Request for Bids

RFB No: MH-MEC-96579-CW-RFB

LOT 1 Plant Design Supply and Installation of Power Station Upgrade and BESS

LOT 2 Supply and Installation of Solar PV System and Associated Controls

Dated: 9th September 2019

Employer: Marshalls Energy Company (MEC)

Project: Sustainable Energy Development Project (SEDeP)

Contract title: LOT 1 Design, Supply and Installation of Power Station Upgrade and BESS

Contract No: MH-MEC-96579-001

Contract title: LOT 2 Design, Supply & Installation of Solar PV System & Associated Controls

Contract No: MH-MEC-96579-002

Country: Republic of the Marshall Islands

Grant No.: IDA-2610-MH, Project Number: P160910

1. The Republic of the Marshall Islands has received financing from the World Bank toward the cost of the Sustainable Energy Development Project (SEDeP) and intends to apply part of the proceeds toward payments under separate Contracts for LOT 1 Design, Supply and Installation of Power Station Upgrade and BESS and LOT 2 Design, Supply and Installation of Solar PV System and Associated Controls. For both Lots, the Borrower shall process the payments using irrevocable letter of credit except for the advance payment using direct payment, as defined in the World Bank's Disbursement Guidelines for Investment Project Financing.
2. Bidders may Bid for either one or both contracts, as further defined in the bidding document. Bidders wishing to offer discounts in case they are awarded more than one contract will be allowed to do so provided those discounts are included in the Letter of Bid.
3. The **Marshalls Energy Company (MEC)** now invites sealed Bids from eligible Bidders for;
    a. LOT 1 - Plant Design Supply and Installation of Power Station Upgrade and BESS, located in Majuro with an expected completion period of fourteen (14 months) and requiring refurbishment of the existing power station and supply and installation of a new battery energy storage system, to support new PV systems (LOT 2).
    b. LOT 2 Supply and Installation of Solar PV System and Associated Controls with a total capacity of 4.0MW at multiple sites on Majuro including system components of 2.6 MW floating PV systems on the Majuro Water Reservoirs, liners for reservoirs and rooftop PV systems at seven educational facilities. The systems are to be sufficiently sized to supply at least 7% of the RMI's total energy consumption from renewable energy.

    Bidders bidding for both Lots will be evaluated on a Lot by Lot basis for all Financial and Experience criteria
4. Bidding will be conducted through international competitive procurement using a Request for Bids (RFB) as specified in the World Bank's "Procurement Regulations for Investment Project Financing (IPF) Borrowers – Procurement in IPF- Goods, Works, Non-Consulting and Consulting Services (dated July 2016)" ("Procurement Regulations"), and is open to all eligible Bidders as defined in the Procurement Regulations.
5. Interested eligible Bidders may obtain further information from *Mr Kamalesh Doshi of the Marshalls Energy Company at* kamaleshdoshi@mecrmi.net with cc to Procurement Advisor Rolito Rillo: rillorolito@gmail.com and Anne-Marie Bishop at ambishous@ozemail.com.au
6. A complete set of bidding documents, in the English language, can be obtained at no cost upon registering directly with MEC, Rolito Rillo; rillorolito@gmail.com and kamaleshdoshi@mecrmi.net. Once registered, the Bidding Documents will be available for download from a secure file share

site. Also, a full set of Bidding Documents will be available for inspection during office hours 9-00am to 4-00pm Monday to Friday at the address given below.

7. Bids must be delivered to the address below on or before 14.00hrs (2pm local time) Wednesday **13th November 2019.** Electronic submission of bidding will not be permitted. 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 shown below.
8. All Bids must be accompanied by a Bid Security; LOT 1, Plant Design Supply and Installation of Power Station Upgrade and BESS, a Bid Security of USD200,000 and for LOT 2, Supply and Installation of Solar PV System and Associated Controls a Bid Security of USD300,000. If submitting for both Lots, then both Bid Securities must be provided.
9. Attention is drawn to the Procurement Regulations 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
10. The addresses referred to above are:

Address to view Bid Documents	**Address for Submission of Bids**	**Address Public Opening of Bid Submissions**
Attention: Kamalesh Doshi, Project Manager, SEDeP and Rolito Rillo, Procurement Advisor Marshalls Energy Company Majuro, Marshall Islands	Attention: Steve Wakefield, Project Manager, CTO, SEDeP CEO's Office Marshalls Energy Company Majuro, Marshall Islands Date: **13th November 2019** Time 14-00 hrs (2-00pm RMI time)	Marshalls Energy Company CEO's Office Majuro, Marshall Islands Date: **13th November *2019*** Time*: immediately following the deadline for submission of bids*

Marshalls Energy Company
Republic of the Marshall Islands

VOLUME 1 BIDDING DOCUMENTS

LOT 1: Design, Supply & Installation of Power Station Upgrade and BESS

LOT 2: Design, Supply & Installation of Solar PV System & Associated Controls

Sustainable Energy Development Project (SEDeP).
World Bank Grant No.: IDA-D2610-MH
World Bank Project No: P160910

ISSUED 9th SEPTEMBER 2019

Request for Bids

LOT 1	**Design, Supply and Installation of Power Station Upgrade and BESS**
LOT 2	**Design, Supply and Installation of Solar PV System and Associated Controls**

RFB No:	MH-MEC-96579 -CW-RFB
Project:	Sustainable Energy Development Project (SEDeP)
Employer:	Marshalls Energy Company (MEC)
Country:	Republic of the Marshall Islands
Issued on:	**9th September 2019**

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PART 1

Bidding Procedures

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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 - Request for Bids (RFB), 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 lots (contracts) of this RFB 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; and

(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.

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 World Bank (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 Anti-Corruption Guidelines and its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework, 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 initial selection process, prequalification process, bid submission, proposal 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 (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, all members shall be jointly and severally liable for the execution of the entire Contract in accordance with the Contract terms. 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. Unless specified **in the BDS**, there is no limit on the number of members in a JV.

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 may have the nationality of any country, 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 Anti-Corruption Guidelines, in accordance with its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework as described in Section VI paragraph 2.2 d., shall be ineligible to be prequalified for, initially selected for, bid for, propose 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 or Proposal-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 Installation Services

5.1 The Plant and Installation Services to be supplied under the Contract and financed by the Bank may have their origin in any country in accordance with Section V, Eligible Countries.

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 in its basic characteristics or in purpose or utility from its components.

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-Request for Bids (RFB) 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 at 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) **Alternative Bid**, if permissible, in accordance with ITB 13;

(e) **Authorization**: written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 21.3;

(f) **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;

(g) **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;

(h) **Conformity:** documentary evidence in accordance to ITB 16that the Plant and Installation Services offered by the Bidder conform to the bidding document;

(i) **Subcontractors**: list of subcontractors in accordance with ITB 16.2; and

(j) 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.

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, 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 Most Advantageous 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**, as will the method for their evaluation, and described in Section VII, Employer's Requirements.

14. Documents Establishing the Eligibility of the Plant and Installation Services

14.1 To establish the eligibility of the Plant and Installation Services in accordance with ITB 5, Bidders shall complete the 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

15.1 To establish its eligibility and 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 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.

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. In addition, the Bidder shall include in its Bid information establishing compliance with the requirements specified by the Employer for these 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 proposed complies with the requirements of ITB 4, and that any plant, or services to be provided by the Subcontractor comply with the requirements of ITB 5 and ITB 15.1.

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.

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.

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);

(d) Installation Services shall be quoted separately (Schedule No. 4) and 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;

(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 quotation will not be rejected, but the price adjustment will be

treated as zero. Bidders are required to indicate the source of labor and material indices in the corresponding Form in Section IV, Bidding Forms.

17.10 If so indicated in ITB 1.1, Bids are being invited for individual lots (contracts) or for any combination of lots (packages). 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 package, or alternatively, to individual Contracts within the package, and the manner in which the price reductions will apply.

17.11 Bidders wishing to offer any unconditional discount shall specify in their Letter of Bid the offered discounts and the manner in which price discounts will apply.

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**;

(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 as specified **in the BDS,** in original form and, in the case of a Bid Security, 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 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 or a Bid-Securing Declaration is specified pursuant to ITB 20.1, any Bid not accompanied by a substantially responsive Bid Security 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 furnishing of the Performance Security pursuant to ITB 47.

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 may be forfeited or the Bid-Securing Declaration executed:

(a) if a Bidder withdraws its Bid during the period of Bid validity specified by the Bidder on the Letter of Bid; or

(b) if the successful Bidder fails to:

(i) sign the Contract in accordance with ITB 46; or

(ii) furnish a Performance Security in accordance with ITB 47.

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 Security is not required **in the BDS**: and

(a) if a Bidder withdraws its Bid during the period of Bid validity specified by the Bidder on the Letter of Bid , except as provided in ITB 19.2; or

(b) if the successful Bidder fails to:

(i) sign the Contract in accordance with ITB 46; or

(ii) furnish a Performance Security in accordance with ITB 47;

the Borrower may, if provided for **in the BDS**, declare the Bidder disqualified 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 withdrawals 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 Bid Price(s), 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 42.

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. Clarification of Bids

28.1 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.

28.2 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 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 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.

30.4 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.

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 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) 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;

(b) 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

(c) 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 No margin of domestic preference shall apply.

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 Most Advantageous Bid.

This is the Bid of the Bidder that meets the qualification criteria and that has been determined to be:

(a) substantially responsive to the bidding document; and

(b) the lowest evaluated cost.

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:

(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; and

(f) the evaluation factors specified **in the BDS** and in 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 analyses, 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 that is selected as having submitted the lowest evaluated cost and substantially responsive Bid is eligible and meets the qualifying criteria specified in Section III, Evaluation and 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 who offers a substantially responsive Bid with the next lowest evaluated cost to make a similar determination of that Bidder's qualifications to perform satisfactorily.

39.4 The capabilities of the manufacturers and subcontractors proposed in its Bid to be used by the Bidder with the Most Advantageous Bid 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 be determined to be unacceptable, the Bid will not be rejected, but the Bidder will be required to substitute an acceptable manufacturer or subcontractor without any change to the Bid price. 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. Employer's right to Accept Any Bid and to Reject Any or All Bids

40.1 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.

41. Standstill Period

41.1 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 45. 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.

42. Notification of Intention to Award

42.1 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

43. Award Criteria

43.1 Subject to ITB 40, the Employer shall award the Contract to the successful Bidder. This is the Bidder whose Bid has been determined to be the Most Advantageous Bid. This is the Bid of the Bidder that meets the qualification criteria and whose Bid has been determined to be:

(a) substantially responsive to the bidding document; and

(b) the lowest evaluated cost.

44. Notification of Award

44.1 Prior to the expiration of the Bid Validity Period, and upon expiry of the Standstill Period, specified in ITB 41.1 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").

44.2 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 therefor;

(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 46.1.

44.3 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.

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

45. Debriefing by the Employer

45.1 On receipt of the Employer's Notification of Intention to Award referred to in ITB 42, 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.

45.2 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.

45.3 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.

45.4 Debriefings of unsuccessful Bidders may be done in writing or verbally. The Bidder shall bear their own costs of attending such a debriefing meeting.

46. Signing of Contract

46.1 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.

46.2 The successful Bidder shall sign, date and return to the Employer, the Contract Agreement within twenty-eight (28) days of its receipt.

46.3 Notwithstanding ITB 46.2 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 Contact 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.

47. Performance Security

47.1 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.

47.2 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 offering the next Most Advantageous Bid.

48. Procurement Related Complaint

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

Section II - Bid Data Sheet

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	The reference number of the Request for Bids (RFB) is: **MH-MEC-96579-CW-RFB** The Employer is: **Marshalls Energy Company (MEC)** The name of the RFB is: **Design, Supply and Installation of Solar PV system, Power Station Upgrade and BESS** The number and identification of lots (contracts)comprising this RFB is: **Lot 1; MH-MEC-96579-001** **Design, Supply and Installation of Power Station Upgrade and BESS** **Lot 2: MH-MEC-96579-002** **Design, Supply and Installation of PV System and Associated Controls**
ITB 2.1	The Borrower is: **Republic of the Marshall Islands, with MEC as the Implementing Agency** The amount of the financing is: **Grant No: IDA-D2610-MH for USD34million** The name of the Project is: **Sustainable Energy Development Project (SEDeP, Project No: P160910)**
ITB 4.1	Maximum number of members in the Joint Venture (JV) shall be: **Three (3).**
ITB 4.5	A list of debarred firms and individuals is available on the Bank's external website: http://www.worldbank.org/debarr.
B. Bidding Document	
ITB 7.1	For **Clarification of Bid purposes** only, the Employer's address is:

	Note! Clarification requests must be received in writing and addressed to the three recipients named below Attention: **Kamalesh Doshi, Project Manager, SEDeP** Address: **Marshalls Energy Company, MEC Office** City: **Majuro** ZIP Code: **MH96960** Country: **Marshall Islands** Facsimile number: **+(692) 625 5886** **Email address:** kamaleshdoshi@mecrmi.net AND Attention: Rolito Rillo, DIDA-CIU,Procurement Advisor **Email Address:** rillorolito@gmail.com AND Procurement Advisor, Anne-Marie Bishop **Email address:** ambishous@ozemail.com.au Requests for clarification should be received by the Employer no later than: ***14 days before the Bid Submission Deadline.*** Web page: **www.mecrmi.net**
ITB 7.4	A Pre-Bid meeting shall take place at the following date, time and place: Date: **2nd-4th October 2019** Time: **9-30am** Place: **Marshalls Energy Corporation Building, Majuro, RMI.** A site visit conducted by the Employer **"shall be"** organized and will follow directly after the Pre-Bid Meeting
ITB 7.6	Web page: **www.mecrmi.net**
C. Preparation of Bids	
ITB 10.1	The language of the Bid is: **English**.
ITB 11.1 (j)	The Bidder shall submit the following additional documents in its Bid: **As per Section VII, Employer's Requirements, Technical Specifications Schedules 1-9 (Lot 1) and 1-11 (Lot 2), the bidder must provide Product Data Sheets and Type Test Reports where indicated**

ITB 13.1	Alternative Bids **"SHALL NOT'** be considered.
ITB 13.2	Alternatives to the Time Schedule **"SHALL'** be permitted, **HOWEVER** a "window of time" for completion is allowed. The Bidder is advised to refer to **Section 3, EQC 1.2.1**, for evaluation methodologies to be applied to the Timing Schedule.
ITB 13.4	Alternative **Technical Solutions** shall be permitted for the following parts of the Plant and Installation Services: ***Pile driven footings for structures may be proposed subject to soil suitability*** as further detailed in the Specification. If alternative technical solutions are permitted, the evaluation method will be as specified in Section III, Evaluation and Qualification Criteria.
ITB 17.1	Bidders shall quote for the following components or services on a single responsibility basis: **Lot 1: Yes** **Lot 2: Yes**
ITB 17.5 (a) and (d)	Place of destination: **Lot1: CIP, Majuro Port,** **Lot 2: CIP, Majuro Port** ***Lot 1: The Bidder is to arrange containerized storage at the Majuro Port as per Lot 1 Price Schedule No 4*** ***Lot 2: The Bidder is to arrange containerized storage at the Majuro Port as per Lot 2 Price Schedule No 4***
ITB 17.6	The Incoterms edition is: **Incoterm ® 2010** https://iccwbo.org/resources-for-business/incoterms-rules/incoterms-rules-2010/
ITB 17.7	The prices quoted by the Bidder **"SHALL NOT"** be subject to adjustment during the performance of the Contract.
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. **Currency of the Republic of the Marshall Islands: USD**
ITB 19.1	The Bid Validity period shall be **120 days**.

ITB 19.3 (a)	The Bid price shall be adjusted by the following factor(s): **2%**
ITB 20.1	A Bid Security **"shall be"** required. If a Bid Security shall be required, the amount and currency of the Bid Security shall be; **Lot 1, USD200,000** **Lot 2, USD300,000** 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. The Bid Security for each lot should be in the name of the respective Employer, as defined in ITB 1.1 above.
ITB 20.3 (d)	Other types of acceptable securities: **None**
ITB 21.1	In addition to the original of the Bid, the number of copies is: ***Four (4) copies*** Plus, one Electronic version (flash drive /USD stick) of entire Bid Submission (except brochures) in freely accessible files. In the event of any discrepancy between the original and the hard or electronic copies, the original shall prevail.
ITB 21.3	The written confirmation of authorization to sign on behalf of the Bidder shall consist of: *"An organizational document, board resolution or its equivalent, or power of attorney specifying the representative's authority to sign the Bid on behalf of, and to legally bind the Bidder. If the Bidder is an intended or an existing Joint Venture, the power of attorney should be signed by all partners and specify the authority of the named representative of the Joint Venture to sign on behalf of, and legally bind, the intended or existing Joint Venture.* *If the Joint Venture has not yet been formed, also include evidence from all proposed Joint Venture partners of their intent to enter into a Joint Venture in the event of a contract award in accordance with ITB 11.2."*

D. Submission and Opening of Bids	
ITB 23.1	For **Bid submission purposes** only, the Employer's address is: Attention: **Kamalesh Doshi, Project Manager, SEDeP** Address: **Marshalls Energy Company** Room number: **CEO's Office** City: **Majuro** ZIP Code: **MH96960** Country: **Marshall Islands** **The deadline for Bid submission is:** Date: ***Wednesday13th November 2019*** Time:***2-00pm (14.00 hours local time, RMI)*** Bidders **"shall not"** have the option of submitting their Bids electronically. ***Bidders should be aware that Courier Services and Flights to the RMI are not daily and that adequate allowance of several days will be needed to ensure a Bid dispatched will reach the RMI***
ITB 26.1	The Bid opening shall take place at: Address: **Marshalls Energy Company** Floor/Room number: **CEO's Office** City: **Majuro** ZIP Code: **MH96960** Country: **Marshall Islands** Date: **Wednesday, 13th November *2019*** Time: ***2-00pm (14.00 hours local time, RMI)*** *immediately following the deadline for submission of bids*
ITB 26.6	The Letter of Bid and Price Schedules shall be initialed by **Two (2)** representatives of the Employer conducting Bid opening The total bid price for each lot shall be read out. The Letter of Bid and Price Schedule Summary shall be initialed by two (2) representatives of the Employer attending Bid opening. Each Bid initialed by the Employer's representatives, shall be numbered.

