the lists referred to in GCC Sub-Clause 19.1.
- 19.3 For items or parts of the Facilities not specified in the Appendix to the Contract Agreement titled List of Major Items of Plant and Installation Services and List of Approved Subcontractors, the Contractor may employ such Subcontractors as it may select, at its discretion.
- 19.4 Each sub-contract shall include provisions which would entitle the Employer to require the sub-contract to be assigned to the Employer under GCC 19.5 (if and when applicable), or in event of termination by the Employer under GCC 42.2.
- 19.5 If a subcontractor's obligations extend beyond the expiry date of the relevant Defects Liability Period and the Project Manager, prior to that date, instructs the Contractor to assign the benefits of such obligations to the Employer, then the Contractor shall do so.
- 19.6 The Contractor shall ensure that its Subcontractors execute the Facilities in accordance with the Contract, including complying with the relevant ES requirements and the obligations set out in GCC Sub-Clause 22.4.

20. Design and Engineering

20.1 Specifications and Drawings

- 20.1.1 The Contractor shall execute the basic and detailed design and the engineering work in compliance with the provisions of the Contract, or where not so specified, in accordance with good engineering practice.

The Contractor shall be responsible for any discrepancies, errors or omissions in the specifications, drawings and

other technical documents that it has prepared, whether such specifications, drawings and other documents have been approved by the Project Manager or not, provided that such discrepancies, errors or omissions are not because of inaccurate information furnished in writing to the Contractor by or on behalf of the Employer.

20.1.2 The Contractor shall be entitled to disclaim responsibility for any design, data, drawing, specification or other document, or any modification thereof provided or designated by or on behalf of the Employer, by giving a notice of such disclaimer to the Project Manager.

20.2 Codes and Standards

Wherever references are made in the Contract to codes and standards in accordance with which the Contract shall be executed, the edition or the revised version of such codes and standards current at the date twenty-eight (28) days prior to date of Bid submission shall apply unless otherwise specified. During Contract execution, any changes in such codes and standards shall be applied subject to approval by the Employer and shall be treated in accordance with GCC Clause 39.

20.3 Approval/Review of Technical Documents by Project Manager

20.3.1 The Contractor shall prepare or cause its Subcontractors to prepare, and furnish to the Project Manager the documents listed in the Appendix to the Contract Agreement titled List of Documents for Approval or Review, for its approval or review as specified and in accordance with the requirements of GCC Sub-Clause 18.2 (Program of Performance).

Any part of the Facilities covered by or related to the documents to be approved by the Project Manager shall be executed only after the Project Manager's approval thereof.

GCC Sub-Clauses 20.3.2 through 20.3.7 shall apply to those documents requiring the Project Manager's approval, but not to those furnished to the Project Manager for its review only.

20.3.2 Within fourteen (14) days after receipt by the Project Manager of any document requiring the Project Manager's approval in accordance with GCC Sub-Clause 20.3.1, the Project Manager shall either return one copy thereof to the Contractor with its approval endorsed thereon or shall notify the Contractor in writing of its disapproval thereof and the reasons therefor and the modifications that the Project Manager proposes.

If the Project Manager fails to take such action within the said fourteen (14) days, then the said document shall be deemed to have been approved by the Project Manager.

20.3.3 The Project Manager shall not disapprove any document, except on the grounds that the document does not comply with the Contract or that it is contrary to good engineering practice.

20.3.4 If the Project Manager disapproves the document, the Contractor shall modify the document and resubmit it for the Project Manager's approval in accordance with GCC Sub-Clause 20.3.2. If the Project Manager approves the document subject to modification(s), the Contractor shall make the required modification(s), whereupon the document shall be deemed to have been approved.

20.3.5 If any dispute or difference occurs between the Employer and the Contractor in connection with or arising out of the disapproval by the Project Manager of any document and/or any modification(s) thereto that cannot be settled between the Parties within a reasonable period, then such dispute or difference may be referred to a Dispute Board for determination in accordance

with GCC Sub-Clause 46.1 hereof. If such dispute or difference is referred to a Dispute Board, the Project Manager shall give instructions as to whether and if so, how, performance of the Contract is to proceed. The Contractor shall proceed with the Contract in accordance with the Project Manager's instructions, provided that if the Dispute Board upholds the Contractor's view on the dispute and if the Employer has not given notice under GCC Sub-Clause 46.3 hereof, then the Contractor shall be reimbursed by the Employer for any additional costs incurred by reason of such instructions and shall be relieved of such responsibility or liability in connection with the dispute and the execution of the instructions as the Dispute Board shall decide, and the Time for Completion shall be extended accordingly.

20.3.6 The Project Manager's approval, with or without modification of the document furnished by the Contractor, shall not relieve the Contractor of any responsibility or liability imposed upon it by any provisions of the Contract except to the extent that any subsequent failure results from modifications required by the Project Manager.

20.3.7 The Contractor shall not depart from any approved document unless the Contractor has first submitted to the Project Manager an amended document and obtained the Project Manager's approval thereof, pursuant to the provisions of this GCC Sub-Clause 20.3.

If the Project Manager requests any change in any already approved document and/or in any document based thereon, the provisions of GCC Clause 39 shall apply to such request.

21. Procurement 21.1 Plant

Subject to GCC Sub-Clause 14.2, the Contractor shall procure and transport all Plant in an expeditious and orderly manner to the Site.

21.2 Employer-Supplied Plant

If the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, provides that the Employer shall furnish any specific items to the Contractor, the following provisions shall apply:

21.2.1 The Employer shall, at its own risk and expense, transport each item to the place on or near the Site as agreed upon by the Parties and make such item available to the Contractor at the time specified in the program furnished by the Contractor, pursuant to GCC Sub-Clause 18.2, unless otherwise mutually agreed.

21.2.2 Upon receipt of such item, the Contractor shall inspect the same visually and notify the Project Manager of any detected shortage, defect or default. The Employer shall immediately remedy any shortage, defect or default, or the Contractor shall, if practicable and possible, at the request of the Employer, remedy such shortage, defect or default at the Employer's cost and expense. After inspection, such item shall fall under the care, custody and control of the Contractor. The provision of this GCC Sub-Clause 21.2.2 shall apply to any item supplied to remedy any such shortage or default or to substitute for any defective item, or shall apply to defective items that have been repaired.

21.2.3 The foregoing responsibilities of the Contractor and its obligations of care, custody and control shall not relieve the Employer of liability for any undetected shortage, defect or default, nor place the Contractor under any liability for any such shortage, defect or default whether under GCC Clause 27 or under any other provision of Contract.

21.3 Transportation

21.3.1 The Contractor shall at its own risk and expense transport all the materials and the Contractor's

Equipment to the Site by the mode of transport that the Contractor judges most suitable under all the circumstances.

21.3.2 Unless otherwise provided in the Contract, the Contractor shall be entitled to select any safe mode of transport operated by any person to carry the materials and the Contractor's Equipment.

21.3.3 Upon dispatch of each shipment of materials and the Contractor's Equipment, the Contractor shall notify the Employer by telex, cable, facsimile or electronic means, of the description of the materials and of the Contractor's Equipment, the point and means of dispatch, and the estimated time and point of arrival in the country where the Site is located, if applicable, and at the Site. The Contractor shall furnish the Employer with relevant shipping documents to be agreed upon between the Parties.

21.3.4 The Contractor shall be responsible for obtaining, if necessary, approvals from the authorities for transportation of the materials and the Contractor's Equipment to the Site. The Employer shall use its best endeavors in a timely and expeditious manner to assist the Contractor in obtaining such approvals, if requested by the Contractor. The Contractor shall indemnify and hold harmless the Employer from and against any claim for damage to roads, bridges or any other traffic facilities that may be caused by the transport of the materials and the Contractor's Equipment to the Site.

21.4 Customs Clearance

The Contractor shall, at its own expense, handle all imported materials and Contractor's Equipment at the point(s) of import and shall handle any formalities for customs clearance, subject to the Employer's obligations under GCC Sub-Clause 14.2, provided that if applicable

laws or regulations require any application or act to be made by or in the name of the Employer, the Employer shall take all necessary steps to comply with such laws or regulations. In the event of delays in customs clearance that are not the fault of the Contractor, the Contractor shall be entitled to an extension in the Time for Completion, pursuant to GCC Clause 40.

22. Installation

22.1 Setting Out/Supervision

22.1.1 Bench Mark: The Contractor shall be responsible for the true and proper setting-out of the Facilities in relation to bench marks, reference marks and lines provided to it in writing by or on behalf of the Employer.

If, at any time during the progress of installation of the Facilities, any error shall appear in the position, level or alignment of the Facilities, the Contractor shall forthwith notify the Project Manager of such error and, at its own expense, immediately rectify such error to the reasonable satisfaction of the Project Manager. If such error is based on incorrect data provided in writing by or on behalf of the Employer, the expense of rectifying the same shall be borne by the Employer.

22.1.2 Contractor's Supervision: The Contractor shall give or provide all necessary superintendence during the installation of the Facilities, and the Construction Manager or its deputy shall be constantly on the Site to provide full-time superintendence of the installation. The Contractor shall provide and employ only technical personnel who are skilled and experienced in their respective callings and supervisory staff who are competent to adequately supervise the work at hand.

22.2 Labor:

22.2.1 Engagement of Staff and Labor

Except as otherwise stated in the Specification, the Contractor shall make arrangements for the engagement of all staff and labor, local or otherwise, and for their payment, housing, feeding and transport.

The Contractor shall provide and employ on the Site in the installation of the Facilities such skilled, semi-skilled and unskilled labor as is necessary for the proper and timely execution of the Contract. The Contractor is encouraged to use local labor that has the necessary skills.

The Contractor shall be responsible for obtaining all necessary permit(s) and/or visa(s) from the appropriate authorities for the entry of all labor and personnel to be employed on the Site into the country where the Site is located. The Employer will, if requested by the Contractor, use his best endeavors in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national or government permission required for bringing in the Contractor's personnel.

The Contractor shall at its own expense provide the means of repatriation to all of its and its Subcontractor's personnel employed on the Contract at the Site to the place where they were recruited or to their domicile. It shall also provide suitable temporary maintenance of all such persons from the cessation of their employment on the Contract to the date programmed for their departure. In the event that the Contractor defaults in providing such means of transportation and temporary maintenance, the Employer may provide the same to such personnel and recover the cost of doing so from the Contractor.

The Contractor shall provide Contractor's Personnel employed for the execution of the Contract at the Site or other places where the Installation Services are carried out, relevant

information and documentation that are clear and understandable regarding their terms and conditions of employment. The information and documentation shall set out their rights under relevant labor laws applicable to the Contractor's Personnel (which will include any applicable collective agreements), including their rights related to hours of work, wages, overtime, compensation and benefits, as well as those arising from any requirements in the Employer's Requirements. The Contractor's Personnel shall be informed when any material changes to their terms or conditions of employment occur.

22.2.2 Persons in the Service of Employer

The Contractor shall not recruit, or attempt to recruit, staff and labor from amongst the Employer's Personnel.

22.2.3 Labor Laws

The Contractor shall comply with all the relevant labor Laws applicable to the Contractor's Personnel, including Laws relating to their employment, health, safety, welfare, immigration and emigration, and shall allow them all their legal rights.

The Contractor shall at all times during the progress of the Contract use its best endeavors to prevent any unlawful, riotous or disorderly conduct or behavior by or amongst its employees and the labor of its Subcontractors.

The Contractor shall, in all dealings with its labor and the labor of its Subcontractors currently employed on or connected with the Contract, pay due regard to all recognized festivals, official holidays, religious or other customs and all local laws and regulations pertaining to the employment of labor.

22.2.4 Rates of Wages and Conditions of Labor

The Contractor shall pay rates of wages, and observe conditions of labor, which are not lower than those established for the trade or industry where the work is carried out. If no established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by employers whose trade or industry is similar to that of the Contractor.

The Contractor shall inform the Contractor's Personnel about:

- (a) any deduction to their payment and the conditions of such deductions in accordance with the applicable laws or as stated in the Employer's Requirements; and
- (b) their liability to pay personal income taxes in the Country in respect of such of their salaries, wages, allowances and any benefits as are subject to tax under the laws of the Country for the time being in force.

The Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such laws.

Where required by applicable Laws or as stated in the Employer's Requirements, the Contractor and its Subcontractors shall provide their personnel written notice of termination of employment and details of severance payments in a timely manner. The Contractor and its Subcontractors shall have paid their personnel (either directly or where appropriate for their benefit) all due wages and entitlements including, as applicable, social security benefits and pension contributions, on or before the end of their engagement/ employment.

22.2.5 Working Hours

No work shall be carried out on the Site on locally recognized days of rest, or outside the normal working hours **stated in the PCC**, unless:

- (a) otherwise stated in the Contract,
- (b) the Project Manager gives consent, or
- (c) the work is unavoidable, or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Project Manager.

If and when the Contractor considers it necessary to carry out work at night or on public holidays so as to meet the Time for Completion and requests the Project Manager's consent thereto, the Project Manager shall not unreasonably withhold such consent.

This Sub-Clause shall not apply to any work which is customarily carried out by rotary or double-shifts.

22.2.6 Facilities for Staff and Labor

Except as otherwise stated in the Specification, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel employed for the execution of the Contract at the Site or other places where the Installation Services are carried out. The Contractor shall also provide facilities for the Employer's Personnel as stated in the Employer's Requirements.

If stated in the Employer's Requirements, the Contractor shall give access to or provide services that accommodate the physical, social and cultural needs of the Contractor's Personnel. The Contractor shall also provide similar facilities for the Employer's Personnel as stated in the Employer's Requirements.

The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Facilities.

22.2.7 Health and Safety

The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel employed for the execution of Installation Services at the Site (or other places in the country where the Site is located).

The Contractor shall:

- (a) comply with all applicable health and safety regulations and laws;
- (b) comply with all applicable health and safety obligations specified in the Contract;
- (c) develop and implement procedures to establish and maintain a safe working environment without risk to health at all workplaces, machinery, equipment and processes under the control of the Contractor, including control measures for chemical, physical and biological substances and agents;
- (d) provide health and safety training of the Contractor's Personnel as appropriate and maintain training records;
- (e) actively engage the Contractor's Personnel in promoting understanding, and methods for, implementation of health and safety requirements, as well as in providing information to such personnel, and provision of personal protective equipment without expense to the personnel;
- (f) put in place workplace processes for the Contractor's Personnel to report work situations that they believe are not safe or

healthy, and to remove themselves from a work situation which they have reasonable justification to believe presents an imminent and serious danger to their life or health; Contractor's Personnel who remove themselves from such work situations shall not be required to return to work until necessary remedial action to correct the situation has been taken. Such personnel shall not be retaliated against or otherwise subject to reprisal or negative action for such reporting or removal;

- (g) in collaboration with local health authorities, ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Employer's Personnel;
- (h) appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the performance of the Contract, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority;
- (i) put in place measures to avoid or minimize the potential for community exposure to water-borne, water-based, water-related, and vector-borne diseases;
- (j) put in place measures to be implemented to avoid or minimize the spread of communicable diseases (including transfer of Sexually Transmitted Diseases or Infections (STDs), such as HIV virus) and non-communicable diseases associated with the Installation Services, taking into consideration

differentiated exposure to and higher sensitivity of vulnerable groups. This includes taking measures to avoid or minimize the transmission of communicable diseases that may be associated with the influx of temporary or permanent Contract-related labor;

- (k) have in place procedures for prevention, preparedness and response activities to be implemented in the case of an emergency event (i.e. an unanticipated incident, arising from both natural and man-made hazards, typically in the form of fire, explosions, leaks or spills, which may occur for a variety of different reasons including failure to implement operating procedures that are designed to prevent their occurrence, extreme weather or lack of early warning);
- (l) collaborate, as applicable, with the Employer's personnel, any other contractors employed by the Employer, and/or personnel of any legally constituted public authorities and private utility companies that are employed in carrying out, on or near the site, of any work not included in the Contract, in applying the health and safety requirements. This is without prejudice to the responsibility of the relevant entities for the health and safety of their own personnel; and
- (m) put in place a system for regular review of health and safety performance and the working environment.

22.2.8 Funeral Arrangements

In the event of the death of any of the Contractor's personnel or accompanying members of their families, the Contractor shall be responsible for making the appropriate arrangements for their

return or burial, unless otherwise **specified in the PCC.**

22.2.9 Records of Contractor's Personnel

The Contractor shall keep accurate records of the Contractor's personnel, including the number of each class of Contractor's Personnel on the Site and the names, ages, genders, hours worked and wages paid to all workers. These records shall be summarized on a monthly basis in a form approved by the Project Manager and shall be available for inspection by the Project Manager until the Contractor has completed all work.

22.2.10 Supply of Foodstuffs

The Contractor shall arrange for the provision of a sufficient supply of suitable food as may be stated in the Specification at reasonable prices for the Contractor's Personnel for the purposes of or in connection with the Contract.

22.2.11 Supply of Water

The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.

22.2.12 Measures against Insect and Pest Nuisance

The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce their danger to health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide.

22.2.13 Alcoholic Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the Laws of the Country, import, sell, give barter or otherwise dispose of any alcoholic liquor or drugs, or permit or allow

importation, sale, gift barter or disposal by Contractor's Personnel.

22.2.14 Arms and Ammunition

The Contractor shall not give, barter, or otherwise dispose of, to any person, any arms or ammunition of any kind, or allow Contractor's Personnel to do so.

22.2.15 Workers' Organizations

In countries where the relevant labor laws recognize workers' rights to form and to join workers' organizations of their choosing and to bargain collectively without interference, the Contractor shall comply with such laws. In such circumstances, the role of legally established workers' organizations and legitimate workers' representatives will be respected, and they will be provided with information needed for meaningful negotiation in a timely manner. Where the relevant labor laws substantially restrict workers' organizations, the Contractor shall enable alternative means for the Contractor's and its Subcontractors' personnel to express their grievances and protect their rights regarding working conditions and terms of employment. The Contractor shall not seek to influence or control these alternative means. The Contractor shall not discriminate or retaliate against the Contractor's and its Subcontractors' personnel who participate, or seek to participate, in such organizations and collective bargaining or alternative mechanisms. Workers' organizations are expected to fairly represent the workers in the workforce.

22.2.16 Non-Discrimination and Equal Opportunity

The Contractor shall not make decisions relating to the employment or treatment of Contractor's Personnel on the basis of personal characteristics unrelated to inherent job requirements. The

Contractor shall base the employment of Contractor's Personnel on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to any aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, job assignment, promotion, termination of employment or retirement, and disciplinary practices.

Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job shall not be deemed discrimination. The Contractor shall provide protection and assistance as necessary to ensure non-discrimination and equal opportunity, including for specific groups such as women, people with disabilities, migrant workers and children (of working age in accordance with GCC Sub-Clause 9.13).

22.2.17 Contractor's Personnel Grievance Mechanism

The Contractor shall have a grievance mechanism for the Contractor's Personnel, and where relevant the workers' organizations stated in subclause 22.2.15, to raise workplace concerns. The grievance mechanism shall be proportionate to the nature, scale, risks and impacts of the Contract. The mechanism shall address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned in a language they understand, without any retribution, and shall operate in an independent and objective manner.

The Contractor's Personnel shall be informed of the grievance mechanism at the time of engagement for the Contract, and the measures put in place to protect them against any reprisal for its use. Measures will be put in place to make the

grievance mechanism easily accessible to all Contractor's and its Subcontractors' personnel.

The grievance mechanism shall not impede access to other judicial or administrative remedies that might be available, or substitute for grievance mechanisms provided through collective agreements.

The grievance mechanism may utilize existing grievance mechanisms, providing that they are properly designed and implemented, address concerns promptly, and are readily accessible to such project workers. Existing grievance mechanisms may be supplemented as needed with Contract-specific arrangements.

22.3 Contractor's Equipment

22.3.1 All Contractor's Equipment brought by the Contractor onto the Site shall be deemed to be intended to be used exclusively for the execution of the Contract. The Contractor shall not remove the same from the Site without the Project Manager's consent that such Contractor's Equipment is no longer required for the execution of the Contract.

22.3.2 Unless otherwise specified in the Contract, upon completion of the Facilities, the Contractor shall remove from the Site all Equipment brought by the Contractor onto the Site and any surplus materials remaining thereon.

22.3.3 The Employer will, if requested, use its best endeavors to assist the Contractor in obtaining any local, state or national government permission required by the Contractor for the export of the Contractor's Equipment imported by the Contractor for use in the execution of the Contract that is no longer required for the execution of the Contract.

22.4 Site Regulations and Safety

The Employer and the Contractor shall establish Site regulations setting out the rules to be observed in the execution of the Contract at the Site and shall comply therewith. The Contractor shall prepare and submit to the Employer, with a copy to the Project Manager, proposed Site regulations for the Employer's approval, which approval shall not be unreasonably withheld.

Such Site regulations shall include, but shall not be limited to, Code of Conduct for environmental and social aspects submitted as part of the Bid and agreed to by the Employer, security arrangements in accordance with GCC Sub-Clause 22.8, safety of the Facilities, gate control, sanitation, medical care, and fire prevention.

The Contractor shall take all necessary measures to ensure that each Contractor's Personnel, employed for the execution of the Contract at the Site or other places where the Installation Services are carried out, is made aware of the Code of Conduct including specific behaviors that are prohibited, and understands the consequences of engaging in such prohibited behaviors.