E. Evaluation, and Comparison of Bids	
ITB 31.3	The adjustment shall be based on the **highest** price of the item or component as quoted in other substantially responsive Bids. If the price of the item or component cannot be derived from the price of other substantially responsive Bids, the Employer shall use its best estimate.
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: **USD** The source of exchange rate shall be: **Reserve Bank of America** https://www.federalreserve.gov/releases/h10/current/default.htm The date for the exchange rate shall be: ***28 days prior to the deadline for submission of the Bids.***
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: ***[refer to Section III, Evaluation and Qualification Criteria];*** (a) Deviation in Time for Completion: ***Yes*** (b) Functional Guarantees of the Facilities: **Yes**;
ITB 46.1	The successful Bidder **shall** submit the Beneficial Ownership Disclosure Form.
ITB 48.1	The procedures for making a Procurement-related Complaint are detailed in the "Procurement Regulations for IPF Borrowers (Annex III)." If a Bidder wishes to make a Procurement-related Complaint, the Bidder should submit its complaint following these procedures, in writing (by the quickest means available, that is either by email or fax), to: Attention: **Malie Tarbwillin: Division of International Development Assistance** **office: (692) 625-5968** **mobile: (692) 455-5935** **email: mtarbwilin@gmail.com** In summary, a Procurement-related Complaint may challenge any of the following: **1.** the terms of the Bidding Documents; and **2.** the Employer's decision to award the contract.

Section III
Evaluation and Qualification Criteria

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.

Table of Criteria

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 Most Advantageous Bid. This is the Bid of the Bidder that meets the qualification criteria and whose Bid has been determined to be:

(a) substantially responsive to the bidding document; and

(b) the lowest evaluated cost.

Unless specifically stated, all qualifying and quantifying criteria described in this Section apply to Lot 1 and Lot 2. All Evaluation and Qualification criteria in this Section will be evaluated, separately on a Lot by Lot basis.

1. Evaluation

1.1. Technical Evaluation

In addition to the criteria listed in ITB 35.2 (a) – (c) the following factors shall apply:

1.1.1 Understanding and Compliance with Requirements

A separate Technical Proposal shall be submitted for both Lot 1 and Lot 2; the Bidder's Technical Proposal shall include sufficient information to demonstrate a clear understanding of all works to be carried out. (refer, amongst others, to Method Statements)

For Lot1 and lot 2, the Bidder shall provide evidence of sufficient planning to show that work will be accomplished as required and on schedule, utilizing all available resources (refer Construction and Mobilization Schedule). The Bidder shall demonstrate a firm understanding of the requirements and goals set forth in the scope of work, address each requirement and goal set forth in the scope of work and provide technical solutions to indicate requirements and goals will be met on schedule.

Evaluation of the Bidder's Technical Proposal will include an assessment of the Bidder's technical capacity to mobilize key equipment and personnel (refer to EQU-1 and PER-1 and PER-2) for the contract consistent with its proposal regarding work methods, scheduling, and material sourcing in sufficient detail and fully in accordance with the requirements stipulated in Section 7 Employer's Requirements.

1.2 Economic Evaluation

The following factors and methods will apply:

1.2.1 Time Schedule

For Lot 1

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 shall be between *425 days* minimum and *467 days* maximum. The adjustment rate in the event of completion beyond the minimum period (425 days) shall be **0.2% for each week, or part thereof,** of delay from that minimum period. No credit will be given for completion earlier than the minimum designated period.

Bids offering a completion date beyond the maximum designated period (467 days) shall be rejected.

Lot 2

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 shall be between 300 days minimum and *342 days* maximum. The adjustment rate in the event of completion beyond the minimum period (300 days) shall be **0.2% for each week**, or part thereof, of delay from that minimum period. No credit will be given for completion earlier than the minimum designated period. **Bids offering a completion date beyond the maximum designated period of 342 days shall be rejected.**

1.2.2 Functional Guarantees of the Facilities

LOT 1

The minimum (or maximum) requirements stated in the Specification for Functional Guarantees required in the Specification are:

Functional Guarantee [*as required in the Specification, e.g., performance, efficiency, consumption, etc.*]	**Minimum or Maximum**	**Requirement** [*as required in the Specification*]
1. Site power rating	*MINIMUM*	*2,200kWe (Min) per genset (prime power), at 0.8PF under specified site conditions (refer to clause 52, Section 7, Technical Specifications)*
2. Fuel Efficiency	*MAXIMUM*	*240 g/kWh (Min) refer compliance matrix and Technical Specification Appendix 2 for calculation methodology*
3. BESS power rating	*MINIMUM*	*2MW (AC) for 30 minutes continuous at BOL in the specified site conditions (refer clause 395)*

For the purposes of evaluation, for each percentage point that the functional guarantee of the proposed Plant and Installation Services is below the norm specified in the Specification and in the above table, but above the minimum acceptable levels also specified therein for item 2, an adjustment of USD13,500 will be added to the Bid price for every 1% below the minimum fuel efficiency. If the drop below the norm or the excess above the minimum acceptable levels is less than one percent, the adjustment will be prorated accordingly.

LOT 2

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

Functional Guarantee [*as required in the Specification, e.g., performance, efficiency, consumption, etc.*]	**Minimum (or Maximum, as appropriate) Requirement** [*as required in the Specification*]
1. PV system guaranteed output	*5,320 MWh/year, year 1, in the specified site conditions*

For the purposes of evaluation, for each MWh that the functional guarantee of the proposed Plant and Installation Services is below the norm specified in the Specification and in the above table, but above the minimum acceptable levels also specified therein, an adjustment of **USD $30/MWh** will be added to the Bid price. If the drop below the norm or the excess above the minimum acceptable levels is less than one percent, the adjustment will be prorated accordingly.

1.2.3 Work, services, facilities, etc., to be provided by the Employer

Note! Where Bids include the undertaking of work or the provision of services or facilities by the Employer in excess of the provisions allowed for in the Bidding document, the Employer shall assess the costs of such additional work, services and/or facilities during the duration of the contract. Such costs shall be added to the Bid price for evaluation. The following works/services will be undertaken by the Employer;

Item	**Description of Works**
1	Decommissioning and disconnection of existing gensets 1, 2, 3 & 4
2	Removal of old switching equipment and MV cables adjacent to switching station.
3	Relocation of pole adjacent to switching station to allow installation of BESS
4	Determine location of (and relocate if req.) septic tank in location where containerized gensets will be installed
5	Relocate 480v supply for fuel farm from PS1 Auxiliary Switchboard
6	Emptying and cleaning of water reservoirs prior to PV installation
7	Any required public communications regarding the works, for example announcement of scheduled power outages
8	Access to site power for construction work at 480V, 60Hz up to 50kW load at the power station

1.2.5 Sustainable procurement

Not applicable

1.2.6 Alternative technical solutions for specified parts

The acceptability of alternative technical solutions for parts of the facilities, if permitted under ITB 13.4, will be determined as follows:

Pile Driven Footings

- Technically competent solution: accompanied by supporting certified design calculations, design drawings and specification
- Construction duration no longer than current design
- Cost cheaper than current design
- Surety of supply

1.3 Multiple Contracts (ITB 35.6)

If in accordance with ITB 1.1, Bids are invited for more than one lot, the contract will be awarded to the Bidder or Bidders offering a substantially responsive Bid(s) and the lowest evaluated cost to the Employer **on a lot by lot basis**, subject to the selected Bidder(s) meeting the required qualification criteria Section III, Evaluation and Qualification Criteria for a lot or combination of lots as the case may be.

In determining Bidder or Bidders that offer the total lowest evaluated cost to the Employer, after considering all possible combination of lots, the Employer shall apply the following steps in sequence:

(a) evaluate individual lots to determine the substantially responsive Bids and corresponding evaluated costs;

(b) for each lot, rank the substantially responsive Bids starting from the lowest evaluated cost for the lot;

(c) apply to the evaluated costs listed in b) above, any applicable discounts/price reductions offered by a Bidder (s) for the award of multiple contracts based on the discounts and the methodology for their application offered by the respective Bidder; and

(d) determine contract award on the basis of the combination of lots that offer the total lowest evaluated cost to the Employer.

2. Qualification

It is the **legal entity or entities comprising the Bidder,** and **NOT** the Bidder's parent companies, subsidiaries or affiliates, that must satisfy the qualification criteria described below and **documentary evidence provided by the Parent Company will not be evaluated**

Factor	2.1 Eligibility					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each Partner	At least one Partner	
2.1.1 Nationality	Nationality in accordance with ITB 4.4.	Must meet requirement	must meet requirement	Must meet requirement	N / A	Form ELI –1.1 and Form ELI 1.2, with attachments
2.1.2 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
2.1.3 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
2.1.4 State Owned Enterprise or Institution	Compliance with conditions of ITB 4.6	Must meet requirement	Must meet requirement	Must meet requirement	N / A	Form ELI –1.1 and Form ELI 1.2, with attachments

Factor	2.1 Eligibility					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each Partner	At least one Partner	
2.1.5 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 4.8and Section V.	Must meet requirement	must meet requirement	Must meet requirement	N / A	Letter of Bid

Factor	2.2 Historical Contract Non-Performance					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
2.1 History of non-performing contracts	LOT 1 and LOT 2 Non-performance[1] of a contract did not occur within the last Five (5) years prior to the deadline for application submission, based on all information on fully settled disputes or litigation. A fully settled dispute or litigation is one 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.	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

Factor	2.2 Historical Contract Non-Performance					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
2.2.1 Suspension	LOT 1 and LOT 2 Not under suspension based on execution of a Bid Securing Declaration or Proposal Securing Declaration pursuant to ITB 4.7 and ITB 20.9	Must meet requirement	Must meet requirement	Must meet requirement	Must meet requirement	Letter of Bid
2.2.2 Pending Litigation	LOT 1 and LOT 2 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

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	2.2 Historical Contract Non-Performance					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
2.2.3 Litigation History	LOT 1 and LOT 2 No consistent history of court/arbitral award decisions against the Bidder[3] since **1st January 2014**	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	2.3 Financial Situation					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
2.3.1 Financial Capabilities	LOT 1 and LOT 2 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 **Three (3) Years** to demonstrate the current soundness of the Bidders financial position and its prospective long-term profitability. Net worth is to be positive.	Must meet requirement	N / A	Must meet requirement	N / A	Form FIN – 3.1 with attachments
2.3.2 Average Annual Turnover	LOT 1 Minimum average annual turnover in Power Station Upgrades/Rehabilitation of **USD14.5million,** calculated as total certified payments received for contracts in	Must meet requirement	Must meet requirement	Must meet Twenty-five percent (25%) of the requirement	Must meet Forty percent (40%) of the requirement	Form FIN –3.2

Factor	2.3 Financial Situation					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
	progress or completed, within the **last 4 years**					
2.3.2 Average Annual Turnover	**LOT 2** Minimum average annual turnover in Solar PV Sector of **USD20million** calculated as total certified payments received for contracts in progress or completed, within the **last 4 years**	Must meet requirement	Must meet requirement	Must meet Twenty-five percent (25%) of the requirement	Must meet Forty percent (40%) of the requirement	Form FIN –3.2
2.3.3 Financial Resources	**LOT 1** 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:	Must meet requirement	Must meet requirement	Must meet Twenty-five percent (25%) of the requirement	Must meet Forty percent (40%) of the requirement	Form FIN –3.3

Factor	2.3 Financial Situation					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
	(i) the following cash-flow requirement: **USD2.5million** and (ii) the overall cash flow requirements for this contract and its current commitments.					
2.3.3 **Financial Resources**	LOT 2 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: (i) the following cash-flow requirement: **USD4.3million**	Must meet requirement	Must meet requirement	Must meet Twenty-five percent (25%) of the requirement	Must meet Forty percent (40%) of the requirement	Form FIN –3.3

Factor	2.3 Financial Situation					
Sub-Factor	Criteria					Documentation 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.					

2.4 EXPERIENCE

Factor	2.4 Experience					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
2.4.1 General Experience	**LOT 1** Experience in at least **one contract** in the Energy Sector in the role of Contractor, Sub-contractor or Management Contractor, that has been successfully or substantially completed within the **last 5 years** commencing January 2014.	Must meet requirement	N / A	Must meet requirement	N / A	Form EXP-4.1
2.4.1 General Experience	**LOT 2** Experience in at least **one contract** in the Energy Sector in the role of Contractor, Sub-contractor or Management Contractor, that has been successfully or substantially completed within the **last 5**	Must meet requirement	N / A	Must meet requirement	N / A	Form EXP-4.1

Factor	2.4 Experience					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
	years commencing January 2014.					
Experience in Key Activities or Specific Experience must be complied with by the Bidder. In case of a Joint Venture Bidder, at least one of the partners must have experience in the key activity. If the activity may be subcontracted, the requirement will be specified in Criterion 2.7 of Section 3.)						
2.4.2 (a) **Specific Experience**	**LOT 1** (a)Participation as contractor, joint venture member[4] , management contractor, or subcontractor, in at least **one (1) contract** within the last **five (5)** years, with a value of at least	Must meet requirement	Must meet requirements[6]	N / A	N/A	Form EXP4.2(a)

[4] 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] 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.

Factor	2.4 Experience					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
	USD7.5million, that has been successfully and substantially[5] completed and that is similar to the proposed Plant and Installation Services. The similarity of the Bidder's participation shall be based on the physical size, nature of works, complexity, methods, technology, or other characteristics as described in physical size, complexity, construction method, technology and/or other characteristics as					

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

Factor	2.4 Experience					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
	described in Section 7, Employer's Requirements					
2.4.2 (a) Specific Experience	**LOT 2** (a)Participation as contractor, joint venture member[7] , management contractor, or subcontractor, in at least **one (1) contract** within the last **five (5)** years, with a value of at least **USD8.5million,** that has been successfully and substantially[8] completed and that is similar to the	Must meet requirement	Must meet requirements[9]	N / A	N/A	Form EXP4.2(a)

[7] 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

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

[9] 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.

Factor	2.4 Experience					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
	proposed Plant and Installation Services. The similarity of the Bidder's participation shall be based on the physical size, nature of works, complexity, methods, technology, or other characteristics as described in physical size, complexity, construction method, technology and/or other characteristics as described in Section 7, Employer's Requirements					

Factor	2.4 Experience					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
2.4.2(b) Specific Experience	**FOR LOT 1** (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: 1. Supply and installation of medium speed gensets and accessories 2. Control systems – experience in integrating hybrid systems including lithium-ion batteries ***(A specialized subcontractor may be nominated for Item 3 as long as Specialized***	Must meet requirements	Must meet requirements [10]	N / A	N/A	Form EXP-4.2(b) and EXP-3

[10] 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.

Factor	2.4 Experience					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
	experience complies as shown in Section 2.7 below and EXP-3)					
2.4.2(b) Specific Experience	**FOR LOT 2** (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: 1. Experience installing floating solar arrays (at least one) (may be sub-contractor) 2. Experience in remote or logistically challenging environments ***(A specialized subcontractor may be***	Must meet requirement	Must meet requirement[11]	N / A	N/A	Form EXP-4.2(b) and EXP-3

[11] 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.

Factor	2.4 Experience					
Sub-Factor	Criteria					Documentation Required
	Requirement	Bidder				
		Single Entity	Joint Venture (existing or intended)			
			All members combined	Each member	At least one member	
	nominated for above items as long as Specialized experience complies as shown in Section 2.7 below and EXP-3)					

2.5 Personnel

The Bidder must demonstrate that it will have the personnel for the key positions that meet the following requirements: refer to Forms PER-1 and PER-2 *A person may hold more than one position as long as time offered and qualifications for both positions correlate to the table below;

LOT 1

No.	Position*	Total Work Similar Experience (years)	In Similar Works Experience (years)
1	Key position – Project Manager	10	5
2	Site Manager	15	5
3	Lead Engineer – Electrical	15	10
4	Lead Engineer - Mechanical	15	10
5	Procurement/logistics manager	10	5

LOT 2

No.	Position*	Total Work Similar Experience (years)	In Similar Works Experience^ (years)
1	Project Manager	10	5
2	Site Manager	10	5
3	Lead Engineer	10	5
4	Procurement/Logistics manager	5	5

^ Experience in Floating PV works is desirable; however, lack of floating PV experience will not be grounds for rejection of the nominee.

The Bidder shall provide details of the proposed personnel and their experience records in the relevant Forms included in Section IV, Bidding Forms.

2.6 Subcontractors

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

LOT 1

Item No.	Description of Item	Minimum Criteria to be met
1	Control system	5 years' experience in design, manufacture and configuration of power station control systems Experience with integration of PV systems and lithium-ion battery storage systems into diesel systems
2	Switchboards	10 years' experience in manufacture and design of MV switchboards

Failure to comply with this requirement will result in rejection of the subcontractor, but not rejection of the Bidder.

LOT 2

Item No.	Description of Item	Minimum Criteria to be met
1	Floating PV systems	At least one previous floating PV project greater than 500kW
2	Reservoir liners	5 years' experience in manufacture and installation of HDPE liners for reservoirs

Failure to comply with this requirement will result in rejection of the subcontractor, but not rejection of the Bidder.

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. Refer to Form Manufacturer's Authorization

Section IV - Bidding Forms

Table of Forms

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*]

RFB No.: [*insert number of RFB process*]

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**: We meet the eligibility requirements and have no conflict of interest in accordance with ITB 4;

(c) **Bid-Securing Declaration:** We have not been suspended nor declared ineligible by the Employer based on execution of a Bid Securing Declaration or Proposal-Securing Declaration in the Employer's Country in accordance with ITB 4.7;

(d) **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*];

(e) **Bid Price:** The total price of our Bid, excluding any discounts offered in item (f) below is: [*fill in below as appropriate]*

LOT No.	Currency	Price Offered (in Figures)	Price Offered (in words)
LOT 1			
LOT 2			
TOTAL (only if offering for both Lots)			

(f) **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 after application of discounts is shown below: [*Specify in detail the method that shall be used to apply the discounts*];

(g) **Bid Validity Period:** Our Bid shall be valid for the period specified in BDS 19.1 (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;

(h) **Performance Security:** If our Bid is accepted, we commit to obtain a Performance Security in accordance with the bidding document;

(i) **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;

(j) **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 World Bank Group or a debarment imposed by the World Bank Group in accordance with the Agreement for Mutual Enforcement of Debarment Decisions between the World 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;

(k) **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*];

(l) **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.")

(m) **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;

(n) **Not Bound to Accept:** We understand that you are not bound to accept the lowest evaluated cost Bid, the Most Advantageous Bid or any other Bid that you may receive; and

(o) **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*]

Form of Bid Security

Form of Bid Security – Bank Guarantee

A Bid Security is required for Each Lot submitted
[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]*

RFB No.:*[Employer to insert reference number for the Request 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 RFB 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 Applicantis 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.