These measures include providing instructions and documentation that can be understood by the Contractor's Personnel and seeking to obtain that person's signature acknowledging receipt of such instructions and/or documentation, as appropriate.

The Contractor shall also ensure that the Code of Conduct is visibly displayed in multiple locations on the Site and any other place where the Installation Services will be carried out, as well as in areas outside the Site accessible to the local community and project affected people. The posted Code of Conduct shall be provided in languages comprehensible to Contractor's Personnel, Employer's Personnel and the local community.

The Contractor's Management Strategy and Implementation Plans shall include appropriate processes

for the Contractor to verify compliance with these obligations.

22.5 Opportunities for Other Contractors

22.5.1 The Contractor shall, upon written request from the Employer or the Project Manager, give all reasonable opportunities for carrying out the work to any other contractors employed by the Employer on or near the Site.

22.5.2 If the Contractor, upon written request from the Employer or the Project Manager, makes available to other contractors any roads or ways the maintenance for which the Contractor is responsible, permits the use by such other contractors of the Contractor's Equipment, or provides any other service of whatsoever nature for such other contractors, the Employer shall fully compensate the Contractor for any loss or damage caused or occasioned by such other contractors in respect of any such use or service, and shall pay to the Contractor reasonable remuneration for the use of such equipment or the provision of such services.

22.5.3 The Contractor shall also so arrange to perform its work as to minimize, to the extent possible, interference with the work of other contractors. The Project Manager shall determine the resolution of any difference or conflict that may arise between the Contractor and other contractors and the workers of the Employer in regard to their work.

22.5.4 The Contractor shall notify the Project Manager promptly of any defects in the other contractors' work that come to its notice, and that could affect the Contractor's work. The Project Manager shall determine the corrective measures, if any, required to rectify the situation after inspection of the

Facilities. Decisions made by the Project Manager shall be binding on the Contractor.

22.6 Emergency Work

If, by reason of an emergency arising in connection with and during the execution of the Contract, any protective or remedial work is necessary as a matter of urgency to prevent damage to the Facilities, the Contractor shall immediately carry out such work.

If the Contractor is unable or unwilling to do such work immediately, the Employer may do or cause such work to be done as the Employer may determine is necessary in order to prevent damage to the Facilities. In such event the Employer shall, as soon as practicable after the occurrence of any such emergency, notify the Contractor in writing of such emergency, the work done and the reasons therefor. If the work done or caused to be done by the Employer is work that the Contractor was liable to do at its own expense under the Contract, the reasonable costs incurred by the Employer in connection therewith shall be paid by the Contractor to the Employer. Otherwise, the cost of such remedial work shall be borne by the Employer.

22.7 Site Clearance

22.7.1 Site Clearance in Course of Performance: In the course of carrying out the Contract, the Contractor shall keep the Site reasonably free from all unnecessary obstruction, store or remove any surplus materials, clear away any wreckage, rubbish or temporary works from the Site, and remove any Contractor's Equipment no longer required for execution of the Contract.

22.7.2 Clearance of Site after Completion: After Completion of all parts of the Facilities, the Contractor shall clear away and remove all wreckage, rubbish and debris of any kind from the Site, and shall leave the Site and Facilities in a clean and safe condition.

22.8 Security of the Site

The Contractor shall be responsible for the security of the Site including providing and maintaining at its own expense all lighting, fencing, and watching when and where necessary for the proper execution and the protection of the Facilities, or for the safety of the owners and occupiers of adjacent property and for the safety of the public.

If required in the Employer's Requirements, the Contractor shall submit for the Project Manager's No-objection a security management plan that sets the security arrangements for the Site.

In making security arrangements, the Contractor shall be guided by applicable laws and any other requirements stated in the Employer's Requirements.

The Contractor shall (i) conduct appropriate background checks on any personnel retained to provide security; (ii) train the security personnel adequately (or determine that they are properly trained) in the use of force (and where applicable, firearms), and appropriate conduct towards Contractor's and Sub-contractor's personnel, Employer's personnel and affected communities; and (iii) require the security personnel to act within the applicable Laws and any requirements set out in the Employer's Requirements.

The Contractor shall not permit any use of force by security personnel in providing security except when used for preventive and defensive purposes in proportion to the nature and extent of the threat.

22.9 Protection of the Environment

The Contractor shall take all necessary measures to:

- i. protect the environment (both on and off the Site);
and
- ii. limit damage and nuisance to people and property resulting from pollution, noise and other results of the Contractor's operations and/ or activities.

The Contractor shall ensure that emissions, surface discharges, effluent and any other pollutants from the Contractor's activities shall exceed neither the values indicated in the Employer's Requirements, nor those prescribed by applicable laws.

In the event of damage to the environment, property and/or nuisance to people, on or off Site as a result of the Contractor's operations, the Contractor shall agree with the Project Manager the appropriate actions and time scale to remedy, as practicable, the damaged environment to its former condition. The Contractor shall implement such remedies at its cost to the satisfaction of the Project Manager.

22.10 Traffic and Road Safety

The Contractor shall take all necessary safety measures to avoid the occurrence of incidents and injuries to any third party associated with the use of Contractor's Equipment on public roads or other public infrastructure.

The Contractor shall monitor and use road safety incidents and accidents reports to identify negative safety issues, and establish and implement necessary measures to resolve them.

22.11 – Cultural Heritage Findings

All fossils, coins, articles of value or antiquity, structures, groups of structures, and other remains or items of geological, archaeological, paleontological, historical, architectural, religious interest found on the Site shall be placed under the care and custody of the Employer.

The Contractor shall:

- (a) take all reasonable precautions, including fencing-off the area or site of the finding, to avoid further disturbance and prevent Contractor's and Subcontractors' personnel or other persons from removing or damaging any of these findings;
- (b) as soon as practicable after discovery of any such finding, give a notice to the Project Manager, to give the Project Manager the opportunity to promptly

inspect and/or investigate the finding before it is disturbed and to issue instructions for dealing with it;

(c) train relevant Contractor's and its Subcontractors' personnel on the procedures for handling such findings; and

(d) implement any other action consistent with the requirements of the Employer's Requirements and relevant laws.

If the Contractor suffers delay and/or incurs extra costs from complying with the Project Manager instructions, the Contractor shall be entitled to an extension of time under GCC Sub-Clause 40.1, and the amount of such extra costs shall be added to the Contract Price.

23. Test and Inspection

23.1 The Contractor shall at its own expense carry out at the place of manufacture and/or on the Site all such tests and/or inspections of the Plant and any part of the Facilities as are specified in the Contract.

23.2 The Employer and the Project Manager or their designated representatives shall be entitled to attend the aforesaid test and/or inspection, provided that the Employer shall bear all costs and expenses incurred in connection with such attendance including, but not limited to, all traveling and board and lodging expenses.

23.3 Whenever the Contractor is ready to carry out any such test and/or inspection, the Contractor shall give a reasonable advance notice of such test and/or inspection and of the place and time thereof to the Project Manager. The Contractor shall obtain from any relevant third Party or manufacturer any necessary permission or consent to enable the Employer and the Project Manager or their designated representatives to attend the test and/or inspection.

23.4 The Contractor shall provide the Project Manager with a certified report of the results of any such test and/or inspection.

If the Employer or Project Manager or their designated representatives fails to attend the test and/or inspection, or if it is agreed between the Parties that such persons shall not do so, then the Contractor may proceed with the test and/or inspection in the absence of such persons, and may provide the Project Manager with a certified report of the results thereof.

23.5 The Project Manager may require the Contractor to carry out any test and/or inspection not required by the Contract, provided that the Contractor's reasonable costs and expenses incurred in the carrying out of such test and/or inspection shall be added to the Contract Price. Further, if such test and/or inspection impede the progress of work on the Facilities and/or the Contractor's performance of its other obligations under the Contract, due allowance will be made in respect of the Time for Completion and the other obligations so affected.

23.6 If any Plant or any part of the Facilities fails to pass any test and/or inspection, the Contractor shall either rectify or replace such Plant or part of the Facilities and shall repeat the test and/or inspection upon giving a notice under GCC Sub-Clause 23.3.

23.7 If any dispute or difference of opinion shall arise between the Parties in connection with or arising out of the test and/or inspection of the Plant or part of the Facilities that cannot be settled between the Parties within a reasonable period of time, it may be referred to an Dispute Board for determination in accordance with GCC Sub-Clause 46.3.

23.8 The Contractor shall afford the Employer and the Project Manager, at the Employer's expense, access at any reasonable time to any place where the Plant are being manufactured or the Facilities are being installed, in order to inspect the progress and the manner of manufacture or installation, provided that the Project Manager shall give the Contractor a reasonable prior notice. Without

prejudice to GCC Sub-Clause 9.7, as instructed by the Project Manager, the Contractor shall also afford other relevant entities (at the Employer's or their respective entities' expense, as appropriate) access to the Facilities, to inspect progress and the manner of the execution of the Facilities, carry out environmental and social audit, as appropriate, or carry out any other duty as stated in the Employer's Requirements or as instructed by the Project Manager.

23.9 The Contractor agrees that neither the execution of a test and/or inspection of Plant or any part of the Facilities, nor the attendance by the Employer or the Project Manager, nor the issue of any test certificate pursuant to GCC Sub-Clause 23.4, shall release the Contractor from any other responsibilities under the Contract.

23.10 No part of the Facilities or foundations shall be covered up on the Site without the Contractor carrying out any test and/or inspection required under the Contract. The Contractor shall give a reasonable notice to the Project Manager whenever any such parts of the Facilities or foundations are ready or about to be ready for test and/or inspection; such test and/or inspection and notice thereof shall be subject to the requirements of the Contract.

23.11 The Contractor shall uncover any part of the Facilities or foundations, or shall make openings in or through the same as the Project Manager may from time to time require at the Site, and shall reinstate and make good such part or parts.

If any parts of the Facilities or foundations have been covered up at the Site after compliance with the requirement of GCC Sub-Clause 23.10 and are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating, and making good the same shall be borne by the Employer, and the Time for Completion shall be reasonably adjusted to the extent that the Contractor has

thereby been delayed or impeded in the performance of any of its obligations under the Contract.

24. Completion of the Facilities

24.1 As soon as the Facilities or any part thereof has, in the opinion of the Contractor, been completed operationally and structurally and put in a tight and clean condition as specified in the Employer's Requirements, excluding minor items not materially affecting the operation or safety of the Facilities, the Contractor shall so notify the Employer in writing.

24.2 Within seven (7) days after receipt of the notice from the Contractor under GCC Sub-Clause 24.1, the Employer shall supply the operating and maintenance personnel specified in the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer for Precommissioning of the Facilities or any part thereof.

Pursuant to the Appendix to the Contract Agreement titled Scope of Works and Supply by the Employer, the Employer shall also provide, within the said seven (7) day period, the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Precommissioning of the Facilities or any part thereof.

24.3 As soon as reasonably practicable after the operating and maintenance personnel have been supplied by the Employer and the raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters have been provided by the Employer in accordance with GCC Sub-Clause 24.2, the Contractor shall commence Precommissioning of the Facilities or the relevant part thereof in preparation for Commissioning, subject to GCC Sub-Clause 25.5.

24.4 As soon as all works in respect of Precommissioning are completed and, in the opinion of the Contractor, the Facilities or any part thereof is ready for Commissioning, the Contractor shall so notify the Project Manager in writing.

24.5 The Project Manager shall, within fourteen (14) days after receipt of the Contractor's notice under GCC Sub-Clause

24.4, either issue a Completion Certificate in the form specified in the Employer's Requirements (Forms and Procedures), stating that the Facilities or that part thereof have reached Completion as of the date of the Contractor's notice under GCC Sub-Clause 24.4, or notify the Contractor in writing of any defects and/or deficiencies.

If the Project Manager notifies the Contractor of any defects and/or deficiencies, the Contractor shall then correct such defects and/or deficiencies, and shall repeat the procedure described in GCC Sub-Clause 24.4.

If the Project Manager is satisfied that the Facilities or that part thereof have reached Completion, the Project Manager shall, within seven (7) days after receipt of the Contractor's repeated notice, issue a Completion Certificate stating that the Facilities or that part thereof have reached Completion as of the date of the Contractor's repeated notice.

If the Project Manager is not so satisfied, then it shall notify the Contractor in writing of any defects and/or deficiencies within seven (7) days after receipt of the Contractor's repeated notice, and the above procedure shall be repeated.

24.6 If the Project Manager fails to issue the Completion Certificate and fails to inform the Contractor of any defects and/or deficiencies within fourteen (14) days after receipt of the Contractor's notice under GCC Sub-Clause 24.4 or within seven (7) days after receipt of the Contractor's repeated notice under GCC Sub-Clause 24.5, or if the Employer makes use of the Facilities or part thereof, then the Facilities or that part thereof shall be deemed to have reached Completion as of the date of the Contractor's notice or repeated notice, or as of the Employer's use of the Facilities, as the case may be.

24.7 As soon as possible after Completion, the Contractor shall complete all outstanding minor items so that the Facilities are fully in accordance with the requirements of the

Contract, failing which the Employer will undertake such completion and deduct the costs thereof from any monies owing to the Contractor.

24.8 Upon Completion, the Employer shall be responsible for the care and custody of the Facilities or the relevant part thereof, together with the risk of loss or damage thereto, and shall thereafter take over the Facilities or the relevant part thereof.

25. Commissioning and Operational Acceptance

25.1 Commissioning

25.1.1 Commissioning of the Facilities or any part thereof shall be commenced by the Contractor immediately after issue of the Completion Certificate by the Project Manager, pursuant to GCC Sub-Clause 24.5, or immediately after the date of the deemed Completion, under GCC Sub-Clause 24.6.

25.1.2 The Employer shall supply the operating and maintenance personnel and all raw materials, utilities, lubricants, chemicals, catalysts, facilities, services and other matters required for Commissioning.

25.1.3 In accordance with the requirements of the Contract, the Contractor's and Project Manager's advisory personnel shall attend the Commissioning, including the Guarantee Test, and shall advise and assist the Employer.

25.2 Guarantee Test

25.2.1 Subject to GCC Sub-Clause 25.5, the Guarantee Test and repeats thereof shall be conducted by the Contractor during Commissioning of the Facilities or the relevant part thereof to ascertain whether the Facilities or the relevant part can attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees. The Employer shall promptly provide the Contractor with such information as the Contractor may reasonably require in relation to

the conduct and results of the Guarantee Test and any repeats thereof.

25.2.2 If for reasons not attributable to the Contractor, the Guarantee Test of the Facilities or the relevant part thereof cannot be successfully completed within the period from the date of Completion **specified in the PCC** or any other period agreed upon by the Employer and the Contractor, the Contractor shall be deemed to have fulfilled its obligations with respect to the Functional Guarantees, and GCC Sub-Clauses 28.2 and 28.3 shall not apply.

25.3 Operational Acceptance

25.3.1 Subject to GCC Sub-Clause 25.4 below, Operational Acceptance shall occur in respect of the Facilities or any part thereof when

- (a) the Guarantee Test has been successfully completed and the Functional Guarantees are met; or
- (b) the Guarantee Test has not been successfully completed or has not been carried out for reasons not attributable to the Contractor within the period from the date of Completion specified in the PCC pursuant to GCC Sub-Clause 25.2.2 above or any other period agreed upon by the Employer and the Contractor; or
- (c) the Contractor has paid the liquidated damages specified in GCC Sub-Clause 28.3 hereof; and
- (d) any minor items mentioned in GCC Sub-Clause 24.7 hereof relevant to the Facilities or that part thereof have been completed.

25.3.2 At any time after any of the events set out in GCC Sub-Clause 25.3.1 have occurred, the Contractor may give a notice to the Project Manager requesting the issue of an Operational Acceptance Certificate in the form provided in the Employer's Requirements (Forms and Procedures) in respect of

the Facilities or the part thereof specified in such notice as of the date of such notice.

25.3.3 The Project Manager shall, after consultation with the Employer, and within seven (7) days after receipt of the Contractor's notice, issue an Operational Acceptance Certificate.

25.3.4 If within seven (7) days after receipt of the Contractor's notice, the Project Manager fails to issue the Operational Acceptance Certificate or fails to inform the Contractor in writing of the justifiable reasons why the Project Manager has not issued the Operational Acceptance Certificate, the Facilities or the relevant part thereof shall be deemed to have been accepted as of the date of the Contractor's said notice.

25.4 Partial Acceptance

25.4.1 If the Contract specifies that Completion and Commissioning shall be carried out in respect of parts of the Facilities, the provisions relating to Completion and Commissioning including the Guarantee Test shall apply to each such part of the Facilities individually, and the Operational Acceptance Certificate shall be issued accordingly for each such part of the Facilities.

25.4.2 If a part of the Facilities comprises facilities such as buildings, for which no Commissioning or Guarantee Test is required, then the Project Manager shall issue the Operational Acceptance Certificate for such facility when it attains Completion, provided that the Contractor shall thereafter complete any outstanding minor items that are listed in the Operational Acceptance Certificate.

25.5 Delayed Precommissioning and/or Guarantee Test

25.5.1 In the event that the Contractor is unable to proceed with the Precommissioning of the Facilities pursuant to Sub-Clause 24.3, or with the

Guarantee Test pursuant to Sub-Clause 25.2, for reasons attributable to the Employer either on account of non availability of other facilities under the responsibilities of other contractor(s), or for reasons beyond the Contractor's control, the provisions leading to "deemed" completion of activities such as Completion, pursuant to GCC Sub-Clause 24.6, and Operational Acceptance, pursuant to GCC Sub-Clause 25.3.4, and Contractor's obligations regarding Defect Liability Period, pursuant to GCC Sub-Clause 27.2, Functional Guarantee, pursuant to GCC Clause 28, and Care of Facilities, pursuant to GCC Clause 32, and GCC Clause 41.1, Suspension, shall not apply. In this case, the following provisions shall apply.

25.5.2 When the Contractor is notified by the Project Manager that he will be unable to proceed with the activities and obligations pursuant to above Sub-Clause 25.5.1, the Contractor shall be entitled to the following:

- (a) the Time of Completion shall be extended for the period of suspension without imposition of liquidated damages pursuant to GCC Sub-Clause 26.2;
- (b) payments due to the Contractor in accordance with the provision specified in the Appendix to the Contract Agreement titled Terms and Procedures of Payment, which would not have been payable in normal circumstances due to non-completion of the subject activities, shall be released to the Contractor against submission of a security in the form of a bank guarantee of equivalent amount acceptable to the Employer, and which shall become null and void when the Contractor will have complied with its obligations regarding those payments,

subject to the provision of Sub-Clause 25.5.3 below;

- (c) the expenses towards the above security and extension of other securities under the contract, of which validity needs to be extended, shall be reimbursed to the Contractor by the Employer;
- (d) the additional charges towards the care of the Facilities pursuant to GCC Sub-Clause 32.1 shall be reimbursed to the Contractor by the Employer for the period between the notification mentioned above and the notification mentioned in Sub-Clause 25.5.4 below. The provision of GCC Sub-Clause 33.2 shall apply to the Facilities during the same period.

25.5.3 In the event that the period of suspension under above Sub-Clause 25.5.1 actually exceeds one hundred eighty (180) days, the Employer and Contractor shall mutually agree to any additional compensation payable to the Contractor.

25.5.4 When the Contractor is notified by the Project Manager that the plant is ready for Precommissioning, the Contractor shall proceed without delay in performing Precommissioning in accordance with Clause 24.

F. Guarantees and Liabilities

26. Completion Time Guarantee

- 26.1 The Contractor guarantees that it shall attain Completion of the Facilities (or a part for which a separate time for completion is specified) within the Time for Completion specified in the PCC pursuant to GCC Sub-Clause 8.2, or within such extended time to which the Contractor shall be entitled under GCC Clause 40 hereof.
- 26.2 If the Contractor fails to attain Completion of the Facilities or any part thereof within the Time for Completion or any extension thereof under GCC Clause 40, the Contractor shall pay to the Employer liquidated damages in the amount

specified in the PCC as a percentage rate of the Contract Price or the relevant part thereof. The aggregate amount of such liquidated damages shall in no event exceed the amount **specified as "Maximum" in the PCC** as a percentage rate of the Contract Price. Once the "Maximum" is reached, the Employer may consider termination of the Contract, pursuant to GCC Sub-Clause 42.2.2.

Such payment shall completely satisfy the Contractor's obligation to attain Completion of the Facilities or the relevant part thereof within the Time for Completion or any extension thereof under GCC Clause 40. The Contractor shall have no further liability whatsoever to the Employer in respect thereof.

However, the payment of liquidated damages shall not in any way relieve the Contractor from any of its obligations to complete the Facilities or from any other obligations and liabilities of the Contractor under the Contract.

Save for liquidated damages payable under this GCC Sub-Clause 26.2, the failure by the Contractor to attain any milestone or other act, matter or thing by any date specified in the Appendix to the Contract Agreement titled Time Schedule, and/or other program of work prepared pursuant to GCC Sub-Clause 18.2 shall not render the Contractor liable for any loss or damage thereby suffered by the Employer.

26.3 If the Contractor attains Completion of the Facilities or any part thereof before the Time for Completion or any extension thereof under GCC Clause 40, the Employer shall pay to the Contractor a bonus in the amount **specified in the PCC**. The aggregate amount of such bonus shall in no event exceed the amount **specified as "Maximum" in the PCC**.

27. Defect Liability

27.1 The Contractor warrants that the Facilities or any part thereof shall be free from defects in the design, engineering, materials and workmanship of the Plant supplied and of the work executed.

27.2 The Defect Liability Period shall be five hundred and forty (540) days from the date of Completion of the Facilities (or any part thereof) or one year from the date of Operational Acceptance of the Facilities (or any part thereof), whichever first occurs, unless specified otherwise in the PCC pursuant to GCC Sub-Clause 27.10.

If during the Defect Liability Period any defect should be found in the design, engineering, materials and workmanship of the Plant supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with the Employer regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good as the Contractor shall determine at its discretion, such defect as well as any damage to the Facilities caused by such defect. The Contractor shall not be responsible for the repair, replacement or making good of any defect, or of any damage to the Facilities arising out of or resulting from any of the following causes:

- (a) improper operation or maintenance of the Facilities by the Employer;
- (b) operation of the Facilities outside specifications provided in the Contract; or
- (c) normal wear and tear.

27.3 The Contractor's obligations under this GCC Clause 27 shall not apply to:

- (a) any materials that are supplied by the Employer under GCC Sub-Clause 21.2, are normally consumed in operation, or have a normal life shorter than the Defect Liability Period stated herein;
- (b) any designs, specifications or other data designed, supplied or specified by or on behalf of the Employer or any matters for which the Contractor has disclaimed responsibility herein; or
- (c) any other materials supplied or any other work executed by or on behalf of the Employer, except for

the work executed by the Employer under GCC Sub-Clause 27.7.

27.4 The Employer shall give the Contractor a notice stating the nature of any such defect together with all available evidence thereof, promptly following the discovery thereof. The Employer shall afford all reasonable opportunity for the Contractor to inspect any such defect.

27.5 The Employer shall afford the Contractor all necessary access to the Facilities and the Site to enable the Contractor to perform its obligations under this GCC Clause 27.

The Contractor may, with the consent of the Employer, remove from the Site any Plant or any part of the Facilities that are defective if the nature of the defect, and/or any damage to the Facilities caused by the defect, is such that repairs cannot be expeditiously carried out at the Site.

27.6 If the repair, replacement or making good is of such a character that it may affect the efficiency of the Facilities or any part thereof, the Employer may give to the Contractor a notice requiring that tests of the defective part of the Facilities shall be made by the Contractor immediately upon completion of such remedial work, whereupon the Contractor shall carry out such tests.

If such part fails the tests, the Contractor shall carry out further repair, replacement or making good, as the case may be, until that part of the Facilities passes such tests. The tests shall be agreed upon by the Employer and the Contractor.

27.7 If the Contractor fails to commence the work necessary to remedy such defect or any damage to the Facilities caused by such defect within a reasonable time (which shall in no event be considered to be less than fifteen (15) days), the Employer may, following notice to the Contractor, proceed to do such work, and the reasonable costs incurred by the Employer in connection therewith shall be paid to the Employer by the Contractor or may be deducted by the

Employer from any monies due the Contractor or claimed under the Performance Security.

- 27.8 If the Facilities or any part thereof cannot be used by reason of such defect and/or making good of such defect, the Defect Liability Period of the Facilities or such part, as the case may be, shall be extended by a period equal to the period during which the Facilities or such part cannot be used by the Employer because of any of the aforesaid reasons.
- 27.9 Except as provided in GCC Clauses 27 and 33, the Contractor shall be under no liability whatsoever and howsoever arising, and whether under the Contract or at law, in respect of defects in the Facilities or any part thereof, the Plant, design or engineering or work executed that appear after Completion of the Facilities or any part thereof, except where such defects are the result of the gross negligence, fraud, or criminal or willful action of the Contractor.
- 27.10 In addition, any such component of the Facilities, and during the period of time as may be **specified in the PCC**, shall be subject to an extended defect liability period. Such obligation of the Contractor shall be in addition to the defect liability period specified under GCC Sub-Clause 27.2.

28. Functional Guarantees

- 28.1 The Contractor guarantees that during the Guarantee Test, the Facilities and all parts thereof shall attain the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, subject to and upon the conditions therein specified.
- 28.2 If, for reasons attributable to the Contractor, the minimum level of the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, are not met either in whole or in part, the Contractor shall at its cost and expense make such changes, modifications and/or additions to the Plant or any part thereof as may be necessary to meet at least the minimum level of such Guarantees. The Contractor shall notify the Employer upon completion of the necessary changes, modifications and/or additions, and shall request the Employer to repeat the Guarantee Test until the minimum level of the Guarantees

has been met. If the Contractor eventually fails to meet the minimum level of Functional Guarantees, the Employer may consider termination of the Contract, pursuant to GCC Sub-Clause 42.2.2.

28.3 If, for reasons attributable to the Contractor, the Functional Guarantees specified in the Appendix to the Contract Agreement titled Functional Guarantees, are not attained either in whole or in part, but the minimum level of the Functional Guarantees specified in the said Appendix to the Contract Agreement is met, the Contractor shall, at the Contractor's option, either

(a) make such changes, modifications and/or additions to the Facilities or any part thereof that are necessary to attain the Functional Guarantees at its cost and expense, and shall request the Employer to repeat the Guarantee Test or

(b) pay liquidated damages to the Employer in respect of the failure to meet the Functional Guarantees in accordance with the provisions in the Appendix to the Contract Agreement titled Functional Guarantees.

28.4 The payment of liquidated damages under GCC Sub-Clause 28.3, up to the limitation of liability specified in the Appendix to the Contract Agreement titled Functional Guarantees, shall completely satisfy the Contractor's guarantees under GCC Sub-Clause 28.3, and the Contractor shall have no further liability whatsoever to the Employer in respect thereof. Upon the payment of such liquidated damages by the Contractor, the Project Manager shall issue the Operational Acceptance Certificate for the Facilities or any part thereof in respect of which the liquidated damages have been so paid.

29. Patent Indemnity

29.1 The Contractor shall, subject to the Employer's compliance with GCC Sub-Clause 29.2, indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses,

which the Employer may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered or otherwise existing at the date of the Contract by reason of: (a) the installation of the Facilities by the Contractor or the use of the Facilities in the country where the Site is located; and (b) the sale of the products produced by the Facilities in any country.

Such indemnity shall not cover any use of the Facilities or any part thereof other than for the purpose indicated by or to be reasonably inferred from the Contract, any infringement resulting from the use of the Facilities or any part thereof, or any products produced thereby in association or combination with any other equipment, plant or materials not supplied by the Contractor, pursuant to the Contract Agreement.

- 29.2 If any proceedings are brought or any claim is made against the Employer arising out of the matters referred to in GCC Sub-Clause 29.1, the Employer shall promptly give the Contractor a notice thereof, and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

If the Contractor fails to notify the Employer within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the twenty-eight (28) day period, the Employer shall make no admission that may be prejudicial to the defense of any such proceedings or claim.

The Employer shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing.

- 29.3 The Employer shall indemnify and hold harmless the Contractor and its employees, officers and Subcontractors from and against any and all suits, actions or administrative

proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, which the Contractor may suffer as a result of any infringement or alleged infringement of any patent, utility model, registered design, trademark, copyright or other intellectual property right registered or otherwise existing at the date of the Contract arising out of or in connection with any design, data, drawing, specification, or other documents or materials provided or designed by or on behalf of the Employer.

- 30. Limitation of Liability**
- 30.1 Except in cases of criminal negligence or willful misconduct,
- (a) neither Party shall be liable to the other Party, whether in contract, tort, or otherwise, for any indirect or consequential loss or damage, loss of use, loss of production, or loss of profits or interest costs, which may be suffered by the other Party in connection with the Contract, other than specifically provided as any obligation of the Party in the Contract, and
 - (b) the aggregate liability of the Contractor to the Employer, whether under the Contract, in tort or otherwise, shall not exceed the amount resulting from the application of the multiplier specified in the PCC, to the Contract Price or, if a multiplier is not so specified, the total Contract Price, provided that this limitation shall not apply to the cost of repairing or replacing defective equipment, or to any obligation of the Contractor to indemnify the Employer with respect to patent infringement.

G. Risk Distribution

- 31. Transfer of Ownership**
- 31.1 Ownership of the Plant (including spare parts) to be imported into the country where the Site is located shall be transferred to the Employer upon loading on to the mode of transport to be used to convey the Plant from the country of origin to that country.

- 31.2 Ownership of the Plant (including spare parts) procured in the country where the Site is located shall be transferred to the Employer when the Plant are brought on to the Site.
- 31.3 Ownership of the Contractor's Equipment used by the Contractor and its Subcontractors in connection with the Contract shall remain with the Contractor or its Subcontractors.
- 31.4 Ownership of any Plant in excess of the requirements for the Facilities shall revert to the Contractor upon Completion of the Facilities or at such earlier time when the Employer and the Contractor agree that the Plant in question are no longer required for the Facilities.
- 31.5 Notwithstanding the transfer of ownership of the Plant, the responsibility for care and custody thereof together with the risk of loss or damage thereto shall remain with the Contractor pursuant to GCC Clause 32 (Care of Facilities) hereof until Completion of the Facilities or the part thereof in which such Plant are incorporated.

**32. Care of
Facilities**

- 32.1 The Contractor shall be responsible for the care and custody of the Facilities or any part thereof until the date of Completion of the Facilities pursuant to GCC Clause 24 or, where the Contract provides for Completion of the Facilities in parts, until the date of Completion of the relevant part, and shall make good at its own cost any loss or damage that may occur to the Facilities or the relevant part thereof from any cause whatsoever during such period. The Contractor shall also be responsible for any loss or damage to the Facilities caused by the Contractor or its Subcontractors in the course of any work carried out, pursuant to GCC Clause 27. Notwithstanding the foregoing, the Contractor shall not be liable for any loss or damage to the Facilities or that part thereof caused by reason of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Sub-Clauses 32.2 and 38.1.
- 32.2 If any loss or damage occurs to the Facilities or any part thereof or to the Contractor's temporary facilities by reason of

- (a) insofar as they relate to the country where the Site is located, nuclear reaction, nuclear radiation, radioactive contamination, pressure wave caused by aircraft or other aerial objects, or any other occurrences that an experienced contractor could not reasonably foresee, or if reasonably foreseeable could not reasonably make provision for or insure against, insofar as such risks are not normally insurable on the insurance market and are mentioned in the general exclusions of the policy of insurance, including War Risks and Political Risks, taken out under GCC Clause 34 hereof; or
- (b) any use or occupation by the Employer or any third Party other than a Subcontractor, authorized by the Employer of any part of the Facilities; or
- (c) any use of or reliance upon any design, data or specification provided or designated by or on behalf of the Employer, or any such matter for which the Contractor has disclaimed responsibility herein,

the Employer shall pay to the Contractor all sums payable in respect of the Facilities executed, notwithstanding that the same be lost, destroyed or damaged, and will pay to the Contractor the replacement value of all temporary facilities and all parts thereof lost, destroyed or damaged. If the Employer requests the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Contractor shall make good the same at the cost of the Employer in accordance with GCC Clause 39. If the Employer does not request the Contractor in writing to make good any loss or damage to the Facilities thereby occasioned, the Employer shall either request a change in accordance with GCC Clause 39, excluding the performance of that part of the Facilities thereby lost, destroyed or damaged, or, where the loss or damage affects a substantial part of the Facilities, the Employer shall terminate the Contract pursuant to GCC Sub-Clause 42.1 hereof.

32.3 The Contractor shall be liable for any loss of or damage to any Contractor's Equipment, or any other property of the Contractor used or intended to be used for purposes of the

Facilities, except (i) as mentioned in GCC Sub-Clause 32.2 with respect to the Contractor's temporary facilities, and (ii) where such loss or damage arises by reason of any of the matters specified in GCC Sub-Clauses 32.2 (b) and (c) and 38.1.

32.4 With respect to any loss or damage caused to the Facilities or any part thereof or to the Contractor's Equipment by reason of any of the matters specified in GCC Sub-Clause 38.1, the provisions of GCC Sub-Clause 38.3 shall apply.

**33. Loss of or
Damage to
Property;
Accident or
Injury to
Workers;
Indemnifica-
tion**

33.1 Subject to GCC Sub-Clause 33.3, the Contractor shall indemnify and hold harmless the Employer and its employees and officers from and against any and all suits, actions or administrative proceedings, claims, demands, losses, damages, costs, and expenses of whatsoever nature, including attorney's fees and expenses, in respect of the death or injury of any person or loss of or damage to any property other than the Facilities whether accepted or not, arising in connection with the supply and installation of the Facilities and by reason of the negligence of the Contractor or its Subcontractors, or their employees, officers or agents, except any injury, death or property damage caused by the negligence of the Employer, its contractors, employees, officers or agents.

33.2 If any proceedings are brought or any claim is made against the Employer that might subject the Contractor to liability under GCC Sub-Clause 33.1, the Employer shall promptly give the Contractor a notice thereof and the Contractor may at its own expense and in the Employer's name conduct such proceedings or claim and any negotiations for the settlement of any such proceedings or claim.

If the Contractor fails to notify the Employer within twenty-eight (28) days after receipt of such notice that it intends to conduct any such proceedings or claim, then the Employer shall be free to conduct the same on its own behalf. Unless the Contractor has so failed to notify the Employer within the twenty-eight (28) day period, the Employer shall make no admission that may be prejudicial to the defense of any such proceedings or claim.

The Employer shall, at the Contractor's request, afford all available assistance to the Contractor in conducting such proceedings or claim, and shall be reimbursed by the Contractor for all reasonable expenses incurred in so doing.

33.3 The Employer shall indemnify and hold harmless the Contractor and its employees, officers and Subcontractors from any liability for loss of or damage to property of the Employer, other than the Facilities not yet taken over, that is caused by fire, explosion or any other perils, in excess of the amount recoverable from insurances procured under GCC Clause 34, provided that such fire, explosion or other perils were not caused by any act or failure of the Contractor.

33.4 The Party entitled to the benefit of an indemnity under this GCC Clause 33 shall take all reasonable measures to mitigate any loss or damage which has occurred. If the Party fails to take such measures, the other Party's liabilities shall be correspondingly reduced.

34. Insurance

34.1 To the extent specified in the Appendix to the Contract Agreement titled Insurance Requirements, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified in the said Appendix. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, who should not unreasonably withhold such approval.

(a) Cargo Insurance During Transport

Covering loss or damage occurring while in transit from the Contractor's or Subcontractor's works or stores until arrival at the Site, to the Plant (including spare parts therefor) and to the Contractor's Equipment.

(b) Installation All Risks Insurance

Covering physical loss or damage to the Facilities at the Site, occurring prior to Completion of the Facilities,

with an extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the Defect Liability Period while the Contractor is on the Site for the purpose of performing its obligations during the Defect Liability Period.

(c) Third Party Liability Insurance

Covering bodily injury or death suffered by third Parties including the Employer's personnel, and loss of or damage to property occurring in connection with the supply and installation of the Facilities.

(d) Automobile Liability Insurance

Covering use of all vehicles used by the Contractor or its Subcontractors, whether or not owned by them, in connection with the execution of the Contract.

(e) Workers' Compensation

In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed.

(f) Employer's Liability

In accordance with the statutory requirements applicable in any country where the Contract or any part thereof is executed.

(g) Other Insurances

Such other insurances as may be specifically agreed upon by the Parties hereto as listed in the Appendix to the Contract Agreement titled Insurance Requirements.

34.2 The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Third Party Liability, Workers' Compensation and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1 except for the Cargo Insurance During Transport, Workers' Compensation and Employer's Liability Insurances. All insurer's rights of

subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

- 34.3 The Contractor shall, in accordance with the provisions of the Appendix to the Contract Agreement titled Insurance Requirements, deliver to the Employer certificates of insurance or copies of the insurance policies as evidence that the required policies are in full force and effect. The certificates shall provide that no less than twenty-one (21) days' notice shall be given to the Employer by insurers prior to cancellation or material modification of a policy.
- 34.4 The Contractor shall ensure that, where applicable, its Subcontractor(s) shall take out and maintain in effect adequate insurance policies for their personnel and vehicles and for work executed by them under the Contract, unless such Subcontractors are covered by the policies taken out by the Contractor.
- 34.5 The Employer shall at its expense take out and maintain in effect during the performance of the Contract those insurances specified in the Appendix to the Contract Agreement titled Insurance Requirements, in the sums and with the deductibles and other conditions specified in the said Appendix. The Contractor and the Contractor's Subcontractors shall be named as co-insureds under all such policies. All insurers' rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies. The Employer shall deliver to the Contractor satisfactory evidence that the required insurances are in full force and effect. The policies shall provide that not less than twenty-one (21) days' notice shall be given to the Contractor by all insurers prior to any cancellation or material modification of the policies. If so requested by the Contractor, the Employer shall provide copies of the policies taken out by the Employer under this GCC Sub-Clause 34.5.
- 34.6 If the Contractor fails to take out and/or maintain in effect the insurances referred to in GCC Sub-Clause 34.1, the Employer may take out and maintain in effect any such

insurances and may from time to time deduct from any amount due the Contractor under the Contract any premium that the Employer shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Contractor. If the Employer fails to take out and/or maintain in effect the insurances referred to in GCC 34.5, the Contractor may take out and maintain in effect any such insurances and may from time to time deduct from any amount due the Employer under the Contract any premium that the Contractor shall have paid to the insurer, or may otherwise recover such amount as a debt due from the Employer. If the Contractor fails to or is unable to take out and maintain in effect any such insurances, the Contractor shall nevertheless have no liability or responsibility towards the Employer, and the Contractor shall have full recourse against the Employer for any and all liabilities of the Employer herein.

34.7 Unless otherwise provided in the Contract, the Contractor shall prepare and conduct all and any claims made under the policies effected by it pursuant to this GCC Clause 34, and all monies payable by any insurers shall be paid to the Contractor. The Employer shall give to the Contractor all such reasonable assistance as may be required by the Contractor. With respect to insurance claims in which the Employer's interest is involved, the Contractor shall not give any release or make any compromise with the insurer without the prior written consent of the Employer. With respect to insurance claims in which the Contractor's interest is involved, the Employer shall not give any release or make any compromise with the insurer without the prior written consent of the Contractor.

**35. Unforeseen
Conditions**

35.1 If, during the execution of the Contract, the Contractor shall encounter on the Site any physical conditions other than climatic conditions, or artificial obstructions that could not have been reasonably foreseen prior to the date of the Contract Agreement by an experienced contractor on the basis of reasonable examination of the data relating to the Facilities including any data as to boring tests, provided by the Employer, and on the basis of information that it could

have obtained from a visual inspection of the Site if access thereto was available, or other data readily available to it relating to the Facilities, and if the Contractor determines that it will in consequence of such conditions or obstructions incur additional cost and expense or require additional time to perform its obligations under the Contract that would not have been required if such physical conditions or artificial obstructions had not been encountered, the Contractor shall promptly, and before performing additional work or using additional Plant or Contractor's Equipment, notify the Project Manager in writing of

- (a) the physical conditions or artificial obstructions on the Site that could not have been reasonably foreseen;
- (b) the additional work and/or Plant and/or Contractor's Equipment required, including the steps which the Contractor will or proposes to take to overcome such conditions or obstructions;
- (c) the extent of the anticipated delay; and
- (d) the additional cost and expense that the Contractor is likely to incur.

On receiving any notice from the Contractor under this GCC Sub-Clause 35.1, the Project Manager shall promptly consult with the Employer and Contractor and decide upon the actions to be taken to overcome the physical conditions or artificial obstructions encountered. Following such consultations, the Project Manager shall instruct the Contractor, with a copy to the Employer, of the actions to be taken.

- 35.2 Any reasonable additional cost and expense incurred by the Contractor in following the instructions from the Project Manager to overcome such physical conditions or artificial obstructions referred to in GCC Sub-Clause 35.1 shall be paid by the Employer to the Contractor as an addition to the Contract Price.

If the Contractor is delayed or impeded in the performance of the Contract because of any such physical conditions or artificial obstructions referred to in GCC Sub-Clause 35.1, the Time for Completion shall be extended in accordance with GCC Clause 40.

36. Change in Laws and Regulations

36.1 If, after the date twenty-eight (28) days prior to the date of Bid submission, in the country where the Site is located, any law, regulation, ordinance, order or by-law having the force of law is enacted, promulgated, abrogated or changed which shall be deemed to include any change in interpretation or application by the competent authorities, that subsequently affects the costs and expenses of the Contractor and/or the Time for Completion, the Contract Price shall be correspondingly increased or decreased, and/or the Time for Completion shall be reasonably adjusted to the extent that the Contractor has thereby been affected in the performance of any of its obligations under the Contract. Notwithstanding the foregoing, such additional or reduced costs shall not be separately paid or credited if the same has already been accounted for in the price adjustment provisions where applicable, in accordance with the PCC pursuant to GCC Sub-Clause 11.2.