Form of Bid Security- Bid Bond

BOND NO. _____

BY THIS BOND _____ as Principal (hereinafter called "the Principal"), and _____,**authorized to transact business in** _____, as Surety (hereinafter called "the Surety"), are held and firmly bound unto _____ as Obligee (hereinafter called "the Employer") in the sum of _____[12](_____), for the payment of which sum, well and truly to be made, we, the said Principal and Surety, bind ourselves, our successors and assigns, jointly and severally, firmly by these presents.

WHEREAS the Principal has submitted a written Bid to the Employer dated the ___ day of _____, 20__, for the construction of _____ (hereinafter called the "Bid").

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION is such that if the Principal:

(a) withdraws its Bid during the period of Bid validity specified in the Form of Bid; or

(b) having been notified of the acceptance of its Bid by the Employer during the period of Bid validity; (i) fails or refuses to execute the Contract Form, if required; or (ii) fails or refuses to furnish the Performance Security in accordance with the Instructions to Bidders;

then the Surety undertakes to immediately pay to the Employer up to the above amount upon receipt of the Employer's first written demand, without the Employer having to substantiate its demand, provided that in its demand the Employer shall state that the demand arises from the occurrence of any of the above events, specifying which event(s) has occurred.

The Surety hereby agrees that its obligation will remain in full force and effect up to and including the date 28 days after the date of expiration of the Bid Validity Period set forth in the Principal's Letter of Bid or any extension thereto provided by the Principal.

IN TESTIMONY WHEREOF, the Principal and the Surety have caused these presents to be executed in their respective names this ____ day of _____ 20__.

Principal: _____	Surety: _____ Corporate Seal (where appropriate)
_____ *(Signature)*	_____ *(Signature)*
(Printed name and title)	*(Printed name and title)*

[12] The amount of the Bond shall be denominated in the currency of the *Employer's Country* or the equivalent amount in a freely convertible currency.

Schedule of Prices

REFER TO SEPARATE (EXCEL FILE)

PART 1, VOLUME 1A - SCHEDULES OF RATES AND PRICES – LOT 1 and LOT 2

General

1. The Price Schedules are divided into separate Schedules as follows and apply separately to LOT 1 and LOT 2; Bidders must fill in a complete set of schedules per lot offered:

   LOT 1

   - Schedule No. 1: Plant and Mandatory Spare Parts Supplied from Abroad
   - Schedule No. 2: Plant and Mandatory Spare Parts Supplied from within the Employer's Country
   - Schedule No. 3: Design Services
   - Schedule No. 4: Installation and Other Services
   - Schedule No. 5: Grand Summary
   - Schedule No. 6: Recommended Spare Parts
   - Schedule No 7: Genset Maintenance

   LOT 2

   - Schedule No. 1: Plant and Mandatory Spare Parts Supplied from Abroad
   - Schedule No. 2: Plant and Mandatory Spare Parts Supplied from within the Employer's Country
   - Schedule No. 3: Design Services
   - Schedule No. 4: Installation and Other Services
   - Schedule No. 5: Grand Summary
   - Schedule No. 6: Recommended Spare Parts

2. The Schedules do not generally give a full description of the plant to be supplied and the services to be performed under each item. Bidders shall be deemed to have read

the Employer's Requirements and other sections of the Bidding Document and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to cover the full scope as aforesaid, including overheads and profit.

3. If Bidders are unclear or uncertain as to the scope of any item, they shall seek clarification in accordance with ITB 7 prior to submitting their bid.

Pricing

4. The units and rates in figures entered into the Price Schedules should be typewritten or if written by hand, must be in print form. Price Schedules not presented accordingly may be considered nonresponsive.

   Any alterations necessary due to errors, etc., shall be initialed by the Bidder.

   As specified in the Bid Data Sheet and Special Conditions of Contract, prices shall be fixed and firm for the duration of the Contract.

5. Bid prices shall be quoted in the manner indicated and in the currencies specified in the Instructions to Bidders in the Bidding Document.

   For each item, Bidders shall complete each appropriate column in the respective Schedules, giving the price breakdown as indicated in the Schedules.

   Prices given in the Schedules against each item shall be for the scope covered by that item as detailed in Section 7 (Employer's Requirements) or elsewhere in the Bidding Document.

6. Payments will be made to the Contractor in the currency or currencies indicated under each respective item.

7. When requested by the Employer for the purposes of making payments or partial payments, valuing variations or evaluating claims, or for such other purposes as the Employer may reasonably require, the Contractor shall provide the Employer with a breakdown of any composite or lump sum items included in the Schedules.

BIDDERS MAY REQUEST MICROSOFT EXCEL VERSIONS OF THESE MATRICES
PLEASE CONTACT THE PROJECT MANAGER, KAMALESH DOSHI
kamaleshdoshi@mecrmi.net

SCHEDULE OF RATES AND PRICES
LOT 1: Plant Design Supply and Installation of Power Station Upgrade and BESS

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad
LOT 1: Plant Design Supply and Installation of Power Station Upgrade and BESS

Item	Description	Code[1] (country)	Qty. (1)	Unit Price[2] Currency	Unit Price[2] CIP	Total Price[2] (1) x (3)
SUB-TOTAL LOT 1 SCHEDULE 1 (to Schedule No. 5. Grand Summary)						

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.

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Supplied from within the Employer's Country
LOT 1: Plant Design Supply and Installation of Power Station Upgrade and BESS

Item	Description	Code[1] (country)	Qty. (1)	Unit Price[2] Currency	Unit Price[2] CIP	Total Price[2] (1) x (3)
SUB-TOTAL LOT 1 SCHEDULE 2 (to Schedule No. 5. Grand Summary)						

Schedule No. 3. Design Services
LOT 1: Plant Design Supply and Installation of Power Station Upgrade and BESS

Item	Description	Qty.	Unit Price[1]	Total Price[1]

		(1)	Local Currency Portion (2)	Foreign Currency Portion (optional)	(1) x (2)
SUB-TOTAL LOT 1 SCHEDULE 3 (to Schedule No. 5 Grand Summary)					

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

Schedule No. 4. Installation and Other Services

LOT 1: Plant Design Supply and Installation of Power Station Upgrade and BESS

Item	Description	Qty. (1)	Unit Price[1] Foreign Currency Portion (2)	Unit Price[1] Local Currency Portion (3)	Total Price[1] Foreign (1) x (2)	Total Price[1] Local (1) x (3)
	Manuals					
	Special Tools Engines per Compliance Matrix 1 G					
	Special Tools Plant and Equipment Complinace Matrix 6C					
	Training					
	Civil Works					
	Demolition					
	Supply and Installation Equipment & Plant					
	Installation Building					
	Services					
	Container/s* (to be rented or Purchased) for storage of Bidder's Equipment and Materials on site at the Majuro Port.					
	** Fees charged by Port Authority for rental of Space for Containers at Port and for Security of Containers at Port					
SUB-TOTAL LOT 1 SCHEDULE 4 (to Schedule No. 5. Grand Summary)						

to be purchased or rented for the duration of the Contract and will remain the Property of the MEC at Contract Conclusion

***** If Applicable***

Schedule No. 5 GRAND SUMMARY

LOT 1: Plant Design Supply and Installation of Power Station Upgrade and BESS

Item	Description	Total Price[1] Foreign	Total Price[1] Local
	Total Schedule No. 1. Plant, and Mandatory Spare Parts Supplied from Abroad		
	Total Schedule No. 1		
	Total Schedule No. 2. Plant, and Mandatory Spare Parts Supplied from within the Employer's Country		
	Total Schedule No. 2		

	Total Schedule No. 3. Design Services		
	Total Schedule No. 3		
	Total Schedule No. 4. Installation and Other Services		
	Total Schedule No. 4		
GRAND TOTAL (to Bid Form)			

Name of Bidder

Signature of Bidder

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

Costs for Schedule 6 and Schedule 7 are not included in overall cost of Price offered, but are evaluated technically

Schedule No. 6. Recommended Spare Parts

LOT 1: Plant Design Supply and Installation of Power Station Upgrade and BESS

Item	Description	Qty.	Unit Price[1] (CIF orCIP) Foreian	Total Price[1] Foreign
		(1)	*(2)*	*(1) x (2) or (3)*
TOTAL LOT 1 SCHEDULE 6				

Name of Bidder

Signature of Bidder

Schedule No. 7. Genset Maintenance Program and Spare Parts

LOT 1: Plant Design Supply and Installation of Power Station Upgrade and BESS

Item	Description	Qty.	Unit Price[1] (CIF orCIP) Foreign Currency Portion	Total Price[1] Foreign
		(1)	*(2)*	*(1) x (2) or (3)*
TOTAL LOT 1 SCHEDULE 7				

Name of Bidder

Signature of Bidder

SCHEDULE OF RATES AND PRICES
LOT 1: Supply and Installation of PV System and Associated Controls

Schedule No. 1. Plant and Mandatory Spare Parts Supplied from Abroad
LOT 2: Supply and Installation of PV System and Associated Controls

Item	Description	Code[1] (country)	Qty. (1)	Unit Price[2] Currency	Unit Price[2] CIP	Total Price[2] (1) x (3)
SUB-TOTAL LOT 2 SCHEDULE 1 (to Schedule No. 5. Grand Summary)						

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.

Schedule No. 2. Plant and Mandatory Spare Parts Supplied from Supplied from within the Employer's Country
LOT 2: Supply and Installation of PV System and Associated Controls

Item	Description	Code[1] (country)	Qty. (1)	Unit Price[2] Currency	Unit Price[2] CIP	Total Price[2] (1) x (3)
SUB-TOTAL LOT 1 SCHEDULE 2 (to Schedule No. 5. Grand Summary)						

Schedule No. 3. Design Services
LOT 2: Supply and Installation of PV System and Associated Controls

Item	Description	Qty. *(1)*	Unit Price[1] Local Currency Portion *(2)*	Unit Price[1] Foreign Currency Portion *(optional)*	Total Price[1] *(1) x (2)*

SUB-TOTAL LOT 1 SCHEDULE 3 (to Schedule No. 5 Grand Summary)					

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

Schedule No. 4. Installation and Other Services
LOT 2: Supply and Installation of PV System and Associated Controls

Item	Description	Qty.	Unit Price[1]		Total Price[1]	
			Foreign Currency Portion	Local Currency Portion	Foreign	Local
		(1)	*(2)*	*(3)*	*(1) x (2)*	*(1) x (3)*
	Container/s* (to be rented or Purchased) for storage of Bidder's Equipment and Materials on site at the Majuro Port.					
	** Fees charged by Port Authority for rental of Space for Containers at Port and for Security of Containers at Port					
	Special Tools					
	Training					
	Manuals					
SUB-TOTAL LOT 1 SCHEDULE 4 (to Schedule No. 5. Grand Summary)						

to be purchased or rented for the duration of the Contract and will remain the Property of the MEC at Contract Conclusion
***** If applicable***

Schedule No. 5 GRAND SUMMARY
LOT 2: Supply and Installation of PV System and Associated Controls

Item	Description	Total Price[1]	
		Foreign	Local
	Total Schedule No. 1. Plant, and Mandatory Spare Parts Supplied from Abroad		
	Total Schedule No. 1		
	Total Schedule No. 2. Plant, and Mandatory Spare Parts Supplied from within the Employer's Country		
	Total Schedule No. 2		
	Total Schedule No. 3. Design Services		
	Total Schedule No. 3		
	Total Schedule No. 3. Installation and Other Services		
	Total Schedule No. 4		
GRAND TOTAL (to Bid Form)			

Name of Bidder **Signature of Bidder**

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

Schedule No. 6. Recommended Spare Parts

LOT 2: Supply and Installation of PV System and Associated Controls

Item	Description	Qty.	Unit Price[1]	Total Price[1]
		(1)	(CIF orCIP) Foreign Currency Portion *(2)*	Foreign *(1) x (2) or (3)*

TOTAL LOT 2 SCHEDULE 6

	Name of Bidder **Signature of Bidder**

Price Adjustment

Not Applicable

Per ITB 17.7 this Contract is not subject to Price Adjustment and for the term of the contract the Price shall be fixed

Technical Proposal

TECHNICAL PROPOSAL REQUIREMENTS APPLY TO LOT 1 AND LOT 2 AND IF SUBMITTING FOR BOTH LOTS MUST PROVIDE SEPARATE PROPOSALS

All parts listed below of The Technical Proposal below must be provided in detail for each Lot Bid for.

This technical Information will be used to evaluate how applicable and acceptable your site, methodology, scheduling and construction are to the Employer and to assess your understanding of and ability to address the Scope required.

Failure to follow these directions may lead to your bid being considered as incomplete and not suitable for evaluation.

- Site Organization
- Method Statement
- Mobilization Schedule
- Construction Schedule
- Plant
- Contractor's Equipment (Not used for Evaluation Purposes)
- Personnel
- Proposed Subcontractors for Major Items of Plant and Installation Services
- Evaluation Compliance Matrix; Refer to Excel File Volume 1B LOT 1 & 1C Lot 2 of the Bid Documents
- Environmental, Health, Gender and Quality Management Plan Outlines

Site Organization

*For **Each LOT** Submitted for;*

The Bidder must show the following detail;

i. *Overall Organisation Chart showing division between site and head office responsibilities*

ii. *Site Organisation Chart clearly showing responsibilities and functions*

iii. *Liaison with Engineer and Employer*

iv. *Liaison with Stakeholders*

v. *Preliminary layout of contractor's facilities including offices*

Method Statement

LOT 1

General

- Staging plan
- Logistics and storage Safety plan
- Materials quality control process
- Location and management of utilities (telecommunications, power, water, waste, etc.)
- Testing and commissioning plan

Civil and Structural works

- Demolition
- Control of dust and hazardous materials
- Waste disposal
- Concrete, sand and aggregate – source and quality control
- Steel – source and quality control
- Construction methods

Gensets & auxiliaries

- Source, procurement and shipping
- Installation
- Testing and commissioning

Fuel and oil systems

- Materials quality control
- Installation quality control
- Management of leaks/spills
- Testing

Pipework and valves

- Materials quality control
- Installation quality control
- Management of leaks/spills
- Testing

Modular gensets

- Source, procurement and shipping
- Installation

- Testing and commissioning

Battery Energy Storage System

- Source, procurement and shipping
- Installation
- Testing and commissioning

Control system

- Design & control philosophy
- Installation
- Integration with BESS and PV
- Testing and commissioning

Switchboards

- Source, procurement and shipping
- Quality control
- Installation
- Testing and commissioning

LOT 2

General

- Staging plan
- Logistics and storage
- Safety plan
- Materials quality control process
- Location and management of utilities (telecommunications, power, water, waste, etc.)
- Testing and commissioning plan

Civil and structural work

- Concrete, sand and aggregate – source and quality control
- Steel – source and quality control
- Construction methods

Reservoir liners

- Source, procurement and shipping
- Quality control
- Installation
- Testing

Reservoir floating PV system

- Source, procurement and shipping
- Quality control
- Installation
- Testing and commissioning

Rooftop PV systems

- Source, procurement and shipping
- Quality control
- Installation
- Testing and commissioning

Control & monitoring system

- Design & control philosophy
- Installation
- Integration with power station control system
- Testing and commissioning

Mobilization Schedule

The Bidder must show realistic, adequately detailed mobilisation of staff, resources and equipment and materials to site, identify all significant activities, take due account of rainy season, environmental constraints, logistics etc).

LOT 1 MOBILISATION SCHEDULE

Mobilisation Resources, Materials, Plant and Equipment

The Bidder must show realistic, adequately detailed mobilisation of staff, resources, equipment and materials to site, identify all significant activities, take due account of rainy season, environmental constraints, (5 pages maximum)

LOT 2 MOBILISATION SCHEDULE

Mobilisation Resources, Materials, Plant and Equipment

The Bidder must show realistic, adequately detailed mobilisation of staff, resources, equipment and materials to site, identify all significant activities, take due account of rainy season, environmental constraints, (5 pages maximum)

Construction Schedule

Bidders shall describe the methods they will use to carry out the Contract Works on time and to the standards specified and must also submit a program for the Works. Bidders must also describe the means and methods by which the desired results will be achieved in a practicable and efficient manner with the aim to meet the standards specified in the Contract and in Section 7 of the Bid Documents. (5 pages maximum).

The following must be addressed;

LOT 1

a. Site establishment including Contractor's Site facilities
b. Staging of works to ensure power supply is maintained
c. Sand and aggregate supply
d. Procurement and delivery of temporary gensets
e. Demolition
f. Building works
g. Procurement and installation of gensets and associated equipment
h. Procurement and installation of switchgear
i. Fuel and oil systems Control system
j. BESS

LOT 2:

a. Site establishment including Contractor's Site facilities
b. Sand and aggregate supply
c. Floating PV systems – supply of components, coordination with water utility
d. Rooftop PV systems - co-ordination with facilities owners, in particular for schools

Plant

Quality Plan Outline

The Bidder's Proposed Quality Plan should outline the following. A Final Quality Plan will be required by the Successful Bidder at Contract signing

a. Responsibilities
b. Outline of inspection and test plans
c. Materials sources and certificates
d. Inspection and testing plan for approval of materials prior to loading / shipping
e. Specialist testing providers
f. Communication processes.
g. Audit
h. Reporting

Health, HIV & Safety Plan Outline

The Bidder's Proposed Health and Safety Plan should outline the following. A Final Health and Safety Plan will be required by the Successful Bidder at Contract signing

a. Responsibilities
b. HIV/AIDS awareness and training
c. Safe work method statements
d. Worker induction and training
e. Emergency action plan
f. First aid facilities
g. records

Environmental Management Plan Outline

The Bidder's Proposed Environmental Management Plan should outline the following. A Final Environmental Management Plan will be required by the Successful Bidder at Contract signing

a. Responsibilities
b. Copy of the Contractor's Environmental Policy
c. Key elements to be addressed in the Construction Environmental Management Plan (CEMP)
d. Worker induction and training
e. Outline of how the Contractor will adhere to the approved CEMP.
f. Inspections and audits
g. Records

Gender Management Plan Outline

The Bidder's Proposed Gender Management Plan should outline the following. A Final Gender Management Plan will be required by the Successful Bidder at Contract signing

a. Responsibilities in line with the requirements of the Project's Gender Action Plan and **applicable** Government's policy on gender

b. Plans to achieve all the Project's Gender Action Plan activities/targets under the contractor's responsibility.

c. Monitoring and reporting/recording

Evaluation Compliance Matrix

Bidders are to complete this compliance matrix and submit it with their tender documents. Any comments or clarifications from bidders shall follow this table with clear reference to the "Specification Reference" number.