37. Force Majeure

37.1 "Force Majeure" shall mean any event beyond the reasonable control of the Employer or of the Contractor, as the case may be, and which is unavoidable notwithstanding the reasonable care of the Party affected, and shall include, without limitation, the following:

- (a) war, hostilities or warlike operations whether a state of war be declared or not, invasion, act of foreign enemy and civil war
- (b) rebellion, revolution, insurrection, mutiny, usurpation of civil or military government, conspiracy, riot, civil commotion and terrorist acts
- (c) confiscation, nationalization, mobilization, commandeering or requisition by or under the order of any government or de jure or de facto authority or ruler

- or any other act or failure to act of any local state or national government authority
- (d) strike, sabotage, lockout, embargo, import restriction, port congestion, lack of usual means of public transportation and communication, industrial dispute, shipwreck, shortage or restriction of power supply, epidemics, quarantine and plague
 - (e) earthquake, landslide, volcanic activity, fire, flood or inundation, tidal wave, typhoon or cyclone, hurricane, storm, lightning, or other inclement weather condition, nuclear and pressure waves or other natural or physical disaster
 - (f) shortage of labor, materials or utilities where caused by circumstances that are themselves Force Majeure.
- 37.2 If either Party is prevented, hindered or delayed from or in performing any of its obligations under the Contract by an event of Force Majeure, then it shall notify the other in writing of the occurrence of such event and the circumstances thereof within fourteen (14) days after the occurrence of such event.
- 37.3 The Party who has given such notice shall be excused from the performance or punctual performance of its obligations under the Contract for so long as the relevant event of Force Majeure continues and to the extent that such Party's performance is prevented, hindered or delayed. The Time for Completion shall be extended in accordance with GCC Clause 40.
- 37.4 The Party or Parties affected by the event of Force Majeure shall use reasonable efforts to mitigate the effect thereof upon its or their performance of the Contract and to fulfill its or their obligations under the Contract, but without prejudice to either Party's right to terminate the Contract under GCC Sub-Clauses 37.6 and 38.5.
- 37.5 No delay or nonperformance by either Party hereto caused by the occurrence of any event of Force Majeure shall
- (a) constitute a default or breach of the Contract, or

- (b) give rise to any claim for damages or additional cost or expense occasioned thereby, subject to GCC Sub-Clauses 32.2, 38.3 and 38.4

if and to the extent that such delay or nonperformance is caused by the occurrence of an event of Force Majeure.

37.6 If the performance of the Contract is substantially prevented, hindered or delayed for a single period of more than sixty (60) days or an aggregate period of more than one hundred and twenty (120) days on account of one or more events of Force Majeure during the currency of the Contract, the Parties will attempt to develop a mutually satisfactory solution, failing which either Party may terminate the Contract by giving a notice to the other, but without prejudice to either Party's right to terminate the Contract under GCC Sub-Clause 38.5.

37.7 In the event of termination pursuant to GCC Sub-Clause 37.6, the rights and obligations of the Employer and the Contractor shall be as specified in GCC Sub-Clauses 42.1.2 and 42.1.3.

37.8 Notwithstanding GCC Sub-Clause 37.5, Force Majeure shall not apply to any obligation of the Employer to make payments to the Contractor herein.

38. War Risks

38.1 "War Risks" shall mean any event specified in paragraphs (a) and (b) of GCC Sub-Clause 37.1 and any explosion or impact of any mine, bomb, shell, grenade or other projectile, missile, munitions or explosive of war, occurring or existing in or near the country (or countries) where the Site is located.

38.2 Notwithstanding anything contained in the Contract, the Contractor shall have no liability whatsoever for or with respect to

- (a) destruction of or damage to Facilities, Plant, or any part thereof;
- (b) destruction of or damage to property of the Employer or any third Party; or
- (c) injury or loss of life

if such destruction, damage, injury or loss of life is caused by any War Risks, and the Employer shall indemnify and hold the Contractor harmless from and against any and all claims, liabilities, actions, lawsuits, damages, costs, charges or expenses arising in consequence of or in connection with the same.

- 38.3 If the Facilities or any Plant or Contractor's Equipment or any other property of the Contractor used or intended to be used for the purposes of the Facilities shall sustain destruction or damage by reason of any War Risks, the Employer shall pay the Contractor for
- (a) any part of the Facilities or the Plant so destroyed or damaged to the extent not already paid for by the Employer
and so far as may be required by the Employer, and as may be necessary for completion of the Facilities
 - (b) replacing or making good any Contractor's Equipment or other property of the Contractor so destroyed or damaged
 - (c) replacing or making good any such destruction or damage to the Facilities or the Plant or any part thereof.

If the Employer does not require the Contractor to replace or make good any such destruction or damage to the Facilities, the Employer shall either request a change in accordance with GCC Clause 39, excluding the performance of that part of the Facilities thereby destroyed or damaged or, where the loss, destruction or damage affects a substantial part of the Facilities, shall terminate the Contract, pursuant to GCC Sub-Clause 42.1.

If the Employer requires the Contractor to replace or make good on any such destruction or damage to the Facilities, the Time for Completion shall be extended in accordance with GCC 40.

- 38.4 Notwithstanding anything contained in the Contract, the Employer shall pay the Contractor for any increased costs or

incidentals to the execution of the Contract that are in any way attributable to, consequent on, resulting from, or in any way connected with any War Risks, provided that the Contractor shall as soon as practicable notify the Employer in writing of any such increased cost.

- 38.5 If during the performance of the Contract any War Risks shall occur that financially or otherwise materially affect the execution of the Contract by the Contractor, the Contractor shall use its reasonable efforts to execute the Contract with due and proper consideration given to the safety of its and its Subcontractors' personnel engaged in the work on the Facilities, provided, however, that if the execution of the work on the Facilities becomes impossible or is substantially prevented for a single period of more than sixty (60) days or an aggregate period of more than one hundred and twenty (120) days on account of any War Risks, the Parties will attempt to develop a mutually satisfactory solution, failing which either Party may terminate the Contract by giving a notice to the other.
- 38.6 In the event of termination pursuant to GCC Sub-Clauses 38.3 or 38.5, the rights and obligations of the Employer and the Contractor shall be specified in GCC Sub-Clauses 42.1.2 and 42.1.3.

H. Change in Contract Elements

39. Change in the Facilities

39.1 Introducing a Change

39.1.1 Subject to GCC Sub-Clauses 39.2.5 and 39.2.7, the Employer shall have the right to propose, and subsequently require, that the Project Manager order the Contractor from time to time during the performance of the Contract to make any change, modification, addition or deletion to, in or from the Facilities hereinafter called "Change", provided that such Change falls within the general scope of the Facilities and does not constitute unrelated work and that it is technically practicable, taking into account both the state of advancement of the Facilities and the

technical compatibility of the Change envisaged with the nature of the Facilities as specified in the Contract.

39.1.2 Value Engineering: The Contractor may prepare, at its own cost, a value engineering proposal at any time during the performance of the contract. The value engineering proposal shall, at a minimum, include the following;

- (a) the proposed change(s), and a description of the difference to the existing contract requirements;
- (b) a full cost/benefit analysis of the proposed change(s) including a description and estimate of costs (including life cycle costs) the Employer may incur in implementing the value engineering proposal; and
- (c) a description of any effect(s) of the change on performance/functionality.

The Employer may accept the value engineering proposal if the proposal demonstrates benefits that:

- (a) accelerates the delivery period; or
 - (b) reduces the Contract Price or the life cycle costs to the Employer; or
 - (c) improves the quality, efficiency, safety or sustainability of the Facilities; or
 - (d) yields any other benefits to the Employer,
- without compromising the necessary functions of the Facilities.

If the value engineering proposal is approved by the Employer and results in:

- (a) a reduction of the Contract Price; the amount to be paid to the Contractor shall be the percentage specified in the PCC of the reduction in the Contract Price; or
- (b) an increase in the Contract Price; but results in a reduction in life cycle costs due to any benefit

described in (a) to (d) above, the amount to be paid to the Contractor shall be the full increase in the Contract Price.

39.1.3 Notwithstanding GCC Sub-Clauses 39.1.1 and 39.1.2, no change made necessary because of any default of the Contractor in the performance of its obligations under the Contract shall be deemed to be a Change, and such change shall not result in any adjustment of the Contract Price or the Time for Completion.

39.1.4 The procedure on how to proceed with and execute Changes is specified in GCC Sub-Clauses 39.2 and 39.3, and further details and forms are provided in the Employer's Requirements (Forms and Procedures).

39.2 Changes Originating from Employer

39.2.1 If the Employer proposes a Change pursuant to GCC Sub-Clause 39.1.1, it shall send to the Contractor a "Request for Change Proposal," requiring the Contractor to prepare and furnish to the Project Manager as soon as reasonably practicable a "Change Proposal," which shall include the following:

- (a) brief description of the Change
- (b) effect on the Time for Completion
- (c) estimated cost of the Change
- (d) effect on Functional Guarantees (if any)
- (e) effect on the Facilities
- (f) effect on any other provisions of the Contract.

39.2.2 Prior to preparing and submitting the "Change Proposal," the Contractor shall submit to the Project Manager an "Estimate for Change Proposal," which shall be an estimate of the cost of preparing and submitting the Change Proposal.

Upon receipt of the Contractor's Estimate for Change Proposal, the Employer shall do one of the following:

- (a) accept the Contractor's estimate with instructions to the Contractor to proceed with the preparation of the Change Proposal
- (b) advise the Contractor of any part of its Estimate for Change Proposal that is unacceptable and request the Contractor to review its estimate
- (c) advise the Contractor that the Employer does not intend to proceed with the Change.

39.2.3 Upon receipt of the Employer's instruction to proceed under GCC Sub-Clause 39.2.2 (a), the Contractor shall, with proper expedition, proceed with the preparation of the Change Proposal, in accordance with GCC Sub-Clause 39.2.1.

39.2.4 The pricing of any Change shall, as far as practicable, be calculated in accordance with the rates and prices included in the Contract. If such rates and prices are inequitable, the Parties thereto shall agree on specific rates for the valuation of the Change.

39.2.5 If before or during the preparation of the Change Proposal it becomes apparent that the aggregate effect of compliance therewith and with all other Change Orders that have already become binding upon the Contractor under this GCC Clause 39 would be to increase or decrease the Contract Price as originally set forth in Article 2 (Contract Price) of the Contract Agreement by more than fifteen percent (15%), the Contractor may give a written notice of objection thereto prior to furnishing the Change Proposal as aforesaid. If the Employer accepts the Contractor's objection, the Employer shall withdraw the proposed Change and shall notify the Contractor in writing thereof.

The Contractor's failure to so object shall neither affect its right to object to any subsequent requested Changes or Change Orders herein, nor affect its right to take into account, when making such subsequent

objection, the percentage increase or decrease in the Contract Price that any Change not objected to by the Contractor represents.

- 39.2.6 Upon receipt of the Change Proposal, the Employer and the Contractor shall mutually agree upon all matters therein contained. Within fourteen (14) days after such agreement, the Employer shall, if it intends to proceed with the Change, issue the Contractor with a Change Order.

If the Employer is unable to reach a decision within fourteen (14) days, it shall notify the Contractor with details of when the Contractor can expect a decision.

If the Employer decides not to proceed with the Change for whatever reason, it shall, within the said period of fourteen (14) days, notify the Contractor accordingly. Under such circumstances, the Contractor shall be entitled to reimbursement of all costs reasonably incurred by it in the preparation of the Change Proposal, provided that these do not exceed the amount given by the Contractor in its Estimate for Change Proposal submitted in accordance with GCC Sub-Clause 39.2.2.

- 39.2.7 If the Employer and the Contractor cannot reach agreement on the price for the Change, an equitable adjustment to the Time for Completion, or any other matters identified in the Change Proposal, the Employer may nevertheless instruct the Contractor to proceed with the Change by issue of a "Pending Agreement Change Order."

Upon receipt of a Pending Agreement Change Order, the Contractor shall immediately proceed with effecting the Changes covered by such Order. The Parties shall thereafter attempt to reach agreement on the outstanding issues under the Change Proposal.

If the Parties cannot reach agreement within sixty (60) days from the date of issue of the Pending Agreement Change Order, then the matter may be

referred to the Dispute Board in accordance with the provisions of GCC Sub-Clause 46.1.

39.3 Changes Originating from Contractor

39.3.1 If the Contractor proposes a Change pursuant to GCC Sub-Clause 39.1.2, the Contractor shall submit to the Project Manager a written "Application for Change Proposal," giving reasons for the proposed Change and including the information specified in GCC Sub-Clause 39.1.2.

Upon receipt of the Application for Change Proposal, the Parties shall follow the procedures outlined in GCC Sub-Clauses 39.2.6 and 39.2.7. However, the Contractor shall not be entitled to recover the costs of preparing the Application for Change Proposal.

40. Extension of Time for Completion

40.1 The Time(s) for Completion specified in the PCC pursuant to GCC Sub-Clause 8.2 shall be extended if the Contractor is delayed or impeded in the performance of any of its obligations under the Contract by reason of any of the following:

- (a) any Change in the Facilities as provided in GCC Clause 39
- (b) any occurrence of Force Majeure as provided in GCC Clause 37, unforeseen conditions as provided in GCC Clause 35, or other occurrence of any of the matters specified or referred to in paragraphs (a), (b) and (c) of GCC Sub-Clause 32.2
- (c) any suspension order given by the Employer under GCC Clause 41 hereof or reduction in the rate of progress pursuant to GCC Sub-Clause 41.2 or
- (d) any changes in laws and regulations as provided in GCC Clause 36 or
- (e) any default or breach of the Contract by the Employer, Appendix to the Contract Agreement titled, or any activity, act or omission of the Employer, or the Project

Manager, or any other contractors employed by the Employer, or

- (f) any delay on the part of a Subcontractor, provided such delay is due to a cause for which the Contractor himself would have been entitled to an extension of time under this sub-clause, or
- (g) delays attributable to the Employer or caused by customs, or
- (h) any other matter specifically mentioned in the Contract

by such period as shall be fair and reasonable in all the circumstances and as shall fairly reflect the delay or impediment sustained by the Contractor.

40.2 Except where otherwise specifically provided in the Contract, the Contractor shall submit to the Project Manager a notice of a claim for an extension of the Time for Completion, together with particulars of the event or circumstance justifying such extension as soon as reasonably practicable after the commencement of such event or circumstance. As soon as reasonably practicable after receipt of such notice and supporting particulars of the claim, the Employer and the Contractor shall agree upon the period of such extension. In the event that the Contractor does not accept the Employer's estimate of a fair and reasonable time extension, the Contractor shall be entitled to refer the matter to a Dispute Board, pursuant to GCC Sub-Clause 46.1.

40.3 The Contractor shall at all times use its reasonable efforts to minimize any delay in the performance of its obligations under the Contract.

40.4 In all cases where the Contractor has given a notice of a claim for an extension of time under GCC 40.2, the Contractor shall consult with the Project Manager in order to determine the steps (if any) which can be taken to overcome or minimize the actual or anticipated delay. The Contractor shall there after comply with all reasonable instructions which the Project Manager shall give in order to minimize such delay.

If compliance with such instructions shall cause the Contractor to incur extra costs and the Contractor is entitled to an extension of time under GCC 40.1, the amount of such extra costs shall be added to the Contract Price.

41. Suspension

41.1 The Employer may request the Project Manager, by notice to the Contractor, to order the Contractor to suspend performance of any or all of its obligations under the Contract. Such notice shall specify the obligation of which performance is to be suspended, the effective date of the suspension and the reasons therefor. The Contractor shall thereupon suspend performance of such obligation, except those obligations necessary for the care or preservation of the Facilities, until ordered in writing to resume such performance by the Project Manager.

If, by virtue of a suspension order given by the Project Manager, other than by reason of the Contractor's default or breach of the Contract, the Contractor's performance of any of its obligations is suspended for an aggregate period of more than ninety (90) days, then at any time thereafter and provided that at that time such performance is still suspended, the Contractor may give a notice to the Project Manager requiring that the Employer shall, within twenty-eight (28) days of receipt of the notice, order the resumption of such performance or request and subsequently order a change in accordance with GCC Clause 39, excluding the performance of the suspended obligations from the Contract.

If the Employer fails to do so within such period, the Contractor may, by a further notice to the Project Manager, elect to treat the suspension, where it affects a part only of the Facilities, as a deletion of such part in accordance with GCC Clause 39 or, where it affects the whole of the Facilities, as termination of the Contract under GCC Sub-Clause 42.1.

41.2 If

- (a) the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting

documents without just cause pursuant to the Appendix to the Contract Agreement titled Terms and Procedures of Payment, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, with interest thereon as stipulated in GCC Sub-Clause 12.3, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay such sum together with such interest, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, or fails to remedy the breach or take steps to remedy the breach within fourteen (14) days after receipt of the Contractor's notice or

- (b) the Contractor is unable to carry out any of its obligations under the Contract for any reason attributable to the Employer, including but not limited to the Employer's failure to provide possession of or access to the Site or other areas in accordance with GCC Sub-Clause 10.2, or failure to obtain any governmental permit necessary for the execution and/or completion of the Facilities,

then the Contractor may by fourteen (14) days' notice to the Employer suspend performance of all or any of its obligations under the Contract, or reduce the rate of progress.

- 41.3 If the Contractor's performance of its obligations is suspended or the rate of progress is reduced pursuant to this GCC Clause 41, then the Time for Completion shall be extended in accordance with GCC Sub-Clause 40.1, and any and all additional costs or expenses incurred by the Contractor as a result of such suspension or reduction shall be paid by the Employer to the Contractor in addition to the Contract Price, except in the case of suspension order or reduction in the rate of progress by reason of the Contractor's default or breach of the Contract.

41.4 During the period of suspension, the Contractor shall not remove from the Site any Plant, any part of the Facilities or any Contractor's Equipment, without the prior written consent of the Employer.

42. Termination 42.1 Termination for Employer's Convenience

42.1.1 The Employer may at any time terminate the Contract for any reason by giving the Contractor a notice of termination that refers to this GCC Sub-Clause 42.1.

42.1.2 Upon receipt of the notice of termination under GCC Sub-Clause 42.1.1, the Contractor shall either immediately or upon the date specified in the notice of termination

- (a) cease all further work, except for such work as the Employer may specify in the notice of termination for the sole purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition
- (b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) (ii) below
- (c) remove all Contractor's Equipment from the Site, repatriate the Contractor's and its Subcontractors' personnel from the Site, remove from the Site any wreckage, rubbish and debris of any kind, and leave the whole of the Site in a clean and safe condition, and
- (d) subject to the payment specified in GCC Sub-Clause 42.1.3,
 - (i) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination
 - (ii) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant

as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors; and

- (iii) deliver to the Employer all non-proprietary drawings, specifications and other documents prepared by the Contractor or its Subcontractors as at the date of termination in connection with the Facilities.

42.1.3 In the event of termination of the Contract under GCC Sub-Clause 42.1.1, the Employer shall pay to the Contractor the following amounts:

- (a) the Contract Price, properly attributable to the parts of the Facilities executed by the Contractor as of the date of termination
- (b) the costs reasonably incurred by the Contractor in the removal of the Contractor's Equipment from the Site and in the repatriation of the Contractor's and its Subcontractors' personnel
- (c) any amounts to be paid by the Contractor to its Subcontractors in connection with the termination of any subcontracts, including any cancellation charges
- (d) costs incurred by the Contractor in protecting the Facilities and leaving the Site in a clean and safe condition pursuant to paragraph (a) of GCC Sub-Clause 42.1.2
- (e) the cost of satisfying all other obligations, commitments and claims that the Contractor may in good faith have undertaken with third Parties in connection with the Contract and that are not covered by paragraphs (a) through (d) above.

42.2 Termination for Contractor's Default

42.2.1 The Employer, without prejudice to any other rights or remedies it may possess, may terminate the

Contract forthwith in the following circumstances by giving a notice of termination and its reasons therefor to the Contractor, referring to this GCC Sub-Clause 42.2:

- (a) if the Contractor becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, if the Contractor is a corporation, a resolution is passed or order is made for its winding up, other than a voluntary liquidation for the purposes of amalgamation or reconstruction, a receiver is appointed over any part of its undertaking or assets, or if the Contractor takes or suffers any other analogous action in consequence of debt
- (b) if the Contractor assigns or transfers the Contract or any right or interest therein in violation of the provision of GCC Clause 43.
- (c) if the Contractor, in the judgment of the Employer has engaged in Fraud and Corruption, as defined in paragraph 2.2 a. of Appendix B to the GCC, in competing for or in executing the Contract.

42.2.2 If the Contractor

- (a) has abandoned or repudiated the Contract
- (b) has without valid reason failed to commence work on the Facilities promptly or has suspended, other than pursuant to GCC Sub-Clause 41.2, the progress of Contract performance for more than twenty-eight (28) days after receiving a written instruction from the Employer to proceed
- (c) persistently fails to execute the Contract in accordance with the Contract or persistently neglects to carry out its obligations under the Contract without just cause

- (d) refuses or is unable to provide sufficient materials, services or labor to execute and complete the Facilities in the manner specified in the program furnished under GCC Sub-Clause 18.2 at rates of progress that give reasonable assurance to the Employer that the Contractor can attain Completion of the Facilities by the Time for Completion as extended,

then the Employer may, without prejudice to any other rights it may possess under the Contract, give a notice to the Contractor stating the nature of the default and requiring the Contractor to remedy the same. If the Contractor fails to remedy or to take steps to remedy the same within fourteen (14) days of its receipt of such notice, then the Employer may terminate the Contract forthwith by giving a notice of termination to the Contractor that refers to this GCC Sub-Clause 42.2.

42.2.3 Upon receipt of the notice of termination under GCC Sub-Clauses 42.2.1 or 42.2.2, the Contractor shall, either immediately or upon such date as is specified in the notice of termination,

- (a) cease all further work, except for such work as the Employer may specify in the notice of termination for the sole purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition
- (b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) below
- (c) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination
- (d) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant as of the date of termination, and, as may be required

by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors

- (e) deliver to the Employer all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection with the Facilities.

42.2.4 The Employer may enter upon the Site, expel the Contractor, and complete the Facilities itself or by employing any third Party. The Employer may, to the exclusion of any right of the Contractor over the same, take over and use with the payment of a fair rental rate to the Contractor, with all the maintenance costs to the account of the Employer and with an indemnification by the Employer for all liability including damage or injury to persons arising out of the Employer's use of such equipment, any Contractor's Equipment owned by the Contractor and on the Site in connection with the Facilities for such reasonable period as the Employer considers expedient for the supply and installation of the Facilities.

Upon completion of the Facilities or at such earlier date as the Employer thinks appropriate, the Employer shall give notice to the Contractor that such Contractor's Equipment will be returned to the Contractor at or near the Site and shall return such Contractor's Equipment to the Contractor in accordance with such notice. The Contractor shall thereafter without delay and at its cost remove or arrange removal of the same from the Site.

42.2.5 Subject to GCC Sub-Clause 42.2.6, the Contractor shall be entitled to be paid the Contract Price attributable to the Facilities executed as of the date of termination, the value of any unused or partially used Plant on the Site, and the costs, if any, incurred in protecting the Facilities and in leaving the Site in a clean and safe condition pursuant to paragraph (a) of GCC Sub-Clause 42.2.3. Any sums due the Employer

from the Contractor accruing prior to the date of termination shall be deducted from the amount to be paid to the Contractor under this Contract.

42.2.6 If the Employer completes the Facilities, the cost of completing the Facilities by the Employer shall be determined.

If the sum that the Contractor is entitled to be paid, pursuant to GCC Sub-Clause 42.2.5, plus the reasonable costs incurred by the Employer in completing the Facilities, exceeds the Contract Price, the Contractor shall be liable for such excess.

If such excess is greater than the sums due the Contractor under GCC Sub-Clause 42.2.5, the Contractor shall pay the balance to the Employer, and if such excess is less than the sums due the Contractor under GCC Sub-Clause 42.2.5, the Employer shall pay the balance to the Contractor.

The Employer and the Contractor shall agree, in writing, on the computation described above and the manner in which any sums shall be paid.

42.3 Termination by the Contractor

42.3.1 If

- (a) the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to the Appendix to the Contract Agreement titled Terms and Procedures of Payment, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, with interest thereon as stipulated in GCC Sub-Clause 12.3, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay such sum together with such interest,

fails to approve such invoice or supporting documents or give its reasons for withholding such approval, fails to remedy the breach or take steps to remedy the breach within fourteen (14) days after receipt of the Contractor's notice, or

- (b) the Contractor is unable to carry out any of its obligations under the Contract for any reason attributable to the Employer, including but not limited to the Employer's failure to provide possession of or access to the Site or other areas or failure to obtain any governmental permit necessary for the execution and/or completion of the Facilities,

then the Contractor may give a notice to the Employer thereof, and if the Employer has failed to pay the outstanding sum, to approve the invoice or supporting documents, to give its reasons for withholding such approval, or to remedy the breach within twenty-eight (28) days of such notice, or if the Contractor is still unable to carry out any of its obligations under the Contract for any reason attributable to the Employer within twenty-eight (28) days of the said notice, the Contractor may by a further notice to the Employer referring to this GCC Sub-Clause 42.3.1, forthwith terminate the Contract.

- 42.3.2 The Contractor may terminate the Contract forthwith by giving a notice to the Employer to that effect, referring to this GCC Sub-Clause 42.3.2, if the Employer becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, being a corporation, if a resolution is passed or order is made for its winding up (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), a receiver is appointed over any part of its undertaking or assets, or if the Employer takes or suffers any other analogous action in consequence of debt.

42.3.3 If the Contract is terminated under GCC Sub-Clauses 42.3.1 or 42.3.2, then the Contractor shall immediately

- (a) cease all further work, except for such work as may be necessary for the purpose of protecting that part of the Facilities already executed, or any work required to leave the Site in a clean and safe condition
- (b) terminate all subcontracts, except those to be assigned to the Employer pursuant to paragraph (d) (ii)
- (c) remove all Contractor's Equipment from the Site and repatriate the Contractor's and its Subcontractors' personnel from the Site, and
- (d) subject to the payment specified in GCC Sub-Clause 42.3.4,
 - (i) deliver to the Employer the parts of the Facilities executed by the Contractor up to the date of termination
 - (ii) to the extent legally possible, assign to the Employer all right, title and benefit of the Contractor to the Facilities and to the Plant as of the date of termination, and, as may be required by the Employer, in any subcontracts concluded between the Contractor and its Subcontractors, and
 - (iii) deliver to the Employer all drawings, specifications and other documents prepared by the Contractor or its Subcontractors as of the date of termination in connection with the Facilities.

42.3.4 If the Contract is terminated under GCC Sub-Clauses 42.3.1 or 42.3.2, the Employer shall pay to the Contractor all payments specified in GCC Sub-Clause 42.1.3, and reasonable compensation for all loss, except for loss of profit, or damage sustained by the

Contractor arising out of, in connection with or in consequence of such termination.

42.3.5 Termination by the Contractor pursuant to this GCC Sub-Clause 42.3 is without prejudice to any other rights or remedies of the Contractor that may be exercised in lieu of or in addition to rights conferred by GCC Sub-Clause 42.3.

42.4 In this GCC Clause 42, the expression "Facilities executed" shall include all work executed, Installation Services provided, and all Plant acquired, or subject to a legally binding obligation to purchase, by the Contractor and used or intended to be used for the purpose of the Facilities, up to and including the date of termination.

42.5 In this GCC Clause 42, in calculating any monies due from the Employer to the Contractor, account shall be taken of any sum previously paid by the Employer to the Contractor under the Contract, including any advance payment paid pursuant to the Appendix to the Contract Agreement titled Terms and Procedures of Payment.

43. Assignment 43.1 Neither the Employer nor the Contractor shall, without the express prior written consent of the other Party, which consent shall not be unreasonably withheld, assign to any third Party the Contract or any part thereof, or any right, benefit, obligation or interest therein or thereunder, except that the Contractor shall be entitled to assign either absolutely or by way of charge any monies due and payable to it or that may become due and payable to it under the Contract.

44. Export Restrictions 44.1 Notwithstanding any obligation under the Contract to complete all export formalities, any export restrictions attributable to the Employer, to the country of the Employer or to the use of the Plant and Installation Services to be supplied which arise from trade regulations from a country supplying those Plant and Installation Services, and which substantially impede the Contractor from meeting its obligations under the Contract, shall release the Contractor

from the obligation to provide deliveries or services, always provided, however, that the Contractor can demonstrate to the satisfaction of the Employer and of the Bank that it has completed all formalities in a timely manner, including applying for permits, authorizations and licenses necessary for the export of the Plant and Installation Services under the terms of the Contract. Termination of the Contract on this basis shall be for the Employer's convenience pursuant to Sub-Clause 42.1.

I. Claims, Disputes and Arbitration

45. Contractor's Claims

45.1 If the Contractor considers himself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract, the Contractor shall submit a notice to the Project Manager, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than 28 days after the Contractor became aware, or should have become aware, of the event or circumstance.

If the Contractor fails to give notice of a claim within such period of 28 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this Sub-Clause shall apply.

The Contractor shall also submit any other notices which are required by the Contract, and supporting particulars for the claim, all as relevant to such event or circumstance.

The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at another location acceptable to the Project Manager. Without admitting the Employer's liability, the Project Manager may, after receiving any notice under this Sub-Clause, monitor the record-keeping and/or instruct the Contractor to keep further contemporary records. The Contractor shall permit the Project Manager to inspect all

these records, and shall (if instructed) submit copies to the Project Manager.

Within 42 days after the Contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Project Manager, the Contractor shall send to the Project Manager a fully detailed claim which includes full supporting particulars of the basis of the claim and of the extension of time and/or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect:

- (a) this fully detailed claim shall be considered as interim;
- (b) the Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further particulars as the Project Manager may reasonably require; and
- (c) the Contractor shall send a final claim within 28 days after the end of the effects resulting from the event or circumstance, or within such other period as may be proposed by the Contractor and approved by the Project Manager.

Within 42 days after receiving a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Project Manager and approved by the Contractor, the Project Manager shall respond with approval, or with disapproval and detailed comments. He may also request any necessary further particulars, but shall nevertheless give his response on the principles of the claim within such time.

Each Payment Certificate shall include such amounts for any claim as have been reasonably substantiated as due under the relevant provision of the Contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the Contractor shall only be entitled to payment for such part of the claim as he has been able to substantiate.

The Project Manager shall agree with the Contractor or estimate: (i) the extension (if any) of the Time for Completion (before or after its expiry) in accordance with GCC Clause 40, and/or (ii) the additional payment (if any) to which the Contractor is entitled under the Contract.

The requirements of this Sub-Clause are in addition to those of any other Sub-Clause which may apply to a claim. If the Contractor fails to comply with this or another Sub-Clause in relation to any claim, any extension of time and/or additional payment shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of this Sub-Clause.

In the event that the Contractor and the Employer cannot agree on any matter relating to a claim, either Party may refer the matter to the Dispute Board pursuant to GCC 46 hereof.

46. Disputes and Arbitration

46.1 Appointment of the Dispute Board

Disputes shall be referred to a DB for decision in accordance with GCC Sub-Clause 46.3. The Parties shall appoint a DB by the date stated in the PCC.

The DB shall comprise, as stated in the PCC, either one or three suitably qualified persons ("the members"), each of whom shall be fluent in the language for communication defined in the Contract and shall be a professional experienced in the type of activities involved in the performance of the Contract and with the interpretation of contractual documents. If the number is not so stated and the Parties do not agree otherwise, the DB shall comprise three persons, one of whom shall serve as chairman.

If the Parties have not jointly appointed the DB 21 days before the date stated in the PCC and the DB is to comprise three persons, each Party shall nominate one member for the approval of the other Party. The first two members shall recommend and the Parties shall agree upon the third member, who shall act as chairman.

However, if a list of potential members is included in the PCC, the members shall be selected from those on the list,

other than anyone who is unable or unwilling to accept appointment to the DB.

The agreement between the Parties and either the sole member or each of the three members shall incorporate by reference the General Conditions of Dispute Board Agreement contained in the Appendix to these General Conditions, with such amendments as are agreed between them.

The terms of the remuneration of either the sole member or each of the three members, including the remuneration of any expert whom the DB consults, shall be mutually agreed upon by the Parties when agreeing the terms of appointment of the member or such expert (as the case may be). Each Party shall be responsible for paying one-half of this remuneration.

If a member declines to act or is unable to act as a result of death, disability, resignation or termination of appointment, a replacement shall be appointed in the same manner as the replaced person was required to have been nominated or agreed upon, as described in this Sub-Clause.

The appointment of any member may be terminated by mutual agreement of both Parties, but not by the Employer or the Contractor acting alone. Unless otherwise agreed by both Parties, the appointment of the DB (including each member) shall expire when the Operational Acceptance Certificate has been issued in accordance with GCC Sub-Clause 25.3.

46.2 Failure to Agree on the Composition of the Dispute Board

If any of the following conditions apply, namely:

- (a) the Parties fail to agree upon the appointment of the sole member of the DB by the date stated in the first paragraph of GCC Sub-Clause 46.1,
- (b) either Party fails to nominate a member (for approval by the other Party) of a DB of three persons by such date,

- (c) the Parties fail to agree upon the appointment of the third member (to act as chairman) of the DB by such date, or
- (d) the Parties fail to agree upon the appointment of a replacement person within 42 days after the date on which the sole member or one of the three members declines to act or is unable to act as a result of death, disability, resignation or termination of appointment,

then the appointing entity or official **named in the PCC** shall, upon the request of either or both of the Parties and after due consultation with both Parties, appoint this member of the DB. This appointment shall be final and conclusive. Each Party shall be responsible for paying one-half of the remuneration of the appointing entity or official.

46.3 Obtaining Dispute Board's Decision

If a dispute (of any kind whatsoever) arises between the Parties in connection with the performance of the Contract, including any dispute as to any certificate, determination, instruction, opinion or valuation of the Project Manager, either Party may refer the dispute in writing to the DB for its decision, with copies to the other Party and the Project Manager. Such reference shall state that it is given under this Sub-Clause.

For a DB of three persons, the DB shall be deemed to have received such reference on the date when it is received by the chairman of the DB.

Both Parties shall promptly make available to the DB all such additional information, further access to the Site, and appropriate facilities, as the DB may require for the purposes of making a decision on such dispute. The DB shall be deemed to be not acting as arbitrator(s).

Within 84 days after receiving such reference, or within such other period as may be proposed by the DB and approved by both Parties, the DB shall give its decision, which shall be reasoned and shall state that it is given under this Sub-Clause. The decision shall be binding on both Parties, who shall promptly give effect to it unless and until it shall be

revised in an amicable settlement or an arbitral award as described below. Unless the Contract has already been abandoned, repudiated or terminated, the Contractor shall continue with the performance of the Facilities in accordance with the Contract.

If either Party is dissatisfied with the DB's decision, then either Party may, within 28 days after receiving the decision, give notice to the other Party of its dissatisfaction and intention to commence arbitration. If the DB fails to give its decision within the period of 84 days (or as otherwise approved) after receiving such reference, then either Party may, within 28 days after this period has expired, give notice to the other Party of its dissatisfaction and intention to commence arbitration.

In either event, this notice of dissatisfaction shall state that it is given under this Sub-Clause, and shall set out the matter in dispute and the reason(s) for dissatisfaction. Except as stated in GCC Sub-Clauses 46.6 and 46.7, neither Party shall be entitled to commence arbitration of a dispute unless a notice of dissatisfaction has been given in accordance with this Sub-Clause.

If the DB has given its decision as to a matter in dispute to both Parties, and no notice of dissatisfaction has been given by either Party within 28 days after it received the DB's decision, then the decision shall become final and binding upon both Parties.

46.4 Amicable Settlement

Where notice of dissatisfaction has been given under GCC Sub-Clause 46.3 above, both Parties shall attempt to settle the dispute amicably before the commencement of arbitration. However, unless both Parties agree otherwise, arbitration may be commenced on or after the fifty-sixth day after the day on which notice of dissatisfaction and intention to commence arbitration was given, even if no attempt at amicable settlement has been made.

46.5 Arbitration

Unless **indicated otherwise in the PCC**, any dispute not settled amicably and in respect of which the DB's decision (if any) has not become final and binding shall be finally settled by arbitration. Unless otherwise agreed by both Parties, arbitration shall be conducted as follows:

- (a) For contracts with foreign contractors:
unless otherwise specified in the PCC; the dispute shall be finally settled under the Rules of Arbitration of the International Chamber of Commerce; by one or three arbitrators appointed in accordance with these Rules. The place of arbitration shall be the neutral location **stated in the PCC**; and the arbitration shall be conducted in the ruling language **stated in the PCC**;
and
- (b) For contracts with domestic contractors, arbitration with proceedings conducted in accordance with the laws of the Employer's Country.

The arbitrator(s) shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Project Manager, and any decision of the DB, relevant to the dispute. Nothing shall disqualify the Project Manager from being called as a witness and giving evidence before the arbitrator(s) on any matter whatsoever relevant to the dispute.

Neither Party shall be limited in the proceedings before the arbitrator(s) to the evidence or arguments previously put before the DB to obtain its decision, or to the reasons for dissatisfaction given in its notice of dissatisfaction. Any decision of the DB shall be admissible in evidence in the arbitration.

Arbitration may be commenced prior to or after completion of the Facilities. The obligations of the Parties, the Project Manager and the DB shall not be altered by reason of any

arbitration being conducted during the progress of the Facilities.

46.6 Failure to Comply with Dispute Board's Decision

In the event that a Party fails to comply with a DB decision which has become final and binding, then the other Party may, without prejudice to any other rights it may have, refer the failure itself to arbitration under GCC Sub-Clause 46.5. GCC Sub-Clauses 46.3 and 46.4 shall not apply to this reference.

46.7 Expiry of Dispute Board's Appointment

If a dispute arises between the Parties in connection with the performance of the Contract, and there is no DB in place, whether by reason of the expiry of the DB's appointment or otherwise:

- (a) GCC Sub-Clauses 46.3 and 46.4 shall not apply, and
- (b) the dispute may be referred directly to arbitration under GCC Sub-Clause 46.5

APPENDIX A

General Conditions of Dispute Board Agreement

1. Definitions

Each "Dispute Board Agreement" is a tripartite agreement by and between:

the "Employer";

the "Contractor"; and

the "Member" who is defined in the Dispute Board Agreement as being:

- (i) the sole member of the "DB" and, where this is the case, all references to the "Other Members" do not apply, or
- (ii) one of the three persons who are jointly called the "DB" (or "dispute board") and, where this is the case, the other two persons are called the "Other Members".

The Employer and the Contractor have entered (or intend to enter) into a contract, which is called the "Contract" and is defined in the Dispute Board Agreement, which incorporates this Appendix. In the Dispute Board Agreement, words and expressions which are not otherwise defined shall have the meanings assigned to them in the Contract.

2. General Provisions

Unless otherwise stated in the Dispute Board Agreement, it shall take effect on the latest of the following dates:

- (a) the Commencement Date defined in the Contract,
- (b) when the Employer, the Contractor and the Member have each signed the Dispute Board Agreement, or
- (c) when the Employer, the Contractor and each of the Other Members (if any) have respectively each signed a dispute board agreement.

This employment of the Member is a personal appointment. At any time, the Member may give not less than 70 days' notice of resignation to the Employer and to the Contractor, and the Dispute Board Agreement shall terminate upon the expiry of this period.

3. Warranties

The Member warrants and agrees that he/she is and shall be impartial and independent of the Employer, the Contractor and the Project Manager. The Member shall promptly disclose, to each of them and to the Other Members (if any), any fact or circumstance which might appear inconsistent with his/her warranty and agreement of impartiality and independence.

When appointing the Member, the Employer and the Contractor relied upon the Member's representations that he/she is:

- (a) experienced in the work which the Contractor is to carry out under the Contract,
- (b) experienced in the interpretation of contract documentation, and
- (c) fluent in the language for communications defined in the Contract.

4. General Obligations of the Member

The Member shall:

- (a) have no interest financial or otherwise in the Employer, the Contractor or the Project Manager, nor any financial interest in the Contract except for payment under the Dispute Board Agreement;
- (b) not previously have been employed as a consultant or otherwise by the Employer, the Contractor or the Project Manager, except in such circumstances as were disclosed in writing to the Employer and the Contractor before they signed the Dispute Board Agreement;
- (c) have disclosed in writing to the Employer, the Contractor and the Other Members (if any), before entering into the Dispute Board Agreement and to his/her best knowledge and recollection, any professional or personal relationships with any director, officer or employee of the Employer, the Contractor or the Project Manager, and any previous involvement in the overall project of which the Contract forms part;
- (d) not, for the duration of the Dispute Board Agreement, be employed as a consultant or otherwise by the Employer, the Contractor or the Project Manager, except as may be agreed in writing by the Employer, the Contractor and the Other Members (if any);
- (e) comply with the annexed procedural rules and with GCC Sub-Clause 46.3;

- (f) not give advice to the Employer, the Contractor, the Employer's Personnel or the Contractor's Personnel concerning the conduct of the Contract, other than in accordance with the annexed procedural rules;
- (g) not while a Member enter into discussions or make any agreement with the Employer, the Contractor or the Project Manager regarding employment by any of them, whether as a consultant or otherwise, after ceasing to act under the Dispute Board Agreement;
- (h) ensure his/her availability for all site visits and hearings as are necessary;
- (i) become conversant with the Contract and with the progress of the Facilities (and of any other parts of the project of which the Contract forms part) by studying all documents received which shall be maintained in a current working file;
- (j) treat the details of the Contract and all the DB's activities and hearings as private and confidential, and not publish or disclose them without the prior written consent of the Employer, the Contractor and the Other Members (if any); and
- (k) be available to give advice and opinions, on any matter relevant to the Contract when requested by both the Employer and the Contractor, subject to the agreement of the Other Members (if any).

5. General Obligations of the Employer and the Contractor

The Employer, the Contractor, the Employer's Personnel and the Contractor's Personnel shall not request advice from or consultation with the Member regarding the Contract, otherwise than in the normal course of the DB's activities under the Contract and the Dispute Board Agreement. The Employer and the Contractor shall be responsible for compliance with this provision, by the Employer's Personnel and the Contractor's Personnel respectively.

The Employer and the Contractor undertake to each other and to the Member that the Member shall not, except as otherwise agreed in writing by the Employer, the Contractor, the Member and the Other Members (if any):

- (a) be appointed as an arbitrator in any arbitration under the Contract;
- (b) be called as a witness to give evidence concerning any dispute before arbitrator(s) appointed for any arbitration under the Contract; or

- (c) be liable for any claims for anything done or omitted in the discharge or purported discharge of the Member's functions, unless the act or omission is shown to have been in bad faith.

The Employer and the Contractor hereby jointly and severally indemnify and hold the Member harmless against and from claims from which he is relieved from liability under the preceding paragraph.