REFER TO SEPARATE EXCEL FILE

PART 1, VOLUME 1B COMPLIANCE MATRIX LOT 1 and

PART 1, VOLUME 1C COMPLIANCE MATRIX LOT 2

BIDDERS ARE TO TAKE NOTE OF THE FOLLOWING EXPLANATIONS AND INSTRUCTIONS WHEN FILLING OUT THE TECHNICAL COMPLIANCE MATRICES

The following COMPLIANCE MATRICES will be used for the Technical Evaluation of all items proposed. Each Schedule of the Compliance Matrix defines minimum/maximum or specific technical requirements that must be complied with. The Bidder is advised to reference, at all times, SECTION 7 TECHNICAL SPECIFICATIONS AND DRAWINGS.

DEPARTURE FROM SPECIFICATIONS

The Bidder is to fill out in detail each Compliance Matrix, per line item and where necessary insert the Documentary Evidence reference for correlation by Evaluators. Where an item departs from the specification, the Bidder is required to fully explain the departure and to support the departure with Documentary evidence.

DOCUMENTARY EVIDENCE

The Bidder is advised to be diligent in the provision of documentary evidence where requested; this includes and may not be limited to supporting brochurs, product catalogues, type test reports, Factory Accetance testing, data sheets, complinace to standards

STANDARDS

Where a particular Standard is expressed, any comparable equivalent recognised International or National standard may be used

IMPERIAL & METRIC REQUIREMENTS

Where a Specifications call for an IMPERIAL measurement (the Republic of the Marshall Islands follows the US Imperial method and Standards) Bidder may substitute Metric Equivalents with, where possible accurate conversions to imperial (and Vice-versa). In all cases, at all times, equipment must be compatible.

BRAND NAMES

are examples only and equivalent Brands may be offered.

BIDDERS MAY REQUEST MICROSOFT EXCEL VERSIONS OF THESE MATRICES
PLEASE CONTACT THE PROJECT MANAGER, KAMALESH DOSHI
kamaleshdoshi@mecrmi.net

DOCUMENTATION

Compliance Matrix Technical Schedule Number	Method Statements Per Section 4 Bidding Forms	Manufacturer's Authorisations	Product Data Sheets	Type Test Reports	FAT	Product Catlogues	Supporting calculation	Certification	Warranty	Local Agent support
1A. Gensets	Yes	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
1B Site power Rating							Yes			
1C. Fuel & Oil Consumption	Yes		Yes	Yes				Yes	Yes	
1D. Genset Load			Yes	Yes			Yes			
1E. Low load & Cold Start			Yes	Yes			Yes			
1F. Genset Maintenance			Yes							
1G. Special Tools			Yes							

Compliance Matrix Technical Schedule Number	Method Statements Per Section 4 Bidding Forms	Manufacturer's Authorisations	Product Data Sheets	Type Test Reports	FAT	Product Catlogues	Supporting calculation	Certification	Warranty	Local Agent support
1H. Manuals										
2. Cooling Exhaust & Waste Water	Yes		Yes	Yes	Yes			Yes	Yes	
3. Modular Containerized Gensets	Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes
4A. Battery Energy Storage	Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes
4B. Power Conversion System			Yes	Yes	Yes			Yes	Yes	Yes
4C. Coupling Transformer			Yes	Yes	Yes			Yes	Yes	
4D. Bess Enclosure			Yes					Yes	Yes	
5. Control System Data	Yes	Yes	Yes	Yes				Yes	Yes	Yes

Compliance Matrix Technical Schedule Number	Method Statements Per Section 4 Bidding Forms	Manufacturer's Authorisations	Product Data Sheets	Type Test Reports	FAT	Product Catlogues	Supporting calculation	Certification	Warranty	Local Agent support
6A. MV SwitchBoard	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
6B. Plant Guaranteed Performance							Yes		Yes	
6C. Special Tools			Yes						Yes	
7. Auxilliary Switchboard										
8. Warranty	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
9. Spares			Yes							Yes
10. Civil Works	Yes		Yes					Yes	Yes	

LOT 1 COMPLIANCE MATRIX
1A - GENSETS

Parameter	Unit	Min req't/Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Genset					
Make		5.3			
Model		5.3			
Country of Manufacture		5.3			
Overall Length	[mm]	5.3			
Overall Width	[mm]	5.3			
Overall Height	[mm]	5.3			
Mass - wet (operating)	[kg]	5.3			
Mass - dry	[kg]	5.3			
Rated Speed	[RPM]	5.3.7			
Steady State speed governing band (Ref ISO 8528)	[%]	5.3.4.2			
Anti Vibration Mountings Type		5.3.9.3			
Anti Vibration Mountings Model		5.3.9.3			

Parameter	Unit	Min req't/Specification reference	Tendered	**Reference Document** *clearly show cross reference to catalogue/data sheet etc*	**Departure from Spec** *clearly define departure from spec and include cross reference to proposed item brochure*
Cylinder configuration (V or inline)		5.3.7			
No of cylinders		5.3.7			
Bore	[mm]	5.6.5			
Stroke	[mm]	5.3.7			
Compression Ratio		5.3.7			
Number of Turbochargers		5.3.7			
Engine starting system details - tenderer to provide atta	**Yes / No**	**5.3.7.7**			
Full functional details of the ECM - tenderer to provide	**Yes / No**	**5.3.7.3**			
Fuel Filter Type		5.3.7.9			
Fuel Filter Filtration level	[mm]	5.3.7.9			
Fuel Filter replacement interval		5.3.7.9			
Recommended oil type		5.3.7.10			
Recommended oil grade		5.3.7.10			
Engine sump volume	[L]	5.3.7.10			
Lubricating Oil Filter Type		5.3.7.10			

Parameter	Unit	Min req't/Specification reference	Tendered	**Reference Document** *clearly show cross reference to catalogue/data sheet etc*	**Departure from Spec** *clearly define departure from spec and include cross reference to proposed item brochure*
Lubricating Oil Filter Replacement Frequency	[hrs]	5.3.7.10			
Lubricating Oil Filter Level	[mm]	5.3.7.10			
Lubricating oil auxiliary equipment details - tenderer to	**Yes / No**	**5.3.7.10**			
Lubricating oil testing and sampling equipment details -	**Yes / No**	**5.3.7.10**			
Coolant system volume - engine block	[L]	5.3.7.4			
Coolant Filter Type		5.3.7.4			
Coolant Filter Filtration level	[mm]	5.3.7.4			
Coolant Filter replacement interval		5.3.7.4			
Coolant treatment details - tenderer to supply attachm	**Yes / No**	**5.3.7.4**			
Air Intake Filter Type		5.3.7.6			
Air Intake Filter Service Interval		5.3.7.6			
Air Intake Filter Flow Rate at 6" of H_2O Column	[L/s]	5.3.7.6			
Exhaust gas flow at rated power	[m^3/s]	5.6			
Max Exhaust Temperature	[^oC]	5.6			
Max allowable exhaust restriction	[kPa]	5.6			

Parameter	Unit	Min req't/Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Exhaust lagging details (turbo & elbow) – tenderer to supply attachment	**Yes / No**	**5.6**			
Engine noise measured @ 1m distance (ISO 6798)	[dB(A)]	5.11.3			
Crankcase ventilation details - tenderer to supply attac	**Yes / No**	**5.3.7.11**			
Full alternator details - tenderer to supply attachment	**Yes / No**	**5.3.8**			
Alternator bearing details - tenderer to supply attachm	**Yes / No**	**5.3.8.5**			
Flexible coupling details - tenderer to supply attachmer	**Yes / No**	**5.3.8.6**			
Alternator winding corrosion treatment details - tender	**Yes / No**	**5.3.8.7**			
Alternator heater details -tenderer to supply attachmer	**Yes / No**	**5.3.8.7**			
Alternator air filter details - tenderer to supply attachm	**Yes / No**	**5.3.7.9**			

LOT 1 COMPLIANCE MATRIX
1B SITE POWER RATING

The Guaranteed Site Power Rating of the generating sets offered in accordance with ISO 8528 -1:1993 Unlimited Prime Power [PRP] classification at the specified site conditions is confirmed in the below table.

Parameter	**kWe**	**Min req't/ Specification reference**	**Tendered**	**Reference Document** *clearly show cross reference to catalogue/data sheet etc*	**Departure from Spec** *clearly define departure from spec and include cross reference to proposed item brochure*
Generator Set Prime Power Rating (as defined in ISO 8528-1:1993 (PRP))		5.3.2			

The engine ISO standard power exceedable by 10 % (ICXN) rating is confirmed in the below table.

Parameter	**kWb**	**Min req't**	**Tendered**	**Reference Document** *clearly show cross reference to catalogue/data sheet etc*	**Departure from Spec** *clearly define departure from spec and include cross reference to proposed item brochure*
ISO standard power exceed able by 10% (ISO 3046-1 ICXN)		5.3.2			

The engine ISO service standard power exceedable by 10% (SCXN) is confirmed in the below table. (Engine Guaranteed Site Power Rating)

Parameter	kWb	Min req't	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
ISO service standard power able to be exceeded by 10% (ISO 3046-1 SCXN)		5.3.2			

The engine Break Mean Effective Pressure at Guaranteed Site Power Rating is confirmed in the below table. (Engine Guaranteed Site Power Rating)

Parameter	kPa	Min req't	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
BMEP		5.3.3.2 and Appendix 3			

The Tenderer shall supply supporting calculations to demonstrate the Guaranteed Site Power Rating as per Appendix 2 of the Technical Specifications (Section 7 of Bid Documents)

LOT 1 COMPLIANCE MATRIX

1C FUEL & OIL CONSUMPTION

Guaranteed Site Fuel Consumption at: -	Unit	Min req't/Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
110% rated site power		5.3.4			
100% rated site power		5.3.4			
80% rated site power		5.3.4			
60% rated site power		5.3.4			
40% rated site power		5.3.4			
10% rated site power		5.3.4			

The Contractor shall supply supporting calculations to demonstrate the Guaranteed Site Fuel Consumption in accordance with ISO 3046.1

The **typical oil consumption** to be confirmed in the table below:

Parameter	Litres/hr	Min req't/Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*

Oil consumption at 70% Average Load Factor		5.3.7			

The **typical oil change interval** to be confirmed in the table below:

Parameter	Litres/hr	Min req't/Specification reference	Tendered	**Reference Document** *clearly show cross reference to catalogue/data sheet etc*	**Departure from Spec** *clearly define departure from spec and include cross reference to proposed item brochure*
Lubricating oil change interval At 70 % Average Load Factor		5.3.7			

LOT 1 COMPLIANCE MATRIX
1D GENSET LOAD ACCEPTANCE & RAMP RATES

Genset Load Acceptance

The Contractor shall provide the following information for each genset provided:

Ref	Parameter	Unit	Minimum Requirement/Specification reference	Tendered	**Reference Document** *clearly show cross reference to catalogue/data sheet etc*	**Departure from Spec** *clearly define departure from spec and include cross reference to proposed item brochure*
1.1	Contractors recommended maximum first stage load application (% of rated load) at 720/900 rpm (60 Hz), 0% rated load	% of rating*	5.3.4.3			
1.2	Maximum transient frequency drop	Hz	5.3.4.3			
1.3	Frequency recovery time	sec	5.3.4.3			
2.1	Contractors recommended maximum second stage load application at 720/900 rpm (60 Hz)	% of rating*	5.3.4.3			
2.2	Maximum transient frequency drop (Hz)	Hz	5.3.4.3			
2.3	Frequency recovery time (sec)	sec	5.3.4.3			

Ref	Parameter	Unit	Minimum Requirement/Specification reference	Tendered	**Reference Document** *clearly show cross reference to catalogue/data sheet etc*	**Departure from Spec** *clearly define departure from spec and include cross reference to proposed item brochure*
3.1	Contractors recommended maximum third stage load application at 720/900 rpm (60 Hz),	% of rating*	5.3.4.3			
3.2	Maximum transient frequency drop	Hz	5.3.4.3			
3.3	Frequency recovery time	sec	5.3.4.3			

Note: Stage load acceptance to be percentage step of the ***Guaranteed Site Power Rating***

Ramp Rate

The Contractor shall provide the following information for each genset provided:

	Parameter	Unit	Minimum Requirement/Specification reference	Tendered	**Reference Document** *clearly show cross reference to catalogue/data sheet etc*	**Departure from Spec** *clearly define departure from spec and include cross reference to proposed item brochure*
	Genset ramp up rate	% of rating* / sec	5.3.3.4			
	Genset ramp down rate	% of rating* / sec	5.3.3.4			
	Ramp rate supporting details - tenderer to supply attachment	**Yes / No**				

Ref	Parameter	Unit	Minimum Requirement/Specification reference	Tendered	**Reference Document** *clearly show cross reference to catalogue/data sheet etc*	**Departure from Spec** *clearly define departure from spec and include cross reference to proposed item brochure*

Note: Ramp rate to be percentage step of the ***Guaranteed Site Power Rating***

LOT 1 COMPLIANCE MATRIX

1E LOW LOAD & COLD START OPERATION

Low Load

The Contractor shall state the low load level achievable for a period of 8 hours / day. The low load level shall be stated as a percentage of Guaranteed Site Power Rating (GSPR) of the genset.

Parameter	% GSPR	Minimum Requirement/Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Low load level		5.3.3.5			

The contractor shall state any implications or limitations on the operation of the genset at low loads in accordance with clause 5.3.5.1.

Parameter	% GSPR	Minimum Requirement	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
		5.3.5.1			
		5.3.5.1			
		5.3.5.1			
		5.3.5.1			
		5.3.5.1			

Cold Start

The contractor shall state any implications or limitations on the operation of the genset at low loads in accordance with clause 5.3.5.1.

Parameter	% GSPR	Minimum Requirement	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
		5.3.5.1			
		5.3.5.1			
		5.3.5.1			
		5.3.5.1			
		5.3.5.1			
		5.3.5.1			

LOT 1 COMPLIANCE MATRIX 1F GENSET MAINTENANCE PROGRAM

The Contractor shall provide details of the manufacturer's recommended maintenance program (with due consideration of normal wear of the engines in similar applications) including work to be carried out at various intervals to ***100,000 hours*** *, the estimated time to carry out the work and the estimated cost of spare parts required. Where maintenance 'on condition', including fuel burned or kWh produced is required, Contractors shall base the requirements on an average load factor of 70%.*

Please include all costs associated with the proposed maintenance Program including necessary spare parts into LOT 1 Price Schedule No 7

LOT 1 COMPLIANCE MATRIX
1G SPECIAL TOOL REQUIREMENTS - ENGINES

Contractor to list down all special tools required for service, maintenance, disassembly and assembly of the engines as per Specification. Provide full breakdown showing quantities with descriptions of all special tools. Please input all costs and items into LOT 1 PRICE SCHEDULE 4. THESE PRICES WILL FORM PART OF THE SUBMITTED AND EVALUATED PRICE OFFERED.

Item	Quantity	Description

The Contractor shall advise details of any CMMS systems offered and its suitability for auxiliary and ancillary equipment	Specification reference
	5.3.7.8
	5.3.7.8
	5.3.7.8
	5.3.7.8
	5.3.7.8

LOT 1 COMPLIANCE MATRIX
1H MANUALS

The Contractor shall provide details of the following and shall provide all costs into LOT 1 Price Schedules No 4 :

Parameter	Language	No Of Copies	Hard Copy	Online Access
Details of electronic / online manual system details (provide exact titles and numbers of and types of manuals to be offered)				
Title 1				
Title 2				
etc				

LOT 1 COMPLIANCE MATRIX
2 - COOLING, EXHAUST & WASTE WATER SYSTEM DATA

Parameter	Unit	Minimum Requirement/Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Radiator manufacturer's data/specification sheet - tenderer to provide attachment		5.5.1			
Radiator noise measured @ $1^{9}/_{32}$' (1m) distance (ISO 6798)	[dB(A)]	5.5.3			
Details of modifications to accommodate an exhaust gas boiler - tenderer to provide attachment		5.6.1			
Exhaust noise measured @ $1^{9}/_{32}$' (1m) distance (ISO 6798)	[dB(A)]	5.6.6			
Details of oil/water separator offered – tenderer to provide attachment		5.9			

LOT 1 COMPLIANCE MATRIX

3 – MODULAR CONTAINERISED GENSETS DATA

Parameter	Unit	Minimum Requirement/ Specification reference	Tendered	**Reference Document** *clearly show cross reference to catalogue/data sheet etc*	**Departure from Spec** *clearly define departure from spec and include cross reference to proposed item brochure*
Details of containerised gensets proposed - tenderer to provide attachment		5.11			
Noise level measured @ $1^{9}/_{32}$' (1m) distance (ISO 6798)	[dB(A)]	5.11.3			

LOT 1 COMPLIANCE MATRIX
4A BATTERY ENERGY STORAGE

Parameter	Unit	Minimum Requirement/ specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Battery Manufacturer's Data Sheet - tenderer to supply attachment		5.12	**Yes / No**		
Battery Cells		5.12.3			
Make		5.12.3			
Cathode Type		5.12.3			
Anode Type		5.12.3			
Nominal Voltage	V_{DC}	5.12.3			
Voltage Range	V_{DC}	5.12.3			
Capacity	Ah	5.12.3			
Form Factor (Prismatic, Cylindrical, Pouch etc.)		5.12.3			
Battery Management System		5.12.3			
Model		5.12.3			
Make		5.12.3			
Cell Voltage Monitoring?		5.12.3			
Cell Temperature Monitoring?		5.12.3			
Battery Modules		5.12.3			

Parameter	Unit	Minimum Requirement/ specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Model		5.12.3			
Make		5.12.3			
Cell Configuration (eg. 14S2P)		5.12.3			
Cell Cooling Mechanism		5.12.3			
Cell Balancing Mechanism		5.12.3			
Dimensions	mm	5.12.3			
Weight	kg	5.12.3			
Voltage Range	V_{DC}	5.12.3			
Nominal Voltage	V_{DC}	5.12.3			
Capacity	Wh	5.12.3			
Maximum Depth of Discharge	%	5.12.3			
Usable Capacity	Wh	5.12.3			
Round-Trip Efficiency @ 2C/1C/C2	%	5.12.3			
Maximum Series Voltage	V_{DC}	5.12.3			
Communications Port(s)		5.12.3			
Communications Protocol(s)		5.12.3			
Casing Material		5.12.3			
Ingress Protection Rating		5.12.3			

Parameter	Unit	Minimum Requirement/ specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Battery Control Module		5.12.3			
Model		5.12.3			
Make		5.12.3			
Maximum Number of Battery Modules		5.12.3			
Communications Port(s)		5.12.3			
Communications Protocol		5.12.3			
Ingress Protection Rating		5.12.3			
Dimensions		5.12.3			
Weight		5.12.3			
Casing Material		5.12.3			
Battery Racking		5.12.3			
Material		5.12.3			
Weight		5.12.3			
Dimensions		5.12.3			

LOT 1 COMPLIANCE MATRIX
4B POWER CONVERSION SYSTEM

Parameter	Unit	Minimum Requirement/ specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*
PCS Manufacturer Data Sheet - attachment supplied		**5.12.4**		
Inverter Modules		**5.12.4**		
Model		**5.12.4**		
Make		**5.12.4**		
AC Connection Type		**5.12.4**		
Communications Port(s)		**5.12.4**		
Communication Protocol(s)		**5.12.4**		
Maximum Continuous AC Output at 25°C	kVA	**5.12.4**		
Short-Circuit/Overload Capacity/Duration at 25°C	A or %	**5.12.4**		
Maximum Continuous AC Output at 35°C	kVA	**5.12.4**		
Short-Circuit/Overload Capacity/Duration at 35°C	A or %	**5.12.4**		
Maximum Efficiency	%	**5.12.4**		
Efficiency at 25%/50%/75%/100% Load at 25°C	%	**5.12.4**		
DC Voltage Range	V_{DC}	**5.12.4**		

Parameter	Unit	Minimum Requirement/ specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*
Maximum DC Current at 25°C	A	**5.12.4**		
Maximum DC Current at 35°C	A	**5.12.4**		
Nominal AC Coupling Voltage	V_{AC}	**5.12.4**		
AC Voltage Range	V_{AC}	**5.12.4**		
Nominal Frequency	Hz	**5.12.4**		
Frequency Range	Hz	**5.12.4**		
Total Harmonic Distortion (grid-connect mode)		**5.12.4**		
Power Factor Range (leading)		**5.12.4**		
Power Factor Range (lagging)		**5.12.4**		
Dimensions	mm	**5.12.4**		
Weight	kg	**5.12.4**		
Ingress Protection Rating		**5.12.4**		
Casing Material		**5.12.4**		
Inverter Enclosure		5.12.2		
Maximum Inverter Modules per Enclosure		5.12.2		
Casing Material		5.12.2		

Parameter	Unit	Minimum Requirement/ specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*
Cooling Mechanism		5.12.2		
Ingress Protection Rating		5.12.2		
In-Built Display?		5.12.2		
Weight		5.12.2		
Dimensions		5.12.2		

Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*

Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*

Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*

LOT 1 COMPLIANCE MATRIX
4C COUPLING TRANSFORMER

Tenders must complete the tables for each transformer type proposed. All transformers must be produced by the same manufacturer.