Whenever the Employer or the Contractor refers a dispute to the DB under GCC Sub-Clause 46.3, which will require the Member to make a site visit and attend a hearing, the Employer or the Contractor shall provide appropriate security for a sum equivalent to the reasonable expenses to be incurred by the Member. No account shall be taken of any other payments due or paid to the Member.

6. Payment

The Member shall be paid as follows, in the currency named in the Dispute Board Agreement:

- (a) a retainer fee per calendar month, which shall be considered as payment in full for:
 - (i) being available on 28 days' notice for all site visits and hearings;
 - (ii) becoming and remaining conversant with all project developments and maintaining relevant files;
 - (iii) all office and overhead expenses including secretarial services, photocopying and office supplies incurred in connection with his duties; and
 - (iv) all services performed hereunder except those referred to in subparagraphs (b) and (c) of this Clause.

The retainer fee shall be paid with effect from the last day of the calendar month in which the Dispute Board Agreement becomes effective; until the last day of the calendar month in which the Taking-Over Certificate is issued for the whole of the Facilities.

With effect from the first day of the calendar month following the month in which Taking-Over Certificate is issued for the whole of the Facilities, the retainer fee shall be reduced by one third. This reduced fee shall be paid until the first day of the calendar

month in which the Member resigns or the Dispute Board Agreement is otherwise terminated.

- (b) a daily fee which shall be considered as payment in full for:
 - (i) each day or part of a day up to a maximum of two days' travel time in each direction for the journey between the Member's home and the site, or another location of a meeting with the Other Members (if any);
 - (ii) each working day on site visits, hearings or preparing decisions; and
 - (iii) each day spent reading submissions in preparation for a hearing.
- (c) all reasonable expenses including necessary travel expenses (air fare in less than first class, hotel and subsistence and other direct travel expenses) incurred in connection with the Member's duties, as well as the cost of telephone calls, courier charges, faxes and telexes: a receipt shall be required for each item in excess of five percent of the daily fee referred to in sub-paragraph (b) of this Clause;
- (d) any taxes properly levied in the Country on payments made to the Member (unless a national or permanent resident of the Country) under this Clause 6.

The retainer and daily fees shall be as specified in the Dispute Board Agreement. Unless it specifies otherwise, these fees shall remain fixed for the first 24 calendar months, and shall thereafter be adjusted by agreement between the Employer, the Contractor and the Member, at each anniversary of the date on which the Dispute Board Agreement became effective.

If the Parties fail to agree on the retainer fee or the daily fee the appointing entity or official named in the PCC shall determine the amount of the fees to be used.

The Member shall submit invoices for payment of the monthly retainer and air fares quarterly in advance. Invoices for other expenses and for daily fees shall be submitted following the conclusion of a site visit or hearing. All invoices shall be accompanied by a brief description of activities performed during the relevant period and shall be addressed to the Contractor.

The Contractor shall pay each of the Member's invoices in full within 56 calendar days after receiving each invoice and shall apply to the Employer (in the Statements under the Contract) for reimbursement of one-half of the amounts of these invoices. The Employer shall then pay the Contractor in accordance with the Contract.

If the Contractor fails to pay to the Member the amount to which he/she is entitled under the Dispute Board Agreement, the Employer shall pay the amount due to the Member and any other amount which may be required to maintain the operation of the DB; and without prejudice to the Employer's rights or remedies. In addition to all other rights arising from this default, the Employer shall be entitled to reimbursement of all sums paid in excess of one-half of these payments, plus all costs of recovering these sums and financing charges calculated at the rate specified in accordance with GCC Sub-Clause 12.3.

If the Member does not receive payment of the amount due within 70 days after submitting a valid invoice, the Member may (i) suspend his/her services (without notice) until the payment is received, and/or (ii) resign his/her appointment by giving notice under Clause 7.

7. Termination

At any time: (i) the Employer and the Contractor may jointly terminate the Dispute Board Agreement by giving 42 days' notice to the Member; or (ii) the Member may resign as provided for in Clause 2.

If the Member fails to comply with the Dispute Board Agreement, the Employer and the Contractor may, without prejudice to their other rights, terminate it by notice to the Member. The notice shall take effect when received by the Member.

If the Employer or the Contractor fails to comply with the Dispute Board Agreement, the Member may, without prejudice to his other rights, terminate it by notice to the Employer and the Contractor. The notice shall take effect when received by them both.

Any such notice, resignation and termination shall be final and binding on the Employer, the Contractor and the Member. However, a notice by the Employer or the Contractor, but not by both, shall be of no effect.

8. Default of the Member

If the Member fails to comply with any of his obligations under Clause 4 concerning his impartiality or independence in relation to the Employer or the Contractor, he/she shall not be entitled to any fees or expenses hereunder and shall, without prejudice to their other rights, reimburse each of the Employer and the Contractor for any fees and expenses received by the Member and the Other Members (if any), for proceedings or decisions (if any) of the DB which are rendered void or ineffective by the said failure to comply.

9. Disputes

Any dispute or claim arising out of or in connection with this Dispute Board Agreement, or the breach, termination or invalidity thereof, shall be finally settled by institutional arbitration. If no other arbitration institute is agreed, the arbitration shall be conducted under the Rules of Arbitration of the International Chamber of Commerce by one arbitrator appointed in accordance with these Rules of Arbitration.

APPENDIX A

DISPUTE BOARD GUIDELINES

1. Unless otherwise agreed by the Employer and the Contractor, the DB shall visit the site at intervals of not more than 140 days, including times of critical construction events, at the request of either the Employer or the Contractor. Unless otherwise agreed by the Employer, the Contractor and the DB, the period between consecutive visits shall not be less than 70 days, except as required to convene a hearing as described below.
2. The timing of and agenda for each site visit shall be as agreed jointly by the DB, the Employer and the Contractor, or in the absence of agreement, shall be decided by the DB. The purpose of site visits is to enable the DB to become and remain acquainted with the progress of the execution of the Contract and of any actual or potential problems or claims, and, as far as reasonable, to prevent potential problems or claims from becoming disputes.
3. Site visits shall be attended by the Employer, the Contractor and the Project Manager and shall be coordinated by the Employer in co-operation with the Contractor. The Employer shall ensure the provision of appropriate conference facilities and secretarial and copying services. At the conclusion of each site visit and before leaving the site, the DB shall prepare a report on its activities during the visit and shall send copies to the Employer and the Contractor.
4. The Employer and the Contractor shall furnish to the DB one copy of all documents which the DB may request, including Contract documents, progress reports, variation instructions, certificates and other documents pertinent to the performance of the Contract. All communications between the DB and the Employer or the Contractor shall be copied to the other Party. If the DB comprises three persons, the Employer and the Contractor shall send copies of these requested documents and these communications to each of these persons.
5. If any dispute is referred to the DB in accordance with GCC Sub-Clause 46.3, the DB shall proceed in accordance with GCC Sub-Clause 46.3 and these Guidelines. Subject to the time allowed to give notice of a decision and other relevant factors, the DB shall:
 - (a) act fairly and impartially as between the Employer and the Contractor, giving each of them a reasonable opportunity of putting his case and responding to the other's case, and

- (b) adopt procedures suitable to the dispute, avoiding unnecessary delay or expense.
- 6. The DB may conduct a hearing on the dispute, in which event it will decide on the date and place for the hearing and may request that written documentation and arguments from the Employer and the Contractor be presented to it prior to or at the hearing.
- 7. Except as otherwise agreed in writing by the Employer and the Contractor, the DB shall have power to adopt an inquisitorial procedure, to refuse admission to hearings or audience at hearings to any persons other than representatives of the Employer, the Contractor and the Project Manager, and to proceed in the absence of any Party who the DB is satisfied received notice of the hearing; but shall have discretion to decide whether and to what extent this power may be exercised.
- 8. The Employer and the Contractor empower the DB, among other things, to:
 - (a) establish the procedure to be applied in deciding a dispute,
 - (b) decide upon the DB's own jurisdiction, and as to the scope of any dispute referred to it,
 - (c) conduct any hearing as it thinks fit, not being bound by any rules or procedures other than those contained in the Contract and these Guidelines,
 - (d) take the initiative in ascertaining the facts and matters required for a decision,
 - (e) make use of its own specialist knowledge, if any,
 - (f) decide upon the payment of financing charges in accordance with the Contract,
 - (g) decide upon any provisional relief such as interim or conservatory measures,
 - (h) open up, review and revise any certificate, decision, determination, instruction, opinion or valuation of the Project Manager, relevant to the dispute, and
 - (i) appoint, should the DB so consider necessary and the Parties agree, a suitable expert at the cost of the Parties to give advice on a specific matter relevant to the dispute.

9. The DB shall not express any opinions during any hearing concerning the merits of any arguments advanced by the Parties. Thereafter, the DB shall make and give its decision in accordance with GCC Sub-Clause 46.3, or as otherwise agreed by the Employer and the Contractor in writing. If the DB comprises three persons:

- (a) it shall convene in private after a hearing, in order to have discussions and prepare its decision;
- (b) it shall endeavor to reach a unanimous decision: if this proves impossible the applicable decision shall be made by a majority of the Members, who may require the minority Member to prepare a written report for submission to the Employer and the Contractor; and
- (c) if a Member fails to attend a meeting or hearing, or to fulfil any required function, the other two Members may nevertheless proceed to make a decision, unless:
 - (i) either the Employer or the Contractor does not agree that they do so, or
 - (ii) the absent Member is the chairman and he/she instructs the other Members to not make a decision.

APPENDIX B

Fraud and Corruption

(Text in this Appendix shall not be modified)

1. Purpose

1.1 The Bank's Integrity Framework and this annex apply with respect to procurement under Bank Investment Project Financing operations.

2. Requirements

2.3 The Bank requires that Borrowers (including beneficiaries of Bank financing); bidders (applicants), consultants, contractors and suppliers; any sub-contractors, sub-consultants, service providers or suppliers; any agents (whether declared or not); and any of their personnel, observe the highest standard of ethics during the procurement process, selection and contract execution of Bank-financed contracts, and refrain from Fraud and Corruption.

2.4 To this end, the Bank:

- a. Defines, for the purposes of this provision, the terms set forth below as follows:
 - i. "corrupt practice" is the offering, giving, receiving, or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;
 - ii. "fraudulent practice" is any act or omission, including misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain financial or other benefit or to avoid an obligation;
 - iii. "collusive practice" is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;
 - iv. "coercive practice" is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
 - v. "obstructive practice" is:
 - (a) deliberately destroying, falsifying, altering, or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive, or collusive practice; and/or threatening, harassing, or intimidating any party to

prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or

- (b) acts intended to materially impede the exercise of the Bank's inspection and audit rights provided for under paragraph 2.2 e. below.
- b. Rejects a proposal for award if the Bank determines that the firm or individual recommended for award, any of its personnel, or its agents, or its sub-consultants, sub-contractors, service providers, suppliers and/ or their employees, has, directly or indirectly, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices in competing for the contract in question;
- c. In addition to the legal remedies set out in the relevant Legal Agreement, may take other appropriate actions, including declaring misprocurement, if the Bank determines at any time that representatives of the Borrower or of a recipient of any part of the proceeds of the loan engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices during the procurement process, selection and/or execution of the contract in question, without the Borrower having taken timely and appropriate action satisfactory to the Bank to address such practices when they occur, including by failing to inform the Bank in a timely manner at the time they knew of the practices;
- d. Pursuant to the Bank's Integrity Framework and in accordance with the Bank's prevailing sanctions policies and procedures, may sanction a firm or individual, either indefinitely or for a stated period of time, including by publicly declaring such firm or individual ineligible (i) to be awarded or otherwise benefit from a Bank-financed contract, financially or in any other manner;¹ (ii) to be a nominated² sub-contractor, consultant, manufacturer or supplier, or service provider of an otherwise eligible firm being awarded a Bank-financed contract; and (iii) to receive the proceeds of any loan made by the Bank or otherwise to participate further in the preparation or implementation of any Bank-financed project;
- e. Requires that a clause be included in bidding documents and in contracts financed by a Bank loan, requiring (i) bidders (applicants), consultants,

¹ For the avoidance of doubt, a sanctioned party's ineligibility to be awarded a contract shall include, without limitation, (i) applying for pre-qualification, expressing interest in a consultancy, and bidding, either directly or as a nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider, in respect of such contract, and (ii) entering into an addendum or amendment introducing a material modification to any existing contract.

² A nominated sub-contractor, nominated consultant, nominated manufacturer or supplier, or nominated service provider (different names are used depending on the particular bidding document) is one which has been: (i) included by the bidder in its pre-qualification application or bid because it brings specific and critical experience and know-how that allow the bidder to meet the qualification requirements for the particular bid; or (ii) appointed by the Borrower.

contractors, and suppliers, and their sub-contractors, sub-consultants, service providers, suppliers, agents personnel, permit the Bank to inspect³ all accounts, records and other documents relating to the procurement process, selection and/or contract execution, and to have them audited by auditors appointed by the Bank.

³ Inspections in this context usually are investigative (i.e., forensic) in nature. They involve fact-finding activities undertaken by the Bank or persons appointed by the Bank to address specific matters related to investigations/audits, such as evaluating the veracity of an allegation of possible Fraud and Corruption, through the appropriate mechanisms. Such activity includes but is not limited to: accessing and examining a firm's or individual's financial records and information, and making copies thereof as relevant; accessing and examining any other documents, data and information (whether in hard copy or electronic format) deemed relevant for the investigation/audit, and making copies thereof as relevant; interviewing staff and other relevant individuals; performing physical inspections and site visits; and obtaining third party verification of information.

APPENDIX C

Metrics for Progress Reports- Environmental and Social (ES)

[Note to Employer: the following metrics is taken from large Work's Standard Procurement Documents (SPDs). This should be suitably amended to reflect the specifics of the Contract. The Employer shall ensure that the metrics provided are appropriate for Plant and impacts/key issues identified in the environmental and social assessment].

Metrics for regular reporting:

- a. *environmental incidents or non-compliances with contract requirements, including contamination, pollution or damage to ground or water supplies;*
- b. *health and safety incidents, accidents, injuries that require treatment and all fatalities;*
- c. *interactions with regulators: identify agency, dates, subjects, outcomes (report the negative if none);*
- d. *status of all permits and agreements:*
 - (i) *work permits: number required, number received, actions taken for those not received;*
 - (ii) *status of permits and consents:*
 - *list areas/facilities with permits required (quarries, asphalt & batch plants), dates of application, dates issued (actions to follow up if not issued), dates submitted to resident engineer (or equivalent), status of area (waiting for permits, working, abandoned without reclamation, decommissioning plan being implemented, etc.);*
 - *list areas with landowner agreements required (borrow and spoil areas, camp sites), dates of agreements, dates submitted to resident engineer (or equivalent);*
 - *identify major activities undertaken in each area in the reporting period and highlights of environmental and social protection (land clearing, boundary marking, topsoil salvage, traffic management, decommissioning planning, decommissioning implementation);*

- for quarries: status of relocation and compensation (completed, or details of activities and current status in the reporting period).
- e. *health and safety supervision:*
- (i) safety officer: number days worked, number of full inspections & partial inspections, reports to construction/project management;
 - (ii) number of workers, work hours, metric of PPE use (percentage of workers with full personal protection equipment (PPE), partial, etc.), worker violations observed (by type of violation, PPE or otherwise), warnings given, repeat warnings given, follow-up actions taken (if any);
- f. *worker accommodations:*
- (i) number of expats housed in accommodations, number of locals;
 - (ii) date of last inspection, and highlights of inspection including status of accommodations' compliance with national and local law and good practice, including sanitation, space, etc.;
 - (iii) actions taken to recommend/require improved conditions, or to improve conditions.
- g. *Health services: provider of health services, information and/or training, location of clinic, number of non-safety disease or illness treatments and diagnoses (no names to be provided);*
- h. *gender (for expats and locals separately): number of female workers, percentage of workforce, gender issues raised and dealt with (cross-reference grievances or other sections as needed);*
- i. *training:*
- (i) number of new workers, number receiving induction training, dates of induction training;
 - (ii) number and dates of toolbox talks, number of workers receiving Occupational Health and Safety (OHS), environmental and social training;
 - (iii) number and dates of communicable diseases (including STDs) sensitization and/or training, no. workers receiving training (in the reporting period and in the past); same questions for gender sensitization, flag person training.
 - (iv) number and date of SEA prevention and SH sensitization and/or training events, including number of workers receiving training on Code

- of Conduct for Contractor's and Subcontractor's Personnel (in the reporting period and in the past), etc.
- j. environmental and social supervision:*
- (i) environmentalist: days worked, areas inspected and numbers of inspections of each (road section, work camp, accommodations, quarries, borrow areas, spoil areas, swamps, forest crossings, etc.), highlights of activities/findings (including violations of environmental and/or social best practices, actions taken), reports to environmental and/or social specialist/construction/site management;
 - (ii) sociologist: days worked, number of partial and full site inspections (by area: road section, work camp, accommodations, quarries, borrow areas, spoil areas, clinic, HIV/AIDS centre, community centres, etc.), highlights of activities (including violations of environmental and/or social requirements observed, actions taken), reports to environmental and/or social specialist/construction/site management; and
 - (iii) community liaison person(s): days worked (hours community centre open), number of people met, highlights of activities (issues raised, etc.), reports to environmental and/or social specialist /construction/site management.
- k. Grievances: list new grievances (e.g. number of allegations of SEA and SH) received in the reporting period and number of unresolved past grievances by date received, complainant's age and sex, how received, to whom referred to for action, resolution and date (if completed), data resolution reported to complainant, any required follow-up (Cross-reference other sections as needed):*
- (i) Worker grievances;
 - (ii) Community grievances
- l. Traffic, road safety and vehicles/equipment:*
- (i) traffic and road safety incidents and accidents involving project vehicles & equipment: provide date, location, damage, cause, follow-up;
 - (ii) traffic and road safety incidents and accidents involving non-project vehicles or property (also reported under immediate metrics): provide date, location, damage, cause, follow-up;

- (iii) overall condition of vehicles/equipment (subjective judgment by environmentalist); non-routine repairs and maintenance needed to improve safety and/or environmental performance (to control smoke, etc.).

m. Environmental mitigations and issues (what has been done):

- (i) dust: number of working bowzers, number of waterings/day, number of complaints, warnings given by environmentalist, actions taken to resolve; highlights of quarry dust control (covers, sprays, operational status); % of rock/ spoil lorries with covers, actions taken for uncovered vehicles;
- (ii) erosion control: controls implemented by location, status of water crossings, environmentalist inspections and results, actions taken to resolve issues, emergency repairs needed to control erosion/sedimentation;
- (iii) quarries, borrow areas, spoil areas, asphalt plants, batch plants: identify major activities undertaken in the reporting period at each, and highlights of environmental and social protection: land clearing, boundary marking, topsoil salvage, traffic management, decommissioning planning, decommissioning implementation;
- (iv) blasting: number of blasts (and locations), status of implementation of blasting plan (including notices, evacuations, etc.), incidents of off-site damage or complaints (cross-reference other sections as needed);
- (v) spill clean-ups, if any: material spilled, location, amount, actions taken, material disposal (report all spills that result in water or soil contamination);
- (vi) waste management: types and quantities generated and managed, including amount taken offsite (and by whom) or reused/recycled/disposed on-site;
- (vii) details of tree plantings and other mitigations required undertaken in the reporting period;
- (viii) details of water and swamp protection mitigations required undertaken in the reporting period.

n. compliance:

- (i) compliance status for conditions of all relevant consents/permits, for the Work, including quarries, etc.): statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance;

- (ii) compliance status of C-ESMP/ESIP requirements: statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance
- (iii) compliance status of SEA and SH prevention and response action plan: statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance
- (iv) compliance status of Health and Safety Management Plan re: statement of compliance or listing of issues and actions taken (or to be taken) to reach compliance
- (v) other unresolved issues from previous reporting periods related to environmental and social: continued violations, continued failure of equipment, continued lack of vehicle covers, spills not dealt with, continued compensation or blasting issues, etc. Cross-reference other sections as needed.

APPENDIX D

Section V - Eligible Countries

Eligibility for the Provision of Goods, Works and Non-Consulting Services in Bank-Financed Procurement

A. Provisions under Section 5 "Eligibility" of the Procurement Policy for Bank Group Funded Operations and Chapter A2 of the Operations Procurement Manual under Procurement Framework of the African Development Bank

The African Development Fund (ADF) permits firms and individuals from all countries to offer goods, works and services for ADF funded projects. However, the proceeds of any Financing undertaken in the operations of the African Development Bank (ADB) and the Nigeria Trust Fund (NTF) shall be used for procurement of goods and works, including the related services, provided by bidders from Eligible⁴ Countries⁵. Any conditions for participation shall be limited to those that are essential to ensure the firm's capability to fulfill the contract in question. In the case of ADB and NTF, bidders from non-Member Countries offering goods, works and related services (including transportation and insurance) are not eligible even if they offer these from Eligible Member Countries. Any waiver to this rule will be in accordance with the Articles 17(1) (d) of the Agreement Establishing the African Development Bank and 4.1 of the Agreement Establishing the Nigeria Trust Fund.

B. Rules and Procedures for Procurement of Goods and Works

Overview

1. The eligibility criteria for participation in the supply of goods, works and related services, to be procured through the ADB and NTF Financing, derive from the requirements of the Agreement Establishing the African Development Bank, Article 17.1.d, and the Agreement Establishing the Nigeria Trust Fund, Article 4.1. The foregoing requirements basically prescribe two types of eligibility criteria:
 - (a) The eligibility of the bidder;
 - (b) The eligibility of the goods, works and related services.

⁴ Refer to Bank Procurement Framework for additional information on Eligibility.

⁵ "Eligible Countries" shall mean: (a) in the case of the African Development Bank and the Nigeria trust Fund, the Member Countries of the African Development Bank; and (b) in the case of the African Development Fund, any country.

Eligibility of the Bidder

2. The eligibility of the bidder shall be based on nationality, in accordance with the following rules:
 - (a) Natural Persons: A natural person is eligible if he or she is a national of a Member Country of the Bank, or a State Participant of the Fund. Where a person has more than one nationality, such a person shall be eligible if the nationality indicated in his or her bid is that of a Member Country of the Bank, or a State Participant of the Fund.
 - (b) Corporations: A corporation is eligible if it satisfies the following criteria:
 1. it is incorporated in a country that is a Member of the Bank, or State Participant of the Fund;
 2. it is a national of a country that is a Member of the Bank, or State Participant of the Fund, as determined by the law of its place of incorporation;
 3. it has its principal place of business in a country that is a Member of the Bank, or State Participant of the Fund.
 - (c) Joint Ventures and Associations: An unincorporated joint venture, partnership, or association, shall be eligible if more than 50% of the value of its works and/or services is executed by its members satisfying the eligibility requirements for individuals or corporations.

Eligibility of the Goods, Works and Related Services

3. In order to be eligible, the goods to be procured must have been mined, grown, or produced, in the form in which they are purchased, in an Eligible Member Country.
4. For works contracts, which may include civil works, plant construction, or turnkey contracts, the contractor must satisfy the nationality criteria of eligibility, either as a natural person, or corporation, or joint venture and association. Labour, equipment, and materials needed for carrying out the works contract, shall be supplied from Eligible Member Countries.
5. For contracts, which have been awarded on the basis of Cost, Insurance and Freight (CIF), or Carriage and Insurance Paid (CIP), bidders shall be free to arrange for ocean and other transportation, and the related insurance, from any Eligible Member Country. On the other hand, where goods are shipped on FOB basis, and the Bank has agreed to finance transportation and insurance separately, which are

arranged by the purchaser, under a separate contract, the Bank shall be satisfied that the services are supplied from Eligible Member Countries.

List of Eligible Countries

6. List of Eligible countries can be found in African Development Bank's website: <https://www.afdb.org/en/about-us/corporate-information/members/>

Ineligible Countries in reference to ITB 4.8 and ITB 5.1

7. In reference to ITB 4.8 and ITB 5.1, for the information of the Bidders, at the present time firms, goods and services from the following countries are excluded from this Bidding process:

Under ITB 4.8(a) and ITB 5.1: *[insert a list of the countries following approval by the Bank to apply the restriction or state "none"]*.

Under ITB 4.8(b) and ITB 5.1: *[insert a list of the countries following approval by the Bank to apply the restriction or state "none"]*

Section IX - Particular Conditions of Contract

The following Particular Conditions of Contract shall supplement the General Conditions of Contract in Section VIII. Whenever there is a conflict, the provisions herein shall prevail over those in the General Conditions.

Particular Conditions of Contract (PCC)

The following Particular Conditions (PCC) shall supplement the General Conditions (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC. The clause number of the PCC is the corresponding clause number of the GCC.

PCC 1. Definitions	<p>The Employer is: Rural Electrification Agency</p> <p>The Project Manager is: Tractebel Engineering GmbH & O.T Otis Engineering Limited (JV)</p> <p>The Bank is: African Development Bank</p> <p>Country of Origin: all countries and territories as indicated in Section V of the bidding document, Eligible Countries.</p>
PCC 5. Law and Language	<p>PCC 5.1 The Contract shall be interpreted in accordance with the laws of: Federal Republic of Nigeria.</p> <p>PCC 5.2 The ruling language is: English</p> <p>PCC 5.3 The language for communications is: English</p>
PCC 7. Scope of Facilities [Spare Parts] (GCC Clause 7)	<p>PCC 7.3 The Contractor agrees to supply spare parts for a period of years: One (1) year</p> <p>Sample Addition to PCC 7.3</p> <p>The Contractor shall carry sufficient inventories to ensure an ex-stock supply of consumable spares for the Plant. Other spare parts and components shall be supplied as promptly as possible, but at the most within six (6) months of placing the order and opening the letter of credit. In addition, in the event of termination of the production of spare parts, advance notification will be made to the Employer of the pending termination, with sufficient time to permit the Employer to procure the needed requirement. Following such termination, the Contractor will furnish to the extent possible and at no cost to the Employer the blueprints, drawings and specifications of the spare parts, if requested.</p>
PCC 8. Time for Commencement and Completion	<p>PCC 8.1 The Contractor shall commence work on the Facilities within Three (3) months from the Effective Date for determining Time for Completion as specified in the Contract Agreement.</p>

PCC 8.2 The Time for Completion of the whole of the Facilities shall be (see table below) from the Effective Date as described in the Contract Agreement.

LOT	LOT NUMBER	Location	Estimated Contract Completion Duration (Months)	
			Construction	Operations & maintenance
1	AfDB-NEP/EEP-3/SHMG – 01	Modibbo Adama University of Technology, Yola, Adamawa State	12	12
2	AfDB-NEP/EEP-3/SHMG – 02	Federal University of Dutsin-Ma, Katsina State	12	12
3	AfDB-NEP/EEP-3/SHMG – 03	Federal University of Lafia, Nasarawa State	12	12
4	AfDB-NEP/EEP-3/SHMG – 04	Federal University of Lokoja, Kogi State	12	12
5	AfDB-NEP/EEP-3/SHMG – 05	Federal University of Technology Owerri, Imo State	12	12
6	AfDB-NEP/EEP-3/SHMG – 06	University of Port Harcourt and the Teaching Hospital, Rivers State	12	12
7	AfDB-NEP/EEP-3/SHMG – 07	Federal University of Uyo, Akwa Ibom State	12	12

	8	AfDB-NEP/EEP-3/SHMG – 08	Federal University of Technology Akure, Ondo State	12	12
PCC 9. Contractor's Responsibilities	PCC 9.6 (d) Maximum number of members in the JV: Modify as below: Maximum number of members in the Joint Venture, Consortium or Association (JV) shall not exceed Three (3)				
PCC 9. Contractor's Responsibilities	PCC 9.6 (e) Minimum share of a member of Joint Venture, Consortium or Association (JV) in the contract shall not be less than 25% percent of the total value of the contract.				
PCC 9. Contractor's Responsibilities	PCC 9.8 The following sustainable procurement contractual provisions apply: Not Applicable				
PCC 11. Contract Price	PCC 11.2 The Contract Price shall be adjusted in accordance with the provisions of the Appendix to the Contract Agreement titled Adjustment Clause.				
PCC 13. Securities	<p>PCC 13.3.1 The amount of Performance Security, as a percentage of the Contract Price for the Facility or for the part of the Facility for which a separate Time for Completion is provided, shall be: 10%</p> <p>PCC 13.3.2 The Performance Security shall be in the form of the Bank Guarantee attached hereto in Section X, Contract Forms.</p> <p>PCC 13.3.3 The Performance Security shall not be reduced on the date of the Operational Acceptance.</p> <p>PCC 13.3.3 The Performance Security shall be reduced to ten percent (10%) of the value of the component covered by the extended defect liability to cover the Contractor's extended defect liability in accordance with the provision in the PCC, pursuant to GCC Sub-Clause 27.10.</p>				
PCC 22 Installation	<p>PCC 22.2.5 Working Hours Normal working hours are: 8.00am to 6.00pm per day, Monday to Friday</p> <p>PCC 22.2.8 Funeral Arrangements: Contractor shall be responsible</p>				

PCC 25. Commissioning and Operational Acceptance	PCC 25.2.2 The Guarantee Test of the Facilities shall be successfully completed within Twenty-One (21) days from the date of Completion.
PCC 26. Completion Time Guarantee	<p>PCC 26.2</p> <p>Applicable rate for liquidated damages: 0.05% per day of delay in completion</p> <p>The above rate applies to the price of the part of the Facilities, as quoted in the Price Schedule, for that part for which the Contractor fails to achieve Completion within the particular Time for Completion.</p> <p>Maximum deduction for liquidated damages: 10% of Contract Price</p> <p>PCC 26.3 No bonus will be given for earlier Completion of the Facilities or part thereof.</p>
PCC 27. Defect Liability	<p>PCC 27.10 The critical components covered under the extended defect liability are:</p> <ul style="list-style-type: none"> • PV Panels • Power Conversion System (PCS) & PV Inverter • Energy Storage System (ESS) • Diesel Generators • Power Transformers, <p>and the period shall be 365 days.</p>
PCC 30. Limitation of Liability	<p>Sample Clause</p> <p>PCC 30.1 (b) The multiplier of the Contract Price is: 1.1</p>
PCC 39. Value Engineering	PCC 39.1.2 If the value engineering proposal is approved by the Employer the amount to be paid to the Contractor shall be 30% . The percentage is normally up to 50%) of the reduction in the Contract Price
PCC46. Disputes and Arbitration	<p>CC 46.1 The DB shall be appointed within 60 days after signature by both parties of the Contract Agreement PCC 46.1</p> <p>The DB shall be: Composed of Three (3) members</p> <p>PCC 46.1 List of potential DB members:</p>

	<p>One representative each of the Employer and the Contractor as well as a jointly appointed member</p> <p>PCC 46.2 Appointment (if not agreed) to be made by: International Chamber of Commerce</p> <p>PCC 46.5 Procedure to settle disputes in respect of DB's decisions: Rules of Arbitration of International Chamber of Commerce</p> <p>Rules of arbitration</p> <p>GCC Sub-Clause 46.5(a) "shall" apply.</p>
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Section X - Contract Forms

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Notification of Intention to Award

[This Notification of Intention to Award shall be sent to each Bidder that submitted a Bid.]

[Send this Notification to the Bidder's Authorized Representative named in the Bidder Information Form]

For the attention of Bidder's Authorized Representative

Name: *[insert Authorized Representative's name]*

Address: *[insert Authorized Representative's Address]*

Telephone/Fax numbers: *[insert Authorized Representative's telephone/fax numbers]*

Email Address: *[insert Authorized Representative's email address]*

[IMPORTANT: insert the date that this Notification is transmitted to Bidders. The Notification must be sent to all Bidders simultaneously. This means on the same date and as close to the same time as possible.]

DATE OF TRANSMISSION: This Notification is sent by: *[email/fax]* on *[date]* (local time)

Notification of Intention to Award

Employer: *[insert the name of the Employer]*

Project: *[insert name of project]*

Contract title: *[insert the name of the contract]*

Country: *[insert country where IFB is issued]*

Loan No. /Credit No. / Grant No.: *[insert reference number for loan/credit/grant]*

OCBI No: *[insert OCBI reference number from Procurement Plan]*

This Notification of Intention to Award (Notification) notifies you of our decision to award the above contract. The transmission of this Notification begins the Standstill Period. During the Standstill Period, you may:

- a) request a debriefing in relation to the evaluation of your Bid, and/or
- b) submit a Procurement-related Complaint in relation to the decision to award the contract.

1. The successful Bidder

Name:	<i>[insert name of successful Bidder]</i>
Address:	<i>[insert address of the successful Bidder]</i>
Contract price:	<i>[insert contract price of the successful Bid]</i>

2. Other Bidders *[INSTRUCTIONS: insert names of all Bidders that submitted a Bid. If the Bid's price was evaluated include the evaluated price as well as the Bid price as read out.]*

Name of Bidder	Bid price	Evaluated Bid Cost
<i>[insert name]</i>	<i>[insert Bid price]</i>	<i>[insert evaluated cost]</i>
<i>[insert name]</i>	<i>[insert Bid price]</i>	<i>[insert evaluated cost]</i>
<i>[insert name]</i>	<i>[insert Bid price]</i>	<i>[insert evaluated cost]</i>
<i>[insert name]</i>	<i>[insert Bid price]</i>	<i>[insert evaluated cost]</i>
<i>[insert name]</i>	<i>[insert Bid price]</i>	<i>[insert evaluated cost]</i>

3. Reason/s why your Bid was unsuccessful

[INSTRUCTIONS: State the reason/s why this Bidder's Bid was unsuccessful. Do NOT include: (a) a point by point comparison with another Bidder's Bid or (b) information that is marked confidential by the Bidder in its Bid.]

4. How to request a debriefing

DEADLINE: The deadline to request a debriefing expires at midnight on *[insert date]* (local time).

You may request a debriefing in relation to the results of the evaluation of your Bid. If you decide to request a debriefing, your written request must be made within three (3) Business Days of receipt of this Notification of Intention to Award.

Provide the contract name, reference number, name of the Bidder, contact details; and address the request for debriefing as follows:

Attention: *[insert full name of person, if applicable]*

Title/position: *[insert title/position]*

Agency: *[insert name of Employer]*

Email address: *[insert email address]*

Fax number: *[insert fax number] delete if not used*

If your request for a debriefing is received within the 3 Business Days deadline, we will provide the debriefing within five (5) Business Days of receipt of your request. If we are unable to provide the debriefing within this period, the Standstill Period shall be extended by five (5) Business Days after the date that the debriefing is provided. If this happens, we will notify you and confirm the date that the extended Standstill Period will end.

The debriefing may be in writing, by phone, video conference call or in person. We shall promptly advise you in writing how the debriefing will take place and confirm the date and time.

If the deadline to request a debriefing has expired, you may still request a debriefing. In this case, we will provide the debriefing as soon as practicable, and normally no later than fifteen (15) Business Days from the date of publication of the Contract Award Notice.

5. How to make a complaint

Period: Procurement-related Complaint challenging the decision to award shall be submitted by midnight, *[insert date]* (local time).

Provide the contract name, reference number, name of the Bidder, contact details; and address the Procurement-related Complaint as follows:

Attention: *[insert full name of person, if applicable]*

Title/position: *[insert title/position]*

Agency: *[insert name of Employer]*

Email address: *[insert email address]*

Fax number: *[insert fax number] delete if not used*

At this point in the procurement process, you may submit a Procurement-related Complaint challenging the decision to award the contract. You do not need to have requested, or received, a debriefing before making this complaint. Your

complaint must be submitted within the Standstill Period and received by us before the Standstill Period ends.

Further information:

For more information see Part B of the Operations Procurement Manual.

Framework

In summary, there are four essential requirements:

1. You must be an 'interested party'. In this case, that means a Bidder who submitted a Bid in this bidding process, and is the recipient of a Notification of Intention to Award.
2. The complaint can only challenge the decision to award the contract.
3. You must submit the complaint within the period stated above.
4. You must include, in your complaint, all necessary information.

6. Standstill Period

DEADLINE: The Standstill Period is due to end at midnight on *[insert date]* (local time).

The Standstill Period lasts ten (10) Business Days after the date of transmission of this Notification of Intention to Award.

The Standstill Period may be extended as stated in Section 4 above.

If you have any questions regarding this Notification please do not hesitate to contact us.

On behalf of the Employer:

Signature: _____

Name: _____

Title/position: _____

Telephone: _____

Email: _____

Beneficial Ownership Disclosure Form

INSTRUCTIONS TO BIDDERS: DELETE THIS BOX ONCE YOU HAVE COMPLETED THE FORM

This Beneficial Ownership Disclosure Form (“Form”) is to be completed by the successful Bidder. In case of joint venture, the Bidder must submit a separate Form for each member. The beneficial ownership information to be submitted in this Form shall be current as of the date of its submission.

For the purposes of this Form, a Beneficial Owner of a Bidder is any natural person who ultimately owns or controls the Bidder by meeting one or more of the following conditions:

- directly or indirectly holding 25% or more of the shares*
- directly or indirectly holding 25% or more of the voting rights*
- directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder*

OCBI No.: *[insert number of OCBI number as per procurement plan]*

Invitation for Bid No.: *[insert identification]*

To: *[insert complete name of Employer]*

In response to your request in the Letter of Acceptance dated *[insert date of letter of Acceptance]* to furnish additional information on beneficial ownership: *[select one option as applicable and delete the options that are not applicable]*

(i) we hereby provide the following beneficial ownership information.

Details of beneficial ownership

Identity of Beneficial Owner	Directly or indirectly holding 25% or more of the shares	Directly or indirectly holding 25 % or more of the Voting Rights	Directly or indirectly having the right to appoint a majority
------------------------------	--	--	---

	(Yes / No)	(Yes / No)	of the board of the directors or an equivalent governing body of the Bidder (Yes / No)
<i>[include full name (last, middle, first), nationality, country of residence]</i>			

OR

(ii) We declare that there is no Beneficial Owner meeting one or more of the following conditions:

- directly or indirectly holding 25% or more of the shares
- directly or indirectly holding 25% or more of the voting rights
- directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder

OR

(iii) We declare that we are unable to identify any Beneficial Owner meeting one or more of the following conditions. *[If this option is selected, the Bidder shall provide explanation on why it is unable to identify any Beneficial Owner]*

- directly or indirectly holding 25% or more of the shares
- directly or indirectly holding 25% or more of the voting rights
- directly or indirectly having the right to appoint a majority of the board of directors or equivalent governing body of the Bidder]"

Name of the Bidder: **[insert complete name of the Bidder]*_____

Name of the person duly authorized to sign the Bid on behalf of the Bidder: *******[insert complete name of person duly authorized to sign the Bid]*_____

Title of the person signing the Bid: *[insert complete title of the person signing the Bid]*_____

Signature of the person named above: *[insert signature of person whose name and capacity are shown above]*_____

Date signed *[insert date of signing]* day of *[insert month]*, *[insert year]*_____

* In the case of the Bid submitted by a Joint Venture specify the name of the Joint Venture as Bidder. In the event that the Bidder is a joint venture, each reference to "Bidder" in the Beneficial Ownership Disclosure Form (including this Introduction thereto) shall be read to refer to the joint venture member.

** Person signing the Bid shall have the power of attorney given by the Bidder. The power of attorney shall be attached with the Bid Schedules.

Letter of Acceptance

To: _____

This is to notify you that your Bid dated _____ for execution of the _____ for the Contract Price in the aggregate of _____, as corrected and modified in accordance with the Instructions to Bidders is hereby accepted by our Agency.

You are requested to furnish (i) the Performance Security within 28 days in accordance with the Conditions of Contract, using for that purpose one of the Performance Security Forms and (ii) the additional information on beneficial ownership in accordance with BDS ITB 47.1, within eight (8) Business days using the Beneficial Ownership Disclosure Form, included in Section X, - Contract Forms, of the bidding document.

Authorized Signature: _____

Name and Title of Signatory: _____

Name of Agency: _____

Attachment: Contract Agreement

Contract Agreement

THIS AGREEMENT is made the _____ day of _____, _____,

BETWEEN

(1) _____, a corporation incorporated under the laws of _____ and having its principal place of business at _____ (hereinafter called "the Employer"), and (2) _____, a corporation incorporated under the laws of _____ and having its principal place of business at _____ (hereinafter called "the Contractor").

WHEREAS the Employer desires to engage the Contractor to design, manufacture, test, deliver, install, complete and commission certain Facilities, viz. _____ ("the Facilities"), and the Contractor has agreed to such engagement upon and subject to the terms and conditions hereinafter appearing.

NOW IT IS HEREBY AGREED as follows:

Article 1. Contract Documents

1.1 Contract Documents (Reference GCC Clause 2)

The following documents shall constitute the Contract between the Employer and the Contractor, and each shall be read and construed as an integral part of the Contract:

- (a) This Contract Agreement and the Appendices hereto
- (b) Letter of Bid and Price Schedules submitted by the Contractor
- (c) Particular Conditions
- (d) General Conditions
- (e) Specification
- (f) Drawings
- (g) Other completed Bidding forms submitted with the Bid

- (h) Any other documents forming part of the Employer's Requirements
- (i) Any other documents forming part of the contract, including, but not limited to:
 - i. the ES Management Strategies and Implementation Plans; and
 - ii. Code of Conduct for Contractor's Personnel (ES).

[Any other documents shall be added here]

1.2 Order of Precedence (Reference GCC Clause 2)

In the event of any ambiguity or conflict between the Contract Documents listed above, the order of precedence shall be the order in which the Contract Documents are listed in Article 1.1 (Contract Documents) above.

1.3 Definitions (Reference GCC Clause 1)

Capitalized words and phrases used herein shall have the same meanings as are ascribed to them in the General Conditions.

Article 2. Contract Price and Terms of Payment

2.1 Contract Price (Reference GCC Clause 11)

The Employer hereby agrees to pay to the Contractor the Contract Price in consideration of the performance by the Contractor of its obligations hereunder. The Contract Price shall be the aggregate of: _____, _____ as specified in Price Schedule No. 5 (Grand Summary), and _____, _____, or such other sums as may be determined in accordance with the terms and conditions of the Contract.

2.2 Terms of Payment (Reference GCC Clause 12)

The terms and procedures of payment according to which the Employer will reimburse the Contractor are given in the Appendix (Terms and Procedures of Payment) hereto.

The Employer may instruct its bank to issue an irrevocable confirmed documentary credit made available to the

Contractor in a bank in the country of the Contractor. The credit shall be for an amount of _____; and shall be subject to the Uniform Customs and Practice for Documentary Credits 2007 Revision, ICC Publication No. 600.