Parameter	Units	Value	Minimum Requirement/ specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Manufacturer			5.12.5			
Model			5.12.5			
Rated primary voltage			5.12.5			
Rated secondary voltage			5.12.5			
Rated power			5.12.5			
Vector grouping			5.12.5			
Rated frequency			5.12.5			
Number of phases			5.12.5			
No-load current with rated voltage applied to the principal tapping			5.12.5			
No-load current with 110% rated voltage applied to the principal A tapping			5.12.5			
No load loss			5.12.5			

Load loss at 75°C			5.12.5			
Cooling type			5.12.5			
Impedance voltage at rated current and 75°C			5.12.5			
Tap changer levels			5.12.5			
Type of material used for windings - HV			5.12.5			
Type of material used for windings - LV			5.12.5			
Type and class of insulation on windings			5.12.5			
Maximum dielectric stress on winding insulation			5.12.5			
Protective treatment to oil tank - internal			5.12.5			
Protective treatment to oil tank - external			5.12.5			
Overall dimensions (length x width x depth)	inch		5.12.5			
Weight without oil	lb		5.12.5			
Weight with oil	lb		5.12.5			
Volume of oil required	gallons		5.12.5			
Housing material			5.12.5			

Bushings

Parameter	Units	Value				Specification Reference
		HV	LV		Neutral	
Manufacturer						5.12.5
Model						5.12.5
Material						5.12.5
Continuous current rating	A					5.12.5
Voltage rating	V					5.12.5
Number per transformer						5.12.5
Lightening Impulse flashover	KVp					5.12.5
Creepage distance	inch					5.12.5
Minimum air clearance between phases	Inch					5.12.5
Phase to earth	inch					5.12.5
Palm dimensions	inch x inch					5.12.5

Separable connectors

Parameter	Units	Value				5.12.5
		HV	LV		Neutral	5.12.5
Manufacturer						5.12.5
Model						5.12.5
Material						5.12.5
Continuous current rating	A					5.12.5
Voltage Rating	V					5.12.5
Number per transformer						5.12.5

LOT 1 COMPLIANCE MATRIX
4D– BESS ENCLOSURE

Parameter	Unit	Minimum Requirement/ specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Type of enclosure – containerized or custom build		5.12.2			
Dimensions		5.12.2			
Material		5.12.2			
Structural certificate supplied		5.12.2			
Details of corrosion resistance treatments supplied		5.12.2			
BESS Enclosure fire suppression system		5.12.2			
BESS enclosure cooling system		5.12.2			

LOT 1 COMPLIANCE MATRIX
5 – CONTROL SYSTEM DATA

Item	Supplied	Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Details of proposed Master Control System philosophy -tenderer to supply attachment	**Yes / No**	5.13			
Details of proposed SCADA & HMI systems - tenderer to supply attachment	**Yes / No**	5.13			
Details of proposed database and reporting system for analysing SCADA data - tenderer to supply attachment	**Yes / No**	5.13			
Details of proposed database and reporting system for analysing metering data - tenderer to supply attachment	**Yes / No**	5.13.12			

LOT 1 COMPLIANCE MATRIX

6A – MV SWITCHBOARD DETAILS

Parameter Description	Units	Minumum Requirement	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Circuit Breakers					
Rated voltage	kV	15			
Rated frequency	Hz	60			
Number of poles		3			
Fixed or withdrawable circuit breaker		Fixed			
Metal enclosed class		Indoor			
Rated insulation level – LIWV/PFWV	kVp/kV	95/36			
Rated current					
Genset circuit breakers	A	400A			
Battery circuit breaker & Spare	A	400A			
Station Supply/Earthing Transformer	A	400A			
Bus-tie circuit breakers	A	630A			

Parameter Description	Units	Minumum Requirement	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Outgoing Feeder circuit breakers	A	630A			
Rated short time current for 1 sec	kA	25			
Rated peak withstand current	kAp	80			
Rated short circuit breaking current					
ac/percentage dc components	kA/%	31.5/33			
Rated short circuit making current	kA	80			
Rated line charging & cable charging breaking currents	A	Table 5 IEC 62271			
First-pole-to-clear factor		Table 5 IEC 62271			

LOT 1 COMPLIANCE MATRIX
6B PLANT DETAILS & GUARANTEED PERFORMANCE

The Contractor shall provide typical details (datasheets, drawings etc) of the MV switchboard proposed to be supplied . The Contractor shall complete this Technical Schedule and shall guarantee all particulars and performances. The maximum values of equipment performance shall be stated in the Technical Schedule.

Notes:

i. Quantities that vary with temperature shall be given for a temperature of 75°C.

ii. Guaranteed values are noted as such.

iii. All values and tests shall be guaranteed to the appropriate Australian or Overseas Standard as type tests

Description	Units	Minimum Requirement/ Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Manufacturer's					
i. Name		5.14			
ii. Address		5.14			
iii. Country, State, City of manufacture		5.14			
Manufacturers type Number		5.14			
Lightning Impulse Withstand Voltage of complete switchboard	kV	5.14			
Busbar rating at 45 Deg C Ambient		5.14.5			

Description	Units	Minimum Requirement/ Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Busbar insulation type & Thickness	mm	5.14.6			
Short time current rating for each type of CB unit		5.14.7			
i. 400 A	kA	5.14.7			
ii. 630A	kA	5.14.7			
Making current (Peak kA) rating at 11kV for each type of CB unit		5.14.7			
i. 400 A	kAp	5.14.7			
ii. 630A	kAp	5.14.7			
Breaking capacity (AC Peak kA) rating at 11kV for each type of CB, plus DC component kA at 11kV		5.14.7			
i. 400 A	kAp	5.14.7			
ii. 630A	kAp	5.14.7			
Mass of each CB panel		5.14.2			
i. 400 A		5.14.2			
ii. 630A		5.14.2			
Overall dimensions – 400A		5.14.2			
i. Height	in./mm	5.14.2			
ii. Length	in./mm	5.14.2			

Description	Units	Minimum Requirement/ Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
iii. Width	in./mm	5.14.2			
Overall dimensions – 630A		5.14.2			
i. Height	in./mm	5.14.2			
ii. Length	in./mm	5.14.2			
iii. Width	in./mm	5.14.2			
Total length of break per pole		5.14.2			
Type of main contacts		5.14.2			
Type of arcing contacts		5.14.2			
Type of arc control device		5.14.2			
Minimum clearances in air b/w Ph		5.14.2			
Minimum clearances in air Ph – G		5.14.2			
Method of closing		5.14.2			
Close and latch on making	Y/N	5.14.2			

Description	Units	Minimum Requirement/ Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
CB Trip free	Y/N	5.14.2			
Normal voltage of close mech.		5.14.2			
Power required at rated voltage to close CB	Watts	5.14.2			
Normal period of energisation		5.14.2			
Normal voltage of shunt trip coil	V	5.14.2			
Min voltage to operate trip control	V	5.14.2			
Power required at normal voltage for shunt trip coil	Watts	5.14.2			
Opening time with no current	s	5.14.2			
Opening time at rated breaking current	s	5.14.2			
Make time 13.8kV		5.14.2			
Arc duration		5.14.2			
i. 10% symmetrical rating at 13.8kV	S	5.14.2			
ii. 30 %	S	5.14.2			
iii. 60%	S	5.14.2			
iv. 100%	S	5.14.2			
Type test certificates - tenderer to supply		5.14.2			

LOT 1 COMPLIANCE MATRIX

6C SPECIAL TOOLS for PLANT AND EQUIPMENT

Contractor to list down all special tools required as per Specification for installation and maintenance of the plant and equipment items specified. Please input all costs and items into **LOT 1 PRICE SCHEDULE 4.** THESE PRICES WILL FORM PART OF THE SUBMITTED AND EVALUATED PRICE OFFERED.

Item	Quantity	Description

LOT 1 COMPLIANCE MATRIX
7 – STATION AUXILLARY SWITCHBOARD

Description	Units	Minimum Requirement/ Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Arc fault containment methodology	Describe	5.15.1			
Dimensions (L x W x H)	in./mm	5.15.1			
Number of tiers		5.15.1			
Proposed drawings of the switchboard submitted	Yes/No	5.15.1			
Construction Material	Describe	5.15.1			
Form of separation	Describe	5.15.1			
IP rating		5.15.1			
Operational voltage	V	5.15.1			
Insulation voltage	V	5.15.1			
Short time current (1 sec)	kA	5.15.1			
Peak fault current	kA	5.15.1			
Main busbar rated current	A	5.15.1			

Description	Units	Minimum Requirement/ Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Vertical bus section rated current	A	5.15.1			
Incoming ACB droppers rated current	A	5.15.1			
Bus Section ACB droppers rated current	A	5.15.1			
Busbars		5.15.2.6			
· Complying standard	Describe	5.15.2.6			
· Temperature rise above 40°C ambient	°C	5.15.2.6			
· Construction of copper bar	Describe	5.15.2.6			
· Details of neutral bar	Describe	5.15.2.6			
· Details of earth bar	Describe	5.15.2.6			
· Withstand short circuit current (1 second)	kA	5.15.2.6			
· Withstand peak fault current	kA	5.15.2.6			
· Access for installation and removal of through-type current transformers	Describe	5.15.2.6			
· Access for inspection and maintenance of busbars	Describe	5.15.2.6			
· Type test information - tenderer to supply	Yes/No	5.15.2.6			
Busbar supports details	Describe	5.15.2.6			

Description	Units	Minimum Requirement/ Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Mounting Panels		5.15.2.8			
· Construction material	Describe	5.15.2.8			
· Positioned on threaded captive studs and secured by dome nuts	Yes/No	5.15.2.8			
Doors		5.15.2.9			
· Construction material	Describe	5.15.2.9			
· Minimum opening angle	Degrees	5.15.2.9			
Tool operated latches	Describe				
Gland Plates	Describe	5.15.2.10			
Details of Current Transformers	Part Numbers	5.15.4.5			
Details of ACB's	Data Sheets	5.15.4.6			
Details of MCCB's	Data Sheets	5.15.4.7			
Details of MCB's	Data Sheets	5.15.4.8			

LOT 1 COMPLIANCE MATRIX
8 WARRANTY

The Contractor shall provide details of warranties that are offered for the major plant listed below. Any extended warranties offered shall also be deta

Warranties are to be valid for the country of installation (RMI) and must include repairs on site including travel costs.

Building Plant
Structural steel coating - 15 years
Profiled metal cladding - 15 years
Gensets and Auxiliaries
Gensets and Auxiliaries - 18 months
Ancillary equipment - 18 months
BESS
Battery Modules - 10 years or 3,000 full discharge cycles

PCS - 5 years
MV Switchboard
MV Switchboard - 24 months
Station Auxiliary Switchboard
Switchboard - 24 months

LOT 1 COMPLIANCE MATR
9 MANDATORY SPARE PAR

The Bidder must provide the following Manadatory Spare Parts and must insert T
No 1 Plant & Mandatory Spare Parts from Abroad (or Schedule 2 Plant & Mandato
Country). The Bidder must adjust or add to the list of Spare Parts to suit design diff
will be used in the Evaluation of Submissio
The Bidder is advised to also fill out LOT 1 PRICING SCHEDULE No 6 - RECOMMEND
take on Advisement. Schedule No 6 will not be used for Eva

SPARE PARTS FOR POWERHOUSE UPGRADE

Item	Quantity	Description of Spare Part	Tendered
Gensets	1 set	Contractor to advise set of spare parts suitable for maintenance of engines for the first 100,000 hours of operation	
Fuses for switching station	3	Three spare 200A fuses to be provided for the MV switching station	
MV switchboard	1 set	Contractor to advise set of spare parts for the MV switchboard supplied	
Circuit breaker	1 spare	Provide 1 spare 400A circuit breaker for the MV switchboard	
BESS spare modules	1%	1% of total BESS modules to be provided as spare	

RIX
RTS

otal costing into LOT 1 PRICING Schedule
ry Spare Parts from within the Employer's
ferences. Costs for Mandatory Spare Parts
ns.
ED SPARE PARTS which the Employer will
aluation purposes.

Reference Document *clearly show cross reference to catalogue/data sheet etc*	**Departure from Spec** *clearly define departure from spec and include cross reference to proposed item brochure*
Technical specification 5.3.7.8	
Technical specification 5.11.4	
Technical specification 5.14.1	
Technical schedule 6	
Technical specification 5.12.3	

10 -LOT 1 CIVIL WORKS, SERVICES & INSTALLATION

Contractor to provide cost breakdown here and must summarise in Pricing Schedules
LOT 1 Schedule 4, Installation and Other Services

Section	Description	Price (USD
5.2	Civil works (including building pads)	
5.2	Building Demolition	
5.2	Building installation works	
5.3	Supply and install of 3 off gensets and auxiliaries	
5.4	Supply and install crankcase ventilation system	
5.5	Supply and install genset cooling system	
5.6	Supply and install genset exhaust system	
5.7	Supply and install genset fuel system	
5.8	Supply and install genset oil system	
5.9	Supply and install waste water system	
5.11	Supply and install modular containerised gensets	
5.12	Supply and install BESS	
5.13	Supply and installation of control, SCADA/HMI equipment	
5.13	Design and programming of control systems	
5.13.1	Control system support & optimisation	
5.14	Supply and install MV switchboard	
5.15	Supply and install of Station Auxiliary Switchboard	
5.16.2.3	PC amount for Light and Power systems	
5.16	Supply and install general electrical	
5.17	SAT & SIT Testing and Commissioning	
????	Contractor Additional (please describe what additional works or items are included here with a breakdown of costs)	

BIDDERS ARE TO TAKE NOTE OF THE FOLLOWING EXPLANATIONS AND INSTRUCTIONS WHEN FILLING OUT THE TECHNICAL COMPLIANCE MATRICES

The following COMPLIANCE MATRICES will be used for the Technical Evaluation of all items proposed. Each Schedule of the Compliance Matrix defines minimum/maximum or specific technical requirements that must be complied with. The Bidder is advised to reference, at all times, SECTION 7 TECHNICAL SPECIFICATIONS AND DRAWINGS.

DEPARTURE FROM SPECIFICATIONS

The Bidder is to fill out in detail each Compliance Matrix, per line item and where necessary insert the Documentary Evidence reference for correlation by Evaluators. Where an item departs from the specification, the Bidder is required to fully explain the departure and to support the departure with Documentary evidence.

DOCUMENTARY EVIDENCE

The Bidder is advised to be diligent in the provision of documentary evidence where requested; this includes and may not be limited to supporting brochurs, product catalogues, type test reports, Factory Accetance testing, data sheets, complinace to standards

STANDARDS

Where a particular Standard is expressed, any comparable equivalent recognised International or National standard may be used

IMPERIAL & METRIC REQUIREMENTS

Where a Specifications call for an IMPERIAL measurement (the Republic of the Marshall Islands follows the US Imperial method and Standards) Bidder may substitute Metric Equivalents with, where possible accurate conversions to imperial (and Vice-versa). In all cases, at all times, equipment must be compatible.

BRAND NAMES

are examples only and equivalent Brands may be offered.

BIDDERS MAY REQUEST MICROSOFT EXCEL VERSIONS OF THESE MATRICES
PLEASE CONTACT THE PROJECT MANAGER, KAMALESH DOSHI
kamaleshdoshi@mecrmi.net

DOCUMENTATION

Compliance Matrix Technical Schedule Number	Method Statements Per Section 4 Bidding Forms	Manufacturer's Authorisations	Product Data Sheets	Type Test Reports	FAT	Product Catlogues	Supporting calculation	Certification	Warranty	Local Agent support
1. Energy supply							Yes			
2. Reservoir Liner Replacement	1. Installation of Liner 2. Field Welding Technique	Yes	Yes						Yes	Yes
3. Reservoir PV System	Yes						Provide design details			
4. Roof Mount PV System	Yes						Provide design details			
5. New Structure PV System	Yes						Provide design details			
6. PV Module		Yes	Yes	Test certificates supplied for IEC 61730, IEC 61215 IEC 62804 IEC 61701 UL6703 or IEC/EN 62852.	Yes			Yes	Yes	

Compliance Matrix Technical Schedule Number	Method Statements Per Section 4 Bidding Forms	Manufacturer's Authorisations	Product Data Sheets	Type Test Reports	FAT	Product Catlogues	Supporting calculation	Certification	Warranty	Local Agent support
7. PV Framing		Yes	Yes	Yes				Yes	Yes	
8. Inverters		Yes	Yes	Yes				Yes	Yes	
9. Transformers		Transformers Bushings Separable Connectors		Yes	Yes			Yes	Yes	
10. RMU Schedule		Yes	Yes	Yes				Yes	Yes	
11 Structures		Yes	Yes					Yes	Yes	

LOT 2 COMPLIANCE MATRIX

No 1 - Energy Supply Schedule

System	Minimum Requirement/ Specification reference	Capacity (kWp)	PR (%)	Year 1 Generation (MWh)	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
	Table 1 Section 2.1					
	Table 1 Section 2.1					
	Table 1 Section 2.1					
	Table 1 Section 2.1					
	Table 1 Section 2.1					
	Table 1 Section 2.1					
	Table 1 Section 2.1					
	Table 1 Section 2.1					
	Table 1 Section 2.1					
	Table 1 Section 2.1					
	Table 1 Section 2.1					
	Table 1 Section 2.1					
	Table 1 Section 2.1					
	Table 1 Section 2.1					

System	Minimum Requirement/ Specification reference	Capacity (kWp)	PR (%)	Year 1 Generation (MWh)	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
	Table 1 Section 2.1					
	Table 1 Section 2.1					
	Table 1 Section 2.1					
Total						

LOT 2 COMPLIANCE MATRIX

No 2 - Reservoir Liner Replacement

Parameter	**Unit**	**Minimum Requirement / Specification reference**	**Tendered**	**Reference Document** *clearly show cross reference to catalogue/data sheet etc*	**Departure from Spec** *clearly define departure from spec and include cross reference to proposed item brochure*
Material		Section 4.2.3			
Thickness	mm	2			
Density	g/cc	0.94			
Installation procedure - tenderer to supply documentation		Section 4.2.3			
Field welding procedure - tenderer to supply documentation		Section 4.2.3			
Manufacturer details - tenderer to supply data sheet		Section 4.2.3			
Total					

LOT 2 COMPLIANCE MATRIX
No 3 - Reservoir PV systems

Bidders are to complete one table per system, for the purposes of this schedule one system is considered the equipment connected to one step-up transformer. A maximum of two sub-systems may be specified.

Parameter	Units	Value		Minimum Requirement / Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
		Sub-system 1	Sub-system 2				
System location				4.2			
Array layout drawing - tenderer to provide	Dwg. No.			Example layout provided in drawing A0285 - E311			
Array SLD drawing - tenderer to provide	Dwg. No			4.2			
PVsyst report - tenderer to provide	Report No.			4.2			
Module model name				4.5			
Module Nominal DC capacity	Wp			4.5			
Module quantity	Pc.			4.5			
Module azimuth	°			4.2.5			
Module tilt	°			4.2.5			

Parameter	Units	Value		Minimum Requirement / Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
System Nominal DC capacity	kWp			4.2.5			
Array mounting system model - tenderer to provide drawings and data sheets				4.2.5			
Array mooring details - tenderer to provide drawings and data sheets				4.2.4			
Inverter Model				4.2			
Inverter Quantity	Pc.			4.2			
Inverter Nominal AC Capacity	kW_{AC}			4.2			
System Nominal AC Capacity	kW_{AC}			4.2			
Step-up transformer model				4.2			
Transformer Capacity	kVA			4.2			
Monitoring Equipment				4.2			
Internet connectivity mode				4.2			

LOT 2 COMPLIANCE MATRIX

No 4 - Roof Mount PV Systems

Bidders are to complete one table per system. For the purposes of this schedule one system is considered the equipment installed at one site (as per Specification Section 2, Table 1). More sub-systems may be added as required.

Parameter	Units	Value		Minimum Requirement / Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
		Sub-system 1	**Sub-system 2**				
System location (site name)				**Table 1, Section 2**			
Sub-system location				**Table 1, section 2**			
Array layout drawing - tenderer to provide	**Dwg. No.**			Refer to Lot 2 drawing pack			
Array SLD drawing - tenderer to provide	**Dwg. No**			Refer to Lot 2 drawing pack			
PVsyst report - tenderer to provide	**Report No.**			4.3			
Module model name				4.5			
Module Nominal DC capacity	**Wp**			4.5			
Module quantity	**Pc.**			4.3			
Module azimuth	**°**			4.3			
Module tilt	**°**			4.3			
System Nominal DC capacity	**kWp**			4.3			

Parameter	Units	Value	Minimum Requirement / Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Array mounting system model			4.3			
Inverter Model			4.6			
Inverter Quantity	**Pc.**		4.6			
Inverter Nominal AC Capacity	**kW_{AC}**		4.6			
System Nominal AC Capacity	**kW_{AC}**		4.6			
Step-up transformer model			4.10.			
Transformer Capacity	**kVA**		4.10.			
Monitoring Equipment			4.14			
Internet connectivity mode			4.14			

LOT 2 COMPLIANCE MATRIX

No 5 - New Structure PV Systems

Bidders are to complete one table per system, for the purposes of this schedule one system is considered the equipment installed at one site (as per Specification Section 2, table 1).

Parameter	Units	Value		Minimum Requirement / Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
		Sub-system 1	Sub-system 2				
System location				Table 1, Section 2			
Array layout drawing provided	Dwg. No.			Table 1, section 2			
Array SLD drawing provided	Dwg. No			Refer to Lot 2 drawing pack			
PVsyst report provided	Report No.			Refer to Lot 2 drawing pack			
Module model name				4.5			
Module Nominal DC capacity	Wp			4.5			
Module quantity	Pc.			4.4			
Module azimuth	°			4.4			
Module tilt	°			4.4			
System Nominal DC capacity	kWp			4.4			

Parameter	Units	Value		Minimum Requirement / Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Array mounting system model				4.4			
Inverter Model				4.6			
Inverter Quantity	Pc.			4.6			
Inverter Nominal AC Capacity	kW_{AC}			4.6			
System Nominal AC Capacity	kW_{AC}			4.4			
Step-up transformer model				4.10.			
Transformer Capacity	kVA			4.10.			
Monitoring Equipment				4.14			
Internet connectivity mode				4.14			

LOT 2 COMPLIANCE MATRIX
No 6 - PV Module Schedule

Bidders must complete the table for each PV module model proposed. A maximum of two different models is permitted. All PV modules must be produced by the same manufacturer.

Parameter	Units	Value (type 1)	Value (type 2)	Minimum Requirement / Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Manufacturer				4.5			
Model name				4.5			
Max power (Pmax) at STC	Wp			4.5			
Max power voltage (Vmp) at STC	V			4.5			
Max power current (Imp) at STC	A			4.5			
Open-circuit voltage (Voc) at STC	V			4.5			
Short-circuit current (Isc) at STC	A			4.5			
Module Efficiency	%			4.5			
Operating temperature range	°C			4.5			
Maximum system voltage	V			4.5			
Maximum series fuse rating	A			4.5			
Power tolerance	%			4.5			

Parameter	Units	Value (type 1)	Value (type 2)	Minimum Requirement / Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Temperature coefficient of Pmax	%/°C			4.5			
Temperature coefficient of Voc	%/°C			4.5			
Temperature coefficient of Isc	%/°C			4.5			
Normal operating cell temp (NOCT)	°C			4.5			
Dimensions (length x width x depth)	inch			4.5			
Cell type and number of cells				4.5			
Cable and connectors				4.5			
Test certificates supplied for IEC 61730		Yes / No	Yes / No	4.5			
Test certificates supplied for IEC 61215		Yes / No	Yes / No	4.5			
Test certificates supplied for IEC 62804		Yes / No	Yes / No	4.5			
Test certificates supplied for IEC 61701		Yes / No	Yes / No	4.5			
Test certificates supplied for UL 6703 (IEC/EN 62852 is an acceptable alternative certification)		Yes / No	Yes / No	4.5			
Warranty statement				4.5			

LOT 2 COMPLIANCE MATRIX

No 7 - PV Framing schedule

Bidders must complete the table for each PV framing system proposed. A maximum of three different systems is permitted; one for the reservoirs, one for the rooftops, and one for the new structures.

Reservoir framing system

Parameter	Units	Value	Minimum Requirement / Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Manufacturer			4.3			
Model			4.3			
Float material			4.3			
Rail material and grade			4.3			
Rail surface treatment			4.3			
Module clamp material and grade			4.3			
Module clamp surface treatment			4.3			
Fastener material and grade			4.3			
Fastener surface treatment			4.3			
Module orientation		Portrait / landscape	4.3			
Engineering certificate to ISO 4354		Yes / no	4.3			

Rooftop framing system

Parameter	Units	Value	Minimum Requirement / Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Manufacturer			4.4			
Model			4.4			
Roof attachment method			4.4			
Roof attachment material and grade			4.4			
Roof attachment surface treatment			4.4			
Rail material and grade			4.4			
Rail surface treatment			4.4			
Module clamp material and grade			4.4			
Module clamp surface treatment			4.4			
Fastener material and grade			4.4			
Fastener surface treatment			4.4			
Module orientation		Portrait / landscape	4.4			
Engineering certificate to ISO 4354		Yes / no	4.4			

Rooftop framing system

Parameter	Units	Value	Minimum Requirement / Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Manufacturer			4.5			
Model			4.5			
Roof attachment method			4.5			
Roof attachment material and grade			4.5			
Roof attachment surface treatment			4.5			
Rail material and grade			4.5			
Rail surface treatment			4.5			
Module clamp material and grade			4.5			
Module clamp surface treatment			4.5			
Fastener material and grade			4.5			
Fastener surface treatment			4.5			
Module orientation		Portrait / landscape	4.5			
Engineering certificate to ISO 4354		Yes / no	4.5			

LOT 2 COMPLIANCE MATRIX
No 8 - Inverter Schedule

Bidders must complete the table for each inverter model proposed. Tenders may specify only one inverter model for the reservoir systems, and up to three different inverters for the rooftop systems. All inverters must be produced by the same manufacturer.

Parameter	**Units**	**Minimum Requirement / Specification reference**	**Inverter**	**Inverter**	**Inverter**	**Inverter**	**Reference Document** *clearly show cross reference to catalogue/data sheet etc*	**Departure from Spec** *clearly define departure from spec and include cross reference to proposed item brochure*
			Reservoir	**Rooftop 1**	**Rooftop 2**	**Rooftop 3**		
Manufacturer		4.6						
Model name		4.6						
Datasheet - tenderer to supply		4.6	Yes / no	Yes / no	Yes / no	Yes / no		
Max. input voltage	V	4.6						
MPP range	V	4.6						
Startup Voltage	V	4.6						
Max. operating current per MPPT input	A	4.6						
Max Isc per MPPT	A	4.6						
Max. Isc per string	A	4.6						
Number of independent MPPT inputs		4.6						
Max strings per MPPT input		4.6						

Parameter	Units	Minimum Requirement / Specification reference	Inverter	Inverter	Inverter	Inverter	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Rated power	kW_{AC}	4.6						
Nominal voltage	V	4.6						
Voltage range	V	4.6						
Nominal Frequency	Hz	4.6						
Frequency range	Hz	4.6						
Max output current	A	4.6						
Total harmonic distortion		4.6						
No. phases / wires		4.6	/	/	/	/		
Max inverter efficiency	%	4.6						
European weighted efficiency	%	4.6						
Degree of protection (as per IEC 60529)	IPxx	4.6						
Mounting type		4.6	floor / wall	floor / wall	floor / wall	floor / wall		
Test certificates supplied for IEC 62116		4.6						
Test certificates supplied for UL 1741 (IEC 62109 is an acceptable alternative)		4.6						

LOT 2 COMPLIANCE MATRIX
No 9 - Transformer Schedule

Bidders must complete the tables for each transformer type proposed. All transformers must be produced by the same manufacturer.

Parameter	Units	Value	Minimum Requirement / Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Manufacturer			4.10.			
Model			4.10.			
Rated primary voltage			4.10.			
Rated secondary voltage			4.10.			
Rated power			4.10.			
Vector grouping			4.10.			
Rated frequency			4.10.			
Number of phases			4.10.			
No-load current with rated voltage applied to the principal tapping			4.10.			
No-load current with 110% rated voltage applied to the principal A tapping			4.10.			
No load loss			4.10.			

Load loss at 75°C			4.10.			
Cooling type			4.10.			
Impedance voltage at rated current and 75°C			4.10.			
Tap changer levels			4.10.			
Type of material used for windings - HV			4.10.			
Type of material used for windings - LV			4.10.			
Type and class of insulation on windings			4.10.			
Maximum dielectric stress on winding insulation			4.10.			
Protective treatment to oil tank - internal			4.10.			
Protective treatment to oil tank - external			4.10.			
Overall dimensions (length x width x depth)	inch		4.10.			
Weight without oil	lb		4.10.			
Weight with oil	lb		4.10.			
Volume of oil required	gallons		4.10.			
Housing material			4.10.			

Bushings

Parameter	Units	Minimum Requirement / Specification reference	Value			Reference Document *clearly show cross reference to catalogue/data sheet etc*
			HV	LV	Neutral	
Manufacturer		4.10.				
Model		4.10.				
Material		4.10.				
Continuous current rating	A	4.10.				
Voltage rating	V	4.10.				
Number per transformer		4.10.				
Lightening Impulse flashover	KVp	4.10.				
Creepage distance	inch	4.10.				
Minimum air clearance between phases	Inch	4.10.				
Phase to earth	inch	4.10.				
Palm dimensions	inch x inch	4.10.				

Separable connectors

Parameter	Units	Minimum Requirement / Specification reference	Value			Reference Document *clearly show cross reference to catalogue/data sheet etc*
			HV	LV	Neutral	
Manufacturer		4.10.				
Model		4.10.				
Material		4.10.				
Continuous current rating	A	4.10.				
Voltage Rating	V	4.10.				
Number per transformer		4.10.				

Departure from Spec *clearly define departure from spec and include*

Departure from Spec *clearly define departure from spec and include cross reference to*

LOT 2 COMPLIANCE MATRIX
No 10 - RMU Schedule

Bidders must complete the tables for each RMU type proposed. All RMUs must be produced by the same manufacturer.

Parameter	Units	Value	Minimum Requirement / Specification reference	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Manufacturer			4.11			
Model			4.11			
Total switchgear mass			4.11			
Circuit breaker qty			4.11			
Switch disconnector qty			4.11			
Switch Fuse combination switch disconnector qty			4.11			
Switchgear Ratings:			4.11			
Voltage	kV		4.11			
Busbar Normal Current	A		4.11			
Peak lightning impulse withstand voltage	kV		4.11			
Short duration power frequency withstand voltage	kV		4.11			
Short time withstand current Ik	kA		4.11			
Peak withstand current Ip	kA		4.11			

Duration of short time current Tk	s		4.11			
Switch-fuse combination Ratings:			4.11			
Rated Current	A		4.11			
Fuse rating	A		4.11			
Off-load making capacity	A		4.11			
Duration of short time current Tk	s		4.11			
Short circuit breaking capacity current	kA		4.11			
Short circuit making current	kA		4.11			
Fuse Ratings:			4.11			
Fuse rating	A		4.11			
Fuse brand			4.11			
Fuse type			4.11			
Fuse length	Inch		4.11			
Fuse diameter	inch		4.11			
Fuse blown indication		Yes/no	4.11			
Supply fuse curve			4.11			
Circuit-Breaker Ratings:			4.11			
Circuit Breaker(s) rating	A		4.11			
Duration of short time current Tk	s		4.11			
Short circuit breaking current	kA		4.11			
Short circuit making current peak	kA		4.11			
Circuit Breaker Protection Relay Self-Powered:			4.11			

manufacturer			4.11			
catalogue/type designation			4.11			
minimum load current for correct operation of relay	A		4.11			
Number of CT required for protection relay			4.11			
How earth protection operates			4.11			
Phase protection operating current Is			4.11			
Type of self powered trip coil system			4.11			
Switch-disconnector Ratings:			4.11			
Rated Current	A		4.11			
Breaking capacity	A		4.11			
Charging current	A		4.11			
Earth leakage fault			4.11			
No-load cable			4.11			
Duration of short time current Tk	s		4.11			
Short circuit breaking capacity current			4.11			
Short circuit making current peak	kA		4.11			
Short circuit making current peak for earth switches	kA		4.11			
Class of disconnector to IEC 60265			4.11			

Bushings

Parameter	Units	Minimum Requirement / Specification reference	Value			Reference Document *clearly show cross reference to catalogue/data sheet etc*
			HV	LV	Neutral	
Manufacturer		4.11				
Model		4.11				
Material		4.11				
Continuous current rating	A	4.11				
Voltage rating	V	4.11				
Number per transformer		4.11				
Lightening Impulse flashover	KVp	4.11				
Creepage distance	inch	4.11				
Minimum air clearance between phases	Inch	4.11				
Phase to earth	inch	4.11				
Palm dimensions	inch x inch	4.11				

Separable connectors

Parameter	Units	Minimum Requirement / Specification reference	Value			Reference Document *clearly show cross reference to catalogue/data sheet etc*
			HV	LV	Neutral	
Manufacturer		4.11				
Model		4.11				
Material		4.11				
Continuous current rating	A	4.11				
Voltage Rating	V	4.11				
Number per transformer		4.11				

LOT 2 COMPLIANCE MATRIX
Schedule 11 - Structures

Parameter	Units	Value	Minimum Requirement	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Supply of design drawings showing:		Yes / no	Refer to Lot 2 drawing pack			
- Overall building dimensions			Refer to Lot 2 drawing pack			
- Dimensions of all structural members			Refer to Lot 2 drawing pack			
- Details of foundations			Refer to Lot 2 drawing pack			
- Placement of lighting equipment			Refer to Lot 2 drawing pack			
- Placement of rainwater collection equipment			Refer to Lot 2 drawing pack			
Minimum internal height	ft		4.4.2			
Roof area	sq ft		4.4.2			
Roof pitch			4.4.2			
Roof material			4.4.2			
Roof material surface treatment			4.4.2			

Parameter	Units	Value	Minimum Requirement	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
Rain gutter sectional area	sq inch		4.4.2			
Rainwater tank quantity			4.4.2			
Rain water tank capacity (each)	Gallons		4.4.2			
Tap located on tank suitable for community water access			4.4.2			
Hight of base of tank above ground level			4.4.2			
Tank foundation / base material			4.4.2			
Lighting technology			4.4.2			
Impact rated light cover		Yes / no	4.4.2			
Manual light switch provided in accessible location		Yes / no	4.4.2			
Light sensor to automatically shut of light during daylight hours provided		Yes / no	4.4.2			

LOT 1 COMPLIANCE MATRIX
No. 12 MANDATORY SPARE PARTS

The Bidder must provide the following Manadatory Spare Parts and must insert Total costing in
Schedule No 1 Plant & Mandatory Spare Parts from Abroad (or Schedule 2 Plant & Mandatory
within the Employer's Country). The Bidder must adjust or add to the list of Spare Parts to suit d
Costs for Mandatory Spare Parts will be used in the Evaluation of Submissions
The Bidder is advised to also fill out LOT 2 PRICING SCHEDULE No 6 - RECOMMENDED SPARE P
Employer will take on Advisement. Schedule No 6 will not be used for Evaluation pu

SPARE PARTS FOR PV SYSTEM

Item	Quantity	Description of Spare Part	Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*
1	1%	of the total installed PV module quantity, for each module type		
2	10%	of the total installed string inverter/inverter module quantity;		
3	5%	of spare inverter fan modules;		
4	1%	of total installed stainless steel earthing shims;		
5	1%	of the total installed PV module clamps;		
6	1%	DC isolators;		
7	1%	DC isolator enclosures;		
8	5%	of the total installed lightning arrestors;		
9	5%	of the total installed string fuses;		
10	10%	of solar connectors;		
11	500m	of solar cable;		
12	1%	AC isolator;		
13	1%	AC isolator enclosure;		
14	5%	of the total communications cable length and terminations;		
15	1%	spare float modules for reservoirs		

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Spare Parts from
lesign differences.
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rposes.

Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*

LOT 1 COMPLIANCE MATRIX
13 WARRANTY

The Contractor shall provide details of warranties that are offered for the major plant listed below. Any extended warranties offered shall also be detailed. Warranties are to be valid for the country of installation (RMI) and must include repairs on site including travel costs.

System warranties

PV Modules
Inverters
10 year warranty required

Structures
Framing
Float modules

LOT 1 COMPLIANCE MATRIX

14 SPECIAL TOOLS for PLANT AND EQUIPMENT

Contractor to list down all special tools required as per Specification for installation and maintenance of the plant and equipment items specified. Please input all costs and items into LOT 2 PRICE SCHEDULE 4. THESE PRICES WILL FORM PART OF THE SUBMITTED AND EVALUATED PRICE OFFERED. 2.The tools will be provided to MEC at commissioning (the tools may be used during construction, but the Principal will assess whether or not they are in sufficient condition to satisfy the requirement). The following list is indicative and the Bidder may add or alter as design requires

Item	Description	Quantity Tendered	Reference Document *clearly show cross reference to catalogue/data sheet etc*	Departure from Spec *clearly define departure from spec and include cross reference to proposed item brochure*
1	A tool to open solar connectors;			
2	A solar connector crimping tool;			
3	An RJ-45 (or otherwise) crimping tool (for communications cable);			
4	Arc-flash protection equipment suitable for BESS servicing;			
5	An infra-red camera with minimum specifications of: 3-inch LCD display; Accuracy of ±2%; Resolution of 120x90; Thermal sensitivity of 0.1°C;			

Contractor's Equipment

Form EQU

The Bidder shall provide adequate information to demonstrate clearly that (it) has access to adequate Equipment and understands and has considered the logistics of getting Equipment to the RMI. A separate Form shall be prepared per Lot, for each item of equipment listed, or for alternative equipment proposed by the Bidder.

LOT 1

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 ☐ Owned ☐ Rented ☐ Leased ☐ Specially manufactured	

USE the following information for equipment TO BE LEASED 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	

LOT 2

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 ☐ Owned ☐ Rented ☐ Leased ☐ Specially manufactured	

USE the following information for equipment LEASED 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.

LOT 1

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

LOT 2

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

Proposed Key Personnel

Form PER -1

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

A Bidder may only propose the same Key Person for more than one position if the Bidder can clearly demonstrate the person has the required qualifications and experience of each position and time availability per scheduling is clearly demonstrated.

If a Bidder is Bidding for both Lots and wishes to propose the same Person in more than one key position, the bidder must clearly demonstrate availability in timing

1.	**Title of position***
	Name
2.	**Title of position***
	Name
3.	**Title of position***
	Name
4.	**Title of position***
	Name

**As listed in Section III.*

Resume of Proposed Personnel

Form PER-2

Please fill out one form per position requested, noting previous experience relevant to the p

Name of Bidder		
Position		
Personnel information	**Name**	**Date of birth**
	Professional qualifications	
Present employment	**Name of employer**	
	Address of employer	
	Telephone	**Contact (manager / personnel officer)**
	Fax	**E-mail**
	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 for Major Items of Plant and Installation Services

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

LOT 1: A list of major items of Plant and Installation Services is provided below.

Major Items of Plant and Installation Services	**Proposed Subcontractors/Manufacturers**	**Nationality**

LOT 2: A list of major items of Plant and Installation Services is provided below.

Major Items of Plant and Installation Services	**Proposed Subcontractors/Manufacturers**	**Nationality**

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! Bidders must fill out separately all of the Qualification Forms for each LOT submitted for.

Form ELI 1.1

Bidder Information Sheet

Date: _____

RFB No.: _____

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 46.1, 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: _____

RFB No.: _____

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 ☐ 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. ☐ 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. *[If required under BDS ITB 46.1, the successful Bidder shall provide additional information on beneficial ownership for each JV member using the Beneficial Ownership Disclosure Form.]*

Form CON – 2

Historical Contract Non-Performance

Bidder's Legal Name:		Date:	
JV Member Legal Name:		RFB No.:	

Non-Performed Contracts in accordance with Section III, Evaluation and Qualification Criteria			
☐ Contract non-performance did not occur since 1st January *[insert year]* specified in Section III, Evaluation and Qualification Criteria, Sub-Factor 2.1. ☐ Contract(s) not performed since 1st January *[insert year]* 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)**
[insert year]	*[insert amount and percentage]*	Contract Identification: *[indicate complete contract name/ number, and any other identification]* Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Reason(s) for nonperformance: *[indicate main reason(s)]*	*[insert amount]*
Pending Litigation, in accordance with Section III, Evaluation and Qualification Criteria			
☐ No pending litigation in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.3. ☐ 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

☐ No Litigation History in accordance with Section III, Evaluation and Qualification Criteria, Sub-Factor 2.4.

☐ 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)**
[insert year]	*[insert percentage]*	Contract Identification: [indicate complete contract name, number, and any other identification] Name of Employer: *[insert full name]* Address of Employer: *[insert street/city/country]* Matter in dispute: *[indicate main issues in dispute]* Party who initiated the dispute: *[indicate "Employer" or "Contractor"]* Reason(s) for Litigation and award decision *[indicate main reason(s)]*	*[insert amount]*

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
Historical Financial Performance

Bidder's Legal Name:		**Date:**	
JV Member Legal Name:		**RFB No.:**	
		Page _____	**of _____ pages**

To be completed by the Bidder and, if JV, by each member

Financial information in US$ equivalent	**Historic information for previous _____ (__) years** (US$ equivalent in 000s)				
	Year 1	**Year 2**	**Year 3**	**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)					
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:		**RFB No.:**	
		Page _____	**of _____ pages**

Annual turnover data		
Year	Amount and Currency	US$ equivalent
Year 1(2016)		
Year 2 (2017)		
Year 3 (2018)		
*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 FIN3.3

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.	

* Documentary evidence to be provide din support of claims – e.g. a Letter of Credit from Bank describing overdraft or credit facilities

Form EXP 4.1

Experience: General Experience

Bidder's Legal Name:		**Date:**	
JV Member Legal Name:		**RFB 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:		**RFB No.:**	
		Page _____	**of _____ pages**

Similar Contract Number: ___ of ___ required.	**Information**		
Contract Identification			
Award date Completion date			
Role in Contract	□ Contractor	□ Management Contractor	□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:		**Date:**	
JV Member Legal Name:		**RFB No.:**	
		Page _____	**of _____ pages**

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:		**RFB No.:**	
		Page _____	**of _____ pages**

	Information		
Contract Identification			
Award date Completion date			
Role in Contract	☐ Contractor	☐ Management Contractor	☐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 (b)(cont.)

Specific Experience in Key Activities

Bidder's Legal Name:		**Date:**	
JV Member Legal Name:		**RFB No.:**	
		Page _____	**of _____ pages**

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

Manufacturer's Authorization

The bidder shall require the manufacturer to fill out this form in accordance with the instructions indicated. This letter of authorization should be signed by a person with the proper authority to sign documents that are binding on the manufacturer. A separate Authorisation is required for all items not manufactured by the Bidder

Date: _____

RFB 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 _____, _____

Proposed Subcontractors for Major Items of Plant and Installation Services

Form EXP -3

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

LOT 1

Major Items of Plant and Installation Services	Proposed Subcontractors/Manufacturers *[indicate which]*	Experience in Specialty in years	Nationality

LOT 2

Major Items of Plant and Installation Services	Proposed Subcontractors/Manufacturers *[indicate which]*	Experience in Specialty in years	Nationality

Continued.....

Use one (1) Form for each specialized sub-contractor who is not a member of the Joint Venture and who is not the Bidder

1. Sub-Contractor's Legal Name			
2. Sub-Contractor's actual or intended Country of Registration:			
3. Sub-Contractor's Year of Registration:			
4. Sub-Contractor's Legal Address in Country of Registration:			
6. Sub-Contractor's Authorized Representative Information Name: Address: Telephone/Fax numbers: Email Address:			
Contract Identification:			
Award date:			
Completion date:			
Role in Contract	☐ Contractor	☐ Management Contractor	☐ Subcontractor
Total contract amount			US$_____
If subcontractor, specify participation of total contract amount	%		US$
Employer's Name:			

Manufacturer's Authorization

The bidder shall require the manufacturer to fill out this form in accordance with the instructions indicated. This letter of authorization should be signed by a person with the proper authority to sign documents that are binding on the manufacturer. A separate Authorisation is required for all items not manufactured by the Bidder

Date: _____

RFB 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

Section V - Eligible Countries

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

In reference to ITB 4.8 and 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 5.1: "*none*".

Under ITB 4.8 (b) and 5.1: "*none*"

Section VI
Fraud and Corruption

Section VI - Fraud and Corruption

(this Section shall not be changed)

1. Purpose

1.1 The Bank's Anti-Corruption Guidelines 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/proposers), 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 Anti- Corruption Guidelines 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;13 (ii) to be a nominated14 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/request for proposals documents and in contracts financed by a Bank loan, requiring (i) bidders (applicants/proposers), consultants, contractors, and suppliers, and their sub-contractors, sub-consultants, service providers, suppliers, agents personnel, permit the Bank to inspect15 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.

---

13 *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.*

14 *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.*

15 *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.*

Marshalls Energy Company
Republic of the Marshall Islands

VOLUME 2
EMPLOYER'S REQUIREMENTS

LOT 1 : Design, Supply & Installation of Power Station Upgrade and BESS

LOT 2 : Design, Supply & Installation of Solar PV System & Associated Controls

Part 2, Volume 2A Technical Specifications Lot 1

Part 2, Volume 2B Technical Specifications Lot 2

Part 2, Volume 2C Drawings Lot 1

Part 2, Volume 2D Drawings Lot 2

Part 2, Volume 2E Environmental Social Management Plan

Part 2, Volume 2F Flow Study

ISSUED 9TH SEPTEMBER 2019

PART 2
Employer's Requirements

Section VII - Employer's Requirements

Contents

Scope of Supply of Plant and Installation Services by the Contractor

Technical Specification

SEPARATE FILES REFER TO VOLUME 2

PART 2, VOLUME 2A TECHNICAL SPECIFICATIONS – LOT 1

PART 2, VOLUME 2B TECHNICAL SPECIFICATIONS LOT 2

Forms and Procedures

Form of Completion Certificate

Date:	
Loan/Credit Nº:	
RFB Nº:	

_____

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 Acceptance Certificate

Date:	
Loan/Credit N°:	
RFB 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.

. 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)

Change Order Procedure and Forms

Date:	
Loan/Credit N°:	
RFB N°:	

CONTENTS

ANNEXES

Change Order Procedure

1. 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.

2. 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.

3. References for Changes

(1) Request for Change as referred to in GCC Clause 39 shall be serially numbered CR-X-nnn.

(2) Estimate for Change Proposal as referred to in GCC Clause 39 shall be serially numbered CN-X-nnn.

(3) Acceptance of Estimate 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.

Annex 1. Request for Change Proposal

(Employer's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

Contract Number: _____

Dear Ladies and/or Gentlemen:

With reference to the captioned Contract, you are requested to prepare and submit a Change Proposal for the Change noted below in accordance with the following instructions within _____ days of the date of this letter_____.

1. Title of Change: _____
2. Change Request No. _____
3. Originator of Change: Employer: _____

   Contractor (by Application for Change Proposal No. _____[1]:
4. Brief Description of Change: _____
5. Facilities and/or Item No. of equipment related to the requested Change: _____
6. Reference drawings and/or technical documents for the request of Change:

   Drawing No./Document No. Description
7. Detailed conditions or special requirements on the requested Change: _____
8. General Terms and Conditions:

_____

(a) Please submit your estimate to us showing what effect the requested Change will have on the Contract Price.

(b) Your estimate shall include your claim for the additional time, if any, for completion of the requested Change.

(c) If you have any opinion negative to the adoption of the requested Change in connection with the conformability to the other provisions of the Contract or the safety of the Plant or Facilities, please inform us of your opinion in your proposal of revised provisions.

(d) Any increase or decrease in the work of the Contractor relating to the services of its personnel shall be calculated.

(e) You shall not proceed with the execution of the work for the requested Change until we have accepted and confirmed the amount and nature in writing.

_____

(Employer's Name)

_____

(Signature)

_____

(Name of signatory)

_____

(Title of signatory)

Annex 2. Estimate for Change Proposal

(Contractor's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

Contract Number: _____

Dear Ladies and/or Gentlemen:

With reference to your Request for Change Proposal, we are pleased to notify you of the approximate cost of preparing the below-referenced Change Proposal in accordance with GCC Sub-Clause 39.2.1 of the General Conditions. We acknowledge that your agreement to the cost of preparing the Change Proposal, in accordance with GCC Sub-Clause 39.2.2, is required before estimating the cost for change work.

1. Title of Change: _____
2. Change Request No./Rev.: _____
3. Brief Description of Change: _____
4. Scheduled Impact of Change: _____
5. Cost for Preparation of Change Proposal: _____[2]

(a) Engineering (Amount)

(i) Engineer _____ hrs x _____ rate/hr = _____

(ii) Draftsperson _____ hrs x _____ rate/hr = _____

Sub-total _____ hrs _____

Total Engineering Cost _____

(b) Other Cost _____

Total Cost (a) + (b) _____

[2] Costs shall be in the currencies of the Contract.

(Contractor's Name)

(Signature)

(Name of signatory)

(Title of signatory)

Annex 3. Acceptance of Estimate

(Employer's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

Contract Number: _____

Dear Ladies and/or Gentlemen:

We hereby accept your Estimate for Change Proposal and agree that you should proceed with the preparation of the Change Proposal.

1. Title of Change: _____
2. Change Request No./Rev.: _____
3. Estimate for Change Proposal No./Rev.: _____
4. Acceptance of Estimate No./Rev.: _____
5. Brief Description of Change: _____
6. Other Terms and Conditions: In the event that we decide not to order the Change accepted, you shall be entitled to compensation for the cost of preparation of Change Proposal described in your Estimate for Change Proposal mentioned in para. 3 above in accordance with GCC Clause 39 of the General Conditions.

_____

(Employer's Name)

_____

(Signature)

_____

(Name and Title of signatory)

Annex 4. Change Proposal

(Contractor's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

Contract Number: _____

Dear Ladies and/or Gentlemen:

In response to your Request for Change Proposal No. _____, we hereby submit our proposal as follows:

1. Title of Change: _____
2. Change Proposal No./Rev.: _____
3. Originator of Change: Employer: *[*_____

   Contractor: _____
4. Brief Description of Change: _____
5. Reasons for Change: _____
6. Facilities and/or Item No. of Equipment related to the requested Change: _____
7. Reference drawings and/or technical documents for the requested Change:

   Drawing/Document No. Description
8. Estimate of increase/decrease to the Contract Price resulting from Change Proposal:[3]

   (Amount)

   (a) Direct material _____

[3] Costs shall be in the currencies of the Contract.

(b) Major construction equipment _____

(c) Direct field labor (Total ____ hrs) _____

(d) Subcontracts _____

(e) Indirect material and labor _____

(f) Site supervision _____

(g) Head office technical staff salaries

Process engineer	_____ hrs @	_____	rate/hr	_____
Project engineer	_____ hrs @	_____	rate/hr	_____
Equipment engineer	_____ hrs @	_____	rate/hr	_____
Procurement	_____ hrs @	_____	rate/hr	_____
Draftsperson	_____ hrs @	_____	rate/hr	_____
Total	_____ hrs			_____

(h) Extraordinary costs (computer, travel, etc.) _____

(i) Fee for general administration, ___ % of Items _____

(j) Taxes and customs duties _____

Total lump sum cost of Change Proposal _____

(Sum of items (a) to (j))

Cost to prepare Estimate for Change Proposal _____

(Amount payable if Change is not accepted)

9. Additional time for Completion required due to Change Proposal

10. Effect on the Functional Guarantees

11. Effect on the other terms and conditions of the Contract

12. Validity of this Proposal: within *[Number]* days after receipt of this Proposal by the Employer

13. Other terms and conditions of this Change Proposal:

    (a) You are requested to notify us of your acceptance, comments or rejection of this detailed Change Proposal within _____ days from your receipt of this Proposal.

    (b) The amount of any increase and/or decrease shall be taken into account in the adjustment of the Contract Price.

(c) Contractor's cost for preparation of this Change Proposal:[2]

_____

(Contractor's Name)

_____

(Signature)

_____

(Name of signatory)

_____

(Title of signatory)

[2] Specify where necessary.

Annex 5. Change Order

(Employer's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

Contract Number: _____

Dear Ladies and/or Gentlemen:

We approve the Change Order for the work specified in the Change Proposal (No. _____), and agree to adjust the Contract Price, Time for Completion and/or other conditions of the Contract in accordance with GCC Clause 39 of the General Conditions.

1. Title of Change: _____
2. Change Request No./Rev.: _____
3. Change Order No./Rev.: _____
4. Originator of Change: Employer: _____
   Contractor: _____
5. Authorized Price:
   Ref. No.: _____ Date: _____
   Foreign currency portion _____ plus Local currency portion _____
6. Adjustment of Time for Completion
   None Increase _____ days Decrease _____ days
7. Other effects, if any

Authorized by: _____ Date: _____

(Employer)

Accepted by: _____ Date: _____

(Contractor)

Annex 6. Pending Agreement Change Order

(Employer's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

Contract Number: *[*_____

Dear Ladies and/or Gentlemen:

We instruct you to carry out the work in the Change Order detailed below in accordance with GCC Clause 39 of the General Conditions.

1. Title of Change: _____
2. Employer's Request for Change Proposal No./Rev.: _____dated: _____
3. Contractor's Change Proposal No./Rev.: _____ dated: _____
4. Brief Description of Change: _____
5. Facilities and/or Item No. of equipment related to the requested Change: _____
6. Reference Drawings and/or technical documents for the requested Change:

   Drawing/Document No. Description
7. Adjustment of Time for Completion:
8. Other change in the Contract terms:
9. Other terms and conditions:

_____

(Employer's Name)

(Signature)

(Name of signatory)

(Title of signatory)

Annex 7. Application for Change Proposal

(Contractor's Letterhead)

To: _____ Date: _____

Attention: _____

Contract Name: _____

Contract Number: _____

Dear Ladies and/or Gentlemen:

We hereby propose that the below-mentioned work be treated as a Change in the Facilities.

1. Title of Change: _____

2. Application for Change Proposal No./Rev.: _____ dated: _____

3. Brief Description of Change: _____

4. Reasons for Change:

5. Order of Magnitude Estimation (in the currencies of the Contract):

6. Scheduled Impact of Change:

7. Effect on Functional Guarantees, if any:

8. Appendix:

(Contractor's Name)

(Signature)

(Name of signatory)

(Title of signatory)

Drawings

SEPARATE FILE REFER TO VOLUME 2

PART 2, VOLUME 2C, DRAWINGS LOT 1

AND

PART 2, VOLUME 2D, DRAWINGS LOT 2

Supplementary Information

SEPARATE FILE REFER TO VOLUME 2

PART 2, VOLUME 2E, ESMP

PART 2, VOLUME 2F, FLOW STUDY

Republic of the Marshall Islands – Sustainable Energy Development Project

Lot 1 – Power Station + BESS Technical Specifications

Contents

1. PRELIMINARY

1.1. About this project

The Government of the Marshall Islands (GRMI) has been provided with grant funding by the World Bank for a Sustainable Energy Development Project (SEDeP) including renewable energy and power system upgrades aimed at increasing the share of renewable energy in the Republic of the Marshall Islands (RMI).

The objective of this component of the project (Lot 1) is to refurbish the existing power station and supply a new battery energy storage system, to support new PV systems sufficiently sized to supply at least 7% of the RMI's total energy consumption from renewable energy. These specifications should be read in conjunction with the solar PV specifications (Lot 2).

1.2. Majuro Electricity Sector

Electricity on Majuro is generated, distributed and retailed by the Marshalls Energy Company (MEC). MEC operates two diesel power stations at one site in Delap and several grid-connected PV systems on buildings around Majuro. Majuro's typical peak loads are approximately 8.5 MW.

2. SCOPE

1. The intent of the Technical Specification documents is to set out and define the work to install diesel generation plant to provide base load power supply. The Contractor shall provide, design, supply, install, test and commission all equipment, materials and labour as part of the Technical Specification to ensure the intent is met. The Contractor shall provide everything reasonably necessary for the full and proper operation of the system not withstanding any omissions in the drawings or specifications.
2. Any doubts, omissions or ambiguities in the documents shall be resolved during the tender process. Any subsequent doubts, omissions or ambiguities shall be clarified by the Principal. The Principals written decision shall be final.

2.1. Scope of Works

3. The Scope of Works shall include the design, supply, testing, construction, commissioning and operational support of the following works:
    a. Refurbishment of the existing power station building including:
        - Full demolition of mechanical annexe

- Establishment of genset footings for new diesel generators (gensets) and auxiliaries
- Modifications to MV switch room and control room
- Establishment of pads for Battery Energy Storage System (BESS) and Modular Containerised Gensets

b. Two new diesel gensets, auxiliary systems including cooling, exhaust, fuel, oil systems and ancillary systems including fuel, oil and waste water systems.
c. MV Switchboard
d. Control and SCADA/HMI systems
e. DC Supply Systems.
f. AC Supply Systems including LV switchboards
g. Modular Containerised Gensets
h. Battery Energy Storage System (BESS)

2. The Contractor shall also supply all necessary documentation and drawings for all plant and equipment supplied. This documentation shall have sufficient detail for the safe and efficient operation and maintenance of all plant. The documentation shall include but not limited to:
   a. Operating manuals for all plant
   b. Maintenance schedules for all plant
   c. P&ID drawings for all mechanical plant including equipment isolation, labelling etc.
   d. Schematic drawings for all electrical plant including equipment isolation, labelling etc.
3. The Contractor shall ensure that all plant and equipment is labelled clearly and reflected in appropriate drawings. The labelling and drawings shall be of a standard to ensure all plant and equipment can be switched (operated) and isolated.
4. All redundant equipment shall be removed from site and disposed of by the Contractor. All major mechanical and electrical equipment shall be transported from the island and disposed of in approved installations. Recovered metal building products (e.g. steel beams, metal cladding and roofing material) shall be also be removed from the island. Building rubble and concrete can be disposed of on the island in a location as approved by the local authorities.

3. REFERENCE STANDARDS

The design, manufacture, testing and performance guarantee for works undertaken shall comply in all respects with this Specification and, except where otherwise specified herein, shall conform to the relevant US standards and regulations, or international equivalent, in force at the time of tendering. In particular, the most recent issue (including relevant amendments) of the following standards and regulations shall apply:

ASCE 7-10	Minimum Design Loads for Buildings and Other Structures
ACI 318-11	Building Code Requirements for Structural Concrete structures
ACI 301-16	Specification for Structural Concrete for Buildings
ANSI/ AISC 360-16	Specification for Structural Steel Buildings
ASTM A240	Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
ASCE 7-10	Minimum Design Loads for Buildings and Other Structures
ANSI C80.5	Electrical Rigid Metal Conduit - Aluminium (ERMC-A)
ANSI/AMCA Std 205	Energy Efficiency Classification For Fans
ANSI/IEC 60529	Degrees of Protection Provided by Enclosures (IP Code)
ASME A13.1	Scheme for the Identification of Piping Systems
ASME B16.5	Pipe Flanges and Flanged Fittings
ASME B18.2.1	Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)
ASME B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
ASME B31.1	Power Piping
ASME B31.3	Pressure Testing
ASME B31.9	Building Services Piping
ASTM A123	Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153ANSI/ AISC 360	Standard Specification for StructuralZinc Coating (Hot-Dip) on Iron and Steel BuildingsHardware
AWS B2.1	Specification for Welding Procedure and Performance Qualification
AWS D1.1	American Welding Society - Structural welding (steel)
EPA 40 CFR Part 112	Spill Prevention, Control and Countermeasure (SPCC) Rules
IEC 60034	Rotating electrical machines
IEC 60060	High-voltage test techniques
IEC 60137	Insulated bushings for alternating voltages above 1000V
IEC 60270	High-voltage test techniques - Partial discharge measurements
IEC 60694	Common specifications for high-voltage switchgear and controlgear
IEC 61869	Instrument transformers
IEC 62271	High voltage switchgear and control gear (all parts)
ASCE 7	Minimum Design Loads for Buildings and Other Structures
IEEE 112	IEEE Standard specification Test Procedure for Zinc Coating on Iron Polyphase Induction Motors and Steel Hardware Generators
AS/NZS 2053IEEE 1187	Conduits and fittings for electrical installations IEEE Recommended Practice for Installation Design and Installation of Valve-Regulated Lead-Acid Batteries for Stationary Applications
ISO 4618	Paints and varnishes – Terms and definitions
AS/NZS 2053	Conduits and fittings for electrical installations
ISO 12944	Corrosion protection of steel structures by protective paint systems
IEEE 1189	IEEE Guide for Selection of Valve-Regulated Lead-Acid (VRLA) Batteries for Stationary Applications
IEEE 1375	IEEE Guide for the Protection of Stationary Battery Systems
IEEE 1635	IEEE/ASHRAE Guide for the Ventilation and Thermal Management of Batteries for Stationary Applications
IEEE 485	IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications
IEEE 80	IEEE Guide for Safety in AC Substation Grounding
IEEE 81	IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System
IEEE C37.101	IEEE ‘Guide for AC Generator Ground Protection’

IEEE C57.12.00	USA Standard General Requirements for Distribution, Power and Regulating Transformers and Shunt Reactors
IEEE C57.12.90	IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers
ISO 3046	Reciprocating internal combustion engines
ISO 31000	Risk management – Principles and guidelines
ISO 668	Series 1 freight containers - Classification, dimensions and ratings
ISO 6798	Reciprocating internal combustion engines -- Measurement of emitted airborne noise
ISO 8501-1	Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness
ISO 8528	Reciprocating internal combustion engine driven alternating current generating sets
ISO 9000	Quality management systems – Fundamentals and vocabulary
ISO 9001	Quality management systems - Requirements
ISO 9224	Corrosion of metals and alloys –- Corrosivity of atmospheres –- Guiding values for the corrosivity categoriescategories
NEC 2017	NFPA 70, National Electrical Code, 2017 Edition
NEMA MG 1	Motors and Generators
NEMA TC 2	Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing
NEMA TC 6	Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installations
NEMA TC 9	Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation
NEMA VE 1	Metal Cable Tray Systems
NFPA 30	National Fire Protection Association - Flammable and Combustible Liquids Code
OHSA CFT 1910.212	General requirements for all machines
UL 1973	UL Standard for Safety Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications
UL 508	Standard for Industrial Control Equipment
UL 508A	Standard for Industrial Control Panels

4. ABBREVIATIONS & DEFINITIONS

AC	Alternating current
Ancillary	Equipment related to the power station and common to all gensets
Auxiliary	Equipment related directly to each genset
AWG	American Wire Gauge
BESS	Battery Energy Storage System
BMEP	Brake Mean Effective Pressure
CAD	Computer-aided design
CMMS	Computerised Maintenance Management System
Contractor	Includes main contractor and any approved sub-contractors & equipment suppliers
cu. ft.	Cubic foot
DC	Direct current
DLP	Defects Liability Period
ECM	Engine Control Module
FAT	Factory Acceptance Testing
Genset	Engine and alternator coupled together on rigid under base.

HD	Heavy duty
HMI	Human Machine Interface
ICXN	ISO power able to be exceeded by 10% at standard conditions
ITP	Inspection test plan
kcmil	Thousand circular mils
kN	KiloNewton
kPa	KiloPascal
kWb	Mechanical kilowatts measured at the engine flywheel
kWe	Electrical kilowatts measured at the alternator terminals
kWh	Kilowatt-hour, unit of energy (1 kW generated/used for 1 hour)
L	Litre
lbf	Pound-force
lbs	Pounds
m	Metre
MCS	Master Control System
micron	Millionth of a metre
mil	Thousandth of an inch
mm	Millimetre
MV	Medium voltage (13.8 kV)
NB	Nominal Bore
NPS	Nominal Pipe Size
O&M	Operations and Maintenance
OEM	Original Equipment Manufacturer
OHS	Occupational, Health and Safety
ppm	Parts per million
Principal	Marshalls Energy Company or its nominated representatives
PRP	Prime power rated output
PS1	Power Station No. 1
PS2	Power Station No. 2
psf	Pounds per square foot
Remote Radiator	A radiator that is not mounted on the same base frame as the generator and the cooling fan is driven by an electric motor
RMU	Ring Main Unit
SAT	Site Acceptance Testing
SCXN	ISO power able to be exceeded by 10% at site conditions
SIT	System Integration Testing
sq. ft.	Square foot
sq. in.	Square inch

5. TECHNICAL REQUIREMENTS

5.1. General

5.1.1. Application

4. The existing Power Station No. 1 (PS1) shall be refurbished to accommodation new gensets, MV switchboard, LV switchboard and control equipment.
5. The two gensets installed under this specification shall be installed in an open generator hall and will be required to operate in parallel with one (1) existing genset in this power station to provide prime power electricity supply to Majuro in the Republic of Marshall Islands. The gensets will also operate in parallel with two gensets installed in Power Station No. 2 (PS2), and at certain times, with up to three portable, containerised gensets that will be used for maintenance and emergency supply purposes.
6. A new MV switchboard and LV switchboard shall replace existing equipment already installed. New control panels for the new gensets shall be installed in the control room.
7. The power station shall be fully automatic and the new gensets shall be required to run in parallel with the existing gensets and integrate with solar PV installed on the distribution network and a BESS that will be used to provide system support.

5.1.2. Site conditions

8. The following site conditions are to be used for design purposes and equipment selection.

CHARACTERISTIC	VALUE
Ambient Temperatures	95°F (35°C) summer day time (Max) 77°F (25°C) winter night time (Min)
Mean Daily Solar Exposure	53.8 kWh/sq. ft/ day (5 kWh/m^2/day)
Precipitation	Mean annual rainfall in excess of 118” (3000mm)
Humidity	Average relative humidity 80%
Mean Barometric pressure	14.6 psi (1009 hPa)
Atmospheric Classifications	Environments as defined in ISO 9223.ISO 9224. Category C5: Very High
Design Wind Speed	157 ft/s (48 m/s)

5.2. Civil and Structural Works

5.2.1. General

9. Modifications and refurbishment of the existing PS1 building is required to accommodate the new gensets, associated exhaust stacks, radiators, new control gear and switchgear.

10. The roof and part of the cladding of the powerhouse building is also to be replaced.
11. All sand and aggregate required for the project must be imported to the Marshall Islands in line with the requirements of the Environmental and Social Management Plan (ESMP).

5.2.2. Generator Hall

12. The generator hall currently has 4 gensets in the original hall and a CAT generator in extension to the generator hall. The existing gensets are installed on large mass concrete foundations that are approximately 10ft (3000mm) below ground level and are separated from the building foundations and ground slabs by concrete cable and oil trenches.
13. The concrete oil trenches around the existing generator foundations are to be partially or completely infilled with mass concrete. Beams will also be installed between the existing generator foundations. This will enable the new generator foundations to be built on or between the existing generator foundations. Refer to drawings A0285-S-422 & A0285-S-423 for details.
14. A grated channel (approximately 6”x6”/150x150mm) will be required around the new gensets to capture any oil or diesel spillage from the generator. This is to be piped to a new collection point adjacent to the fuel room.
15. The cable trenches in the generator hall will need to be modified to allow for cables from the gensets to the switchroom and control room. New trench covers will be needed to suit the new layout of cable trenches and ground beams.

5.2.3. Mechanical Annexe

16. The mechanical annexe between building gridlines 1-53 & A-B is to be demolished to allow space to accommodate the new generator exhaust stack, radiators and associated equipment. The annexe is a poor condition, as is the steel work surrounding it. The removal will include the suspended floor, support structure and concrete foundation pad.
17. The cladding, masonry blocks and profiled steel sheeting is to be replaced along building gridlines 1-53, with new steel girts and profiled metal sheeting. Included in the replacement will be filtered intake louvres sized to the cooling needed for the gensets. See clause 5.2.4 for further details.
18. The existing steel portal frame columns adjacent to the mechanical annexe cleaned of rust and protective treatment system applied.

5.2.4. Roof Ventilators & Generator Hall Ventilation

19. As part of the roof replacement (see clause 5.2.5) new roof ventilators are to be installed, design to provide sufficient air flow to provide cooling and combustion air for the gensets.
20. The intake louvres have a high velocity F7 filtration, for removal of airborne saline, and have fans attached to the back of the louvre to allow for the pressure drop from the filter and eliminate any air flow from other openings in the building (i.e. positive pressure to building). Filter to perform to EN779:2012 or tested to ASHRAE 52.2:1999. The filters are to be removable cartridges and cleanable.

21. The design for the ventilation should be based on an ambient outdoor temperature of 91.4°F (33°C). The peak temperature within the generator shall be limited to 118°F (48°C).
22. The roof ventilators are to be designed to work in conjunction with the positive pressure system. The roof ventilators are to be installed at the same time as the roof replacement to ensure appropriate roof flashings installed and weathertightness is achieved.
23. Ventilation system to have an isolation system to connected to the fire alarm. Louvres are to have fire dampers installed, activated with the alarm system.

5.2.5. Generator Hall Roof

24. The roof of the generator hall has had sections of roofing replaced but now needs to have a complete replacement due to deterioration and issues with ongoing rain ingress into the generator hall.
25. The roofing is to be a minimum of 28 mil (0.70mm) BMT (base metal thickness) and have a high level of protective treatment, meeting requirement of the loading (5.2.14) and durability (5.2.17).
26. The sheeting will need to span between the existing steel roof purlins (Z purlin), which are spaced at approximately 6 ft (1.8m). The condition of the existing purlins is to be reviewed during a full inspection of the building, allowance of replacement of 1/3 of the purlins is to be made.

5.2.6. MV Switchroom

27. To accommodate additional switchgear in the existing switchroom the following works are required:
    a. Removal of existing masonry partition wall (non-load bearing) between the switchroom and the adjacent utility room.
    b. Removal of existing doors and infill of these doors, where they will be blocked by the new equipment.
    c. Installation of new doors to allow for delivery of the switchgear.
    d. Removal of the existing cable trenches into the utility room to allow for extension of the switchboards in the room.
    e. New covers over the cable trenches.
    f. New room enclosure for battery storage.
    g. Upgrade of air conditioning equipment to suit revised heat loads

5.2.7. Control Room

28. The control room is to be modified as follows:
    a. Contractor shall allow for the removal and replacement of the raised floor in the control room. The raised flooring is to be replaced with a Tate Access Floors raised cable

floor, or similar, to allow for control cables to be taken across the floor to the control gear panels. Final details to be determined during detailed design.

b. Removal and replacement of the viewing windows to the control room. The existing control gear panels will need to be delivered through the windows of the control room.
c. New steel stand installed in the control room to support the new control gear.
d. Upgrade of air conditioning equipment to suit revised heat loads

5.2.8. Modular Containerised Gensets Foundations

29. These gensets are expected to be in ISO containers mounted in the approximate location shown on drawing A0285-G-140. These units will only require temporary foundations. These foundations can be concrete, steel or crushed gravel designed for the ground conditions and container loads, including any overturning from wind on the container.

5.2.9. BESS Enclosure Foundations

30. The enclosure/s for the battery storage is to be placed in a corner of the site adjacent to the PS1 building in the location shown