In the event that the amount payable under Schedule No. 1 is adjusted in accordance with GCC 11.2 or with any of the other terms of the Contract, the Employer shall arrange for the documentary credit to be amended accordingly.

Article 3. Effective Date

3.1 Effective Date (Reference GCC Clause 1)

The Effective Date from which the Time for Completion of the Facilities shall be counted is the date when all of the following conditions have been fulfilled:

- (a) This Contract Agreement has been duly executed for and on behalf of the Employer and the Contractor;
- (b) The Contractor has submitted to the Employer the Performance Security and the advance payment guarantee;
- (c) The Employer has paid the Contractor the advance payment
- (d) The Contractor has been advised that the documentary credit referred to in Article 2.2 above has been issued in its favor.

Each party shall use its best efforts to fulfill the above conditions for which it is responsible as soon as practicable.

- 3.2 If the conditions listed under 3.1 are not fulfilled within two (2) months from the date of this Contract notification because of reasons not attributable to the Contractor, the Parties shall discuss and agree on an equitable adjustment to the Contract Price and the Time for Completion and/or other relevant conditions of the Contract.

Article 4. Communications

- 4.1 The address of the Employer for notice purposes, pursuant to GCC 4.1 is: _____.

**Article 5.
Appendices**

- 4.2 The address of the Contractor for notice purposes, pursuant to GCC 4.1 is: _____.
- 5.1 The Appendices listed in the attached List of Appendices shall be deemed to form an integral part of this Contract Agreement.
- 5.2 Reference in the Contract to any Appendix shall mean the Appendices attached hereto, and the Contract shall be read and construed accordingly.

IN WITNESS WHEREOF the Employer and the Contractor have caused this Agreement to be duly executed by their duly authorized representatives the day and year first above written.

Signed by, for and on behalf of the Employer

[Signature]

[Title]

in the presence of _____

Signed by, for and on behalf of the Contractor

[Signature]

[Title]

in the presence of _____

APPENDICES

- Appendix 1 Terms and Procedures of Payment
- Appendix 2 Price Adjustment
- Appendix 3 Insurance Requirements
- Appendix 4 Time Schedule
- Appendix 5 List of Major Items of Plant and Installation Services and List of Approved Subcontractors
- Appendix 6 Scope of Works and Supply by the Employer
- Appendix 7 List of Documents for Approval or Review
- Appendix 8 Functional Guarantees

Appendix 1. Terms and Procedures of Payment

In accordance with the provisions of GCC Clause 12 (Terms of Payment), the Employer shall pay the Contractor in the following manner and at the following times, on the basis of the Price Breakdown given in the section on Price Schedules. Payments will be made in the currencies quoted by the Bidder unless otherwise agreed between the Parties. Applications for payment in respect of part deliveries may be made by the Contractor as work proceeds.

TERMS OF PAYMENT

Schedule No. 1. Plant and Equipment Supplied from Abroad

In respect of plant and equipment supplied from abroad, the following payments shall be made:

Ten percent (10%) of the total CIP amount as an advance payment against receipt of invoice and an irrevocable advance payment security for the equivalent amount made out in favor of the Employer. The advance payment security may be reduced in proportion to the value of the plant and equipment delivered to the site, as evidenced by shipping and delivery documents.

Eighty percent (80%) of the total or pro rata CIP amount upon Incoterm "CIP", upon delivery to the carrier within forty-five (45) days after receipt of documents.

Five percent (5%) of the total or pro rata CIP amount upon issue of the Completion Certificate, within forty-five (45) days after receipt of invoice.

Five percent (5%) of the total or pro rata CIP amount upon issue of the Operational Acceptance Certificate, within forty-five (45) days after receipt of invoice.

Schedule No. 2. Plant and Equipment Supplied from within the Employer's Country

In respect of plant and equipment supplied from within the Employer's Country, the following payments shall be made:

Ten percent (10%) of the total EXW amount as an advance payment against receipt of invoice, and an irrevocable advance payment security for the equivalent amount made out in favor of the Employer. The advance payment security may be reduced in proportion to the value of the plant and equipment delivered to the site, as evidenced by shipping and delivery documents.

Eighty percent (80%) of the total or pro rata EXW amount upon Incoterm "Ex-Works," upon delivery to the carrier within forty-five (45) days after receipt of invoice and documents.

Five percent (5%) of the total or pro rata EXW amount upon issue of the Completion Certificate, within forty-five (45) days after receipt of invoice.

Five percent (5%) of the total or pro rata EXW amount upon issue of the Operational Acceptance Certificate, within forty-five (45) days after receipt of invoice.

Schedule No. 3. Design Services

In respect of design services for both the foreign currency and the local currency portions, the following payments shall be made:

Ten percent (10%) of the total design services amount as an advance payment against receipt of invoice, and an irrevocable advance payment security for the equivalent amount made out in favor of the Employer.

Ninety percent (90%) of the total or pro rata design services amount upon acceptance of design in accordance with GCC Clause 20 by the Project Manager within forty-five (45) days after receipt of invoice.

Schedule No. 4. Installation Services

In respect of installation services for both the foreign and local currency portions, the following payments shall be made:

Ten percent (10%) of the total installation services amount as an advance payment against receipt of invoice, and an irrevocable advance payment security for the equivalent amount made out in favor of the Employer. The advance payment security may be reduced in proportion to the value of work performed by the Contractor as evidenced by the invoices for installation services.

Eighty percent (80%) of the measured value of work performed by the Contractor, as identified in the said Program of Performance, during the preceding month, as evidenced by the Employer's authorization of the Contractor's application, will be made monthly within forty-five (45) days after receipt of invoice.

Five percent (5%) of the total or pro rata value of installation services performed by the Contractor as evidenced by the Employer's authorization of the Contractor's monthly applications, upon issue of the Completion Certificate, within forty-five (45) days after receipt of invoice.

Five percent (5%) of the total or pro rata value of installation services performed by the Contractor as evidenced by the Employer's authorization of the Contractor's monthly applications, upon issue of the Operational Acceptance Certificate, within forty-five (45) days after receipt of invoice.

In the event that the Employer fails to make any payment on its respective due date, the Employer shall pay to the Contractor interest on the amount of such delayed

payment at the rate of _____ percent (___%) per month for period of delay until payment has been made in full.

PAYMENT PROCEDURES

The procedures to be followed in applying for certification and making payments shall be as follows:

Appendix 2. Price Adjustment (Not Applicable)

Where the Contract Period (excluding the Defects Liability Period) exceeds eighteen (18) months, it is normal procedure that prices payable to the Contractor shall be subject to adjustment during the performance of the Contract to reflect changes occurring in the cost of labor and material components. In such cases the bidding document shall include in this Appendix 2 a formula of the following general type, pursuant to GCC Sub-Clause 11.2.

Where Contracts are of a shorter duration than eighteen (18) months or in cases where there is to be no Price Adjustment, the following provision shall not be included. Instead, it shall be indicated under this Appendix 2 that the prices are to remain firm and fixed for the duration of the Contract.

Sample Price Adjustment Formula

If in accordance with GCC 11.2, prices shall be adjustable, the following method shall be used to calculate the price adjustment:

Prices payable to the Contractor, in accordance with the Contract, shall be subject to adjustment during performance of the Contract to reflect changes in the cost of labor and material components, in accordance with the following formula:

$$P_1 = P_0 \left(a + b \frac{L_1}{L_0} + c \frac{M_1}{M_0} \right) - P_0$$

in which:

P_1 = adjustment amount payable to the Contractor

P_0 = Contract price (base price)

a = percentage of fixed element in Contract price ($a = \%$)

b = percentage of labor component in Contract price ($b = \%$)

c = percentage of material and equipment component in Contract price ($c = \%$)

L_0, L_1 = labor indices applicable to the appropriate industry in the country of origin on the base date and the date for adjustment, respectively

M_0, M_1 = material and equipment indices in the country of origin on the base date and the date for adjustment, respectively

N.B. $a+b+c = 100\%$.

Conditions Applicable To Price Adjustment

The Bidder shall indicate the source of labor and materials indices, source of exchange rates and the base date indices in its Bid.

<u>Item</u>	<u>Source of Indices Used</u>	<u>Base Date Indices</u>
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The base date shall be the date twenty-eight (28) days prior to the Bid closing date.

The date of adjustment shall be the mid-point of the period of manufacture or installation of component or Plant.

The following conditions shall apply:

- (a) No price increase will be allowed beyond the original delivery date unless covered by an extension of time awarded by the Employer under the terms of the Contract. No price increase will be allowed for periods of delay for which the Contractor is responsible. The Employer will, however, be entitled to any price decrease occurring during such periods of delay.

(b) If the currency in which the Contract price, P_0 , is expressed is different from the currency of the country of origin of the labor and/or materials indices, a correction factor will be applied to avoid incorrect adjustments of the Contract price. The correction factor shall be: Z_0 / Z_1 , where,

Z_0 = the number of units of currency of the origin of the indices which equal to one unit of the currency of the Contract Price P_0 on the Base date, and

Z_1 = the number of units of currency of the origin of the indices which equal to one unit of the currency of the Contract Price P_0 on the Date of Adjustment.

(c) No price adjustment shall be payable on the portion of the Contract price paid to the Contractor as an advance payment.

Appendix 3. Insurance Requirements

Insurances to be Taken Out by the Contractor

In accordance with the provisions of GCC Clause 34, the Contractor shall at its expense take out and maintain in effect, or cause to be taken out and maintained in effect, during the performance of the Contract, the insurances set forth below in the sums and with the deductibles and other conditions specified. The identity of the insurers and the form of the policies shall be subject to the approval of the Employer, such approval not to be unreasonably withheld.

(a) Cargo Insurance

Covering loss or damage occurring, while in transit from the supplier's or manufacturer's works or stores until arrival at the Site, to the Facilities (including spare parts therefor) and to the construction equipment to be provided by the Contractor or its Subcontractors.

<u>Amount</u>	<u>Deductible limits</u>	<u>Parties insured</u>	<u>From</u>	<u>To</u>
110% of DAP	USD 5,000	Employer/ Contractor	Warehouse/ storage	Storage at Project site

(b) Installation All Risks Insurance

Covering physical loss or damage to the Facilities at the Site, occurring prior to completion of the Facilities, with an extended maintenance coverage for the Contractor's liability in respect of any loss or damage occurring during the defect liability period while the Contractor is on the Site for the purpose of performing its obligations during the defect liability period.

<u>Amount</u>	<u>Deductible limits</u>	<u>Parties insured</u>	<u>From</u>	<u>To</u>
100% of contract price	USD 5,000	Employer/ Contractor	Commencement of work on Site	End of Defects Liability Period

(c) Third Party Liability Insurance

Covering bodily injury or death suffered by third parties (including the Employer's personnel) and loss of or damage to property (including the Employer's property and any parts of the Facilities that have been accepted by the Employer) occurring in connection with the supply and installation of the Facilities.

<u>Amount</u>	<u>Deductible limits</u>	<u>Parties insured</u>	<u>From</u>	<u>To</u>
1.5 Mio. EUR par case	N/A	Employer/ Contractor	Commencement of work on Site	End of Defects Liability Period

(d) Automobile Liability Insurance

Covering use of all vehicles used by the Contractor or its Subcontractors (whether or not owned by them) in connection with the supply and installation of the Facilities. Comprehensive insurance in accordance with statutory requirements.

(e) Workers' Compensation

In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

Insurance to be taken out in accordance with the laws of the project country

(f) Employer's Liability

In accordance with the statutory requirements applicable in any country where the Facilities or any part thereof is executed.

(g) Other Insurances

The Contractor is also required to take out and maintain at its own cost the following insurances:

Details:

Amount Deductible limits Parties insured From To

The Employer shall be named as co-insured under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Third Party Liability, Workers' Compensation and Employer's Liability Insurances, and the Contractor's Subcontractors shall be named as co-insureds under all insurance policies taken out by the Contractor pursuant to GCC Sub-Clause 34.1, except for the Cargo, Workers' Compensation and Employer's Liability Insurances. All insurer's rights of subrogation against such co-insureds for losses or claims arising out of the performance of the Contract shall be waived under such policies.

Insurances To Be Taken Out By The Employer
(Not Applicable)

The Employer shall at its expense take out and maintain in effect during the performance of the Contract the following insurances.

Details:

<u>Amount</u>	<u>Deductible limits</u>	<u>Parties insured</u>	<u>From</u>	<u>To</u>
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Appendix 4. Time Schedule

Appendix 5. List of Major Items of Plant and Installation Services and List of Approved Subcontractors

A list of major items of Plant and Installation Services is provided below.

The following Subcontractors and/or manufacturers are approved for carrying out the items of the Facilities indicated below. Where more than one Subcontractor is listed, the Contractor is free to choose between them, but it must notify the Employer of its choice in good time prior to appointing any selected Subcontractor. In accordance with GCC Sub-Clause 19.1, the Contractor is free to submit proposals for Subcontractors for additional items from time to time. No Subcontracts shall be placed with any such Subcontractors for additional items until the Subcontractors have been approved in writing by the Employer and their names have been added to this list of Approved Subcontractors.

Major Items of Plant and Installation Services	Approved Subcontractors/Manufacturers	Nationality
Advanced Metering Infrastructure Solutions (AMI)	Steamaco	United Kingdom
Supervisory Control and Data Acquisition (SCADA), and Energy Management System (EMS)	INACCESS Limited	Greece

Appendix 6. Scope of Works and Supply by the Employer
(Not Applicable)

The following personnel, facilities, works and supplies will be provided/supplied by the Employer, and the provisions of GCC Clauses 10, 21 and 24 shall apply as appropriate.

All personnel, facilities, works and supplies will be provided by the Employer in good time so as not to delay the performance of the Contractor, in accordance with the approved Time Schedule and Program of Performance pursuant to GCC Sub-Clause 18.2.

Unless otherwise indicated, all personnel, facilities, works and supplies will be provided free of charge to the Contractor.

Personnel Charge to Contractor (if any)

Facilities Charge to Contractor (if any)

Works Charge to Contractor (if any)

Supplies Charge to Contractor (if any)

Appendix 7. List of Documents for Approval or Review

Pursuant to GCC Sub-Clause 20.3.1, the Contractor shall prepare, or cause its Subcontractor to prepare, and present to the Project Manager in accordance with the requirements of GCC Sub-Clause 18.2 (Program of Performance), the following documents for

A. Approval

1.

2.

3.

B. Review

1.

2.

3.

Appendix 8. Functional Guarantees

1. General

This Appendix sets out

- (a) the functional guarantees referred to in GCC Clause 28 (Functional Guarantees)
- (b) the preconditions to the validity of the functional guarantees, either in production and/or consumption, set forth below
- (c) the minimum level of the functional guarantees
- (d) the formula for calculation of liquidated damages for failure to attain the functional guarantees.

2. Preconditions

The Contractor gives the functional guarantees (specified herein) for the facilities, subject to the following preconditions being fully satisfied:

3. Functional Guarantees

Subject to compliance with the foregoing preconditions, the Contractor guarantees as follows:

3.1 Production Capacity

and/or

3.2 Raw Materials and Utilities Consumption

4. Failure in Guarantees and Liquidated Damages

4.1 Failure to Attain Guaranteed Production Capacity

If the production capacity of the facilities attained in the guarantee test, pursuant to GCC Sub-Clause 25.2, is less than the guaranteed figure specified in para. 3.1 above, but the actual production capacity attained in

the guarantee test is not less than the minimum level specified in para. 4.3 below, and the Contractor elects to pay liquidated damages to the Employer in lieu of making changes, modifications and/or additions to the Facilities, pursuant to GCC Sub-Clause 28.3, then the Contractor shall pay liquidated damages at the rate of _____ for every complete one percent (1%) of the deficiency in the production capacity of the Facilities, or at a proportionately reduced rate for any deficiency, or part thereof, of less than a complete one percent (1%).

4.2 Raw Materials and Utilities Consumption in Excess of Guaranteed Level

If the actual measured figure of specified raw materials and utilities consumed per unit (or their average total cost of consumption) exceeds the guaranteed figure specified in para. 3.2 above (or their specified average total cost of consumption), but the actual consumption attained in the guarantee test, pursuant to GCC Sub-Clause 25.2, is not more than the maximum level specified in para. 4.3 below, and the Contractor elects to pay liquidated damages to the Employer in lieu of making changes, modifications and/or additions to the Facilities pursuant to GCC Sub-Clause 28.3, then the Contractor shall pay liquidated damages at the rate of [*amount in the contract currency*] for every complete one percent (1%) of the excess consumption of the Facilities, or part thereof, of less than a complete one percent (1%).

4.3 Minimum Levels

Notwithstanding the provisions of this paragraph, if as a result of the guarantee test(s), the following minimum levels of performance guarantees (and consumption guarantees) are not attained by the Contractor, the Contractor shall at its own cost make good any deficiencies until the Facilities reach any of such minimum performance levels, pursuant to GCC Sub-Clause 28.2:

- (a) production capacity of the Facilities attained in the guarantee test: ninety-five percent (95%) of the guaranteed production capacity (the values offered by the Contractor in its Bid for functional guarantees represents 100%).

and/or

- (b) average total cost of consumption of all the raw materials and utilities of the Facilities: one hundred and five percent (105%) of the guaranteed figures (the figures offered by the Contractor in its Bid for functional guarantees represents 100%).

4.4 Limitation of Liability

Subject to para. 4.3 above, the Contractor's aggregate liability to pay liquidated damages for failure to attain the functional guarantees shall not exceed _____ percent (___ %) of the Contract price.

Performance Security Form– Bank Guarantee¹

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[insert name and Address of Employer]*

Date: *_[insert date of issue]*

PERFORMANCE GUARANTEE No.: *____[insert guarantee reference number]*

Guarantor: *[insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _____ (hereinafter called “the Applicant”) has entered into Contract No. _____ dated _____ with the Beneficiary, for the execution of _____ (hereinafter called “the Contract”).

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (____)², such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary’s complying demand supported by the Beneficiary’s statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant is in breach of its obligation(s) under the Contract, without the Beneficiary needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall be reduced by half upon our receipt of:

- (a) a copy of the Operational Acceptance Certificate; or

¹ The Employer should insert either the Bank Guarantee or the Conditional Guarantee.

² The Guarantor shall insert an amount representing the percentage of the Contract Price specified in the Contract and denominated either in the currency(ies) of the Contract or a freely convertible currency acceptable to the Employer.

- (b) a registered letter from the Applicant (i) attaching a copy of its notice requesting issuance of the Operational Acceptance Certificate and (ii) stating that the Project Manager has failed to issue such Certificate within the time required or provide in writing justifiable reasons why such Certificate has not been issued, so that Operational Acceptance is deemed to have occurred.

This guarantee shall expire no later than the earlier of:³

- (a) twelve months after our receipt of either (a) or (b) above; or
- (b) eighteen months after our receipt of:
 - (i) a copy of the Completion Certificate; or
 - (ii) a registered letter from the Applicant, attaching a copy of the notice to the Project Manager that the Facilities are ready for commissioning, and stating that fourteen days have elapsed from receipt of such notice (or seven days have elapsed if the notice was a repeated notice) and the Project Manager has failed to issue a Completion Certificate or inform the Applicant in writing of any defects or deficiencies; or
 - (iii) a registered letter from the Applicant stating that no Completion Certificate has been issued but the Employer is making use of the Facilities; or
- (c) the ___ day of ___, 2__.⁴

Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

³ This text shall be revised as and where necessary to take into account (i) partial acceptance of the Facilities in accordance with Sub-Clause 25.4 of the GCC; and (ii) extension of the Performance Security when the Contractor is liable for an extended warranty obligation pursuant to Sub-Clause 27.10 of the GCC (although in this latter case the *Employer* might want to consider an extended warranty security in lieu of the extension of the Performance Security).

⁴ Insert the date twenty-eight days after the expected expiration date of the Defect Liability Period. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months] [one year], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

[signature(s)]

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

Advance Payment Security

Demand Guarantee

[Guarantor letterhead or SWIFT identifier code]

Beneficiary: *[Name and Address of Employer]*

Date: *[Insert date of issue]*

Advance Payment Guarantee No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that _____ (hereinafter called "the Applicant") has entered into Contract No. _____ dated _____ with the Beneficiary, for the execution of, _____ (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum _____ (_____) is to be made against an advance payment guarantee.

At the request of the Applicant, we as Guarantor, hereby irrevocably undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of. (_____) ¹ upon receipt by us of the Beneficiary's complying demand supported by the Beneficiary's statement whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating either that the applicant:

- (a) has used the advance payment for purposes other than the costs of mobilization in respect of the Facilities; or

¹ The Guarantor shall insert an amount representing the amount of the advance payment and denominated either in the currency(ies) of the advance payment as specified in the Contract, or in a freely convertible currency acceptable to the Employer.

(b) has failed to repay the advance payment in accordance with the Contract conditions, specifying the amount which the Applicant has failed to repay.

A demand under this guarantee may be presented as from the presentation to the Guarantor of a certificate from the Beneficiary's bank stating that the advance payment referred to above has been credited to the Applicant on its account number _____ at _____.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Applicant as indicated in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of documentation indicating full repayment by the Applicant of the amount of the advance payment, or on the _____ day of _____,² whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

_____ *[signature(s)]*

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

² Insert the expected expiration date of the Time for Completion. The Employer should note that in the event of an extension of the time for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months][one year], in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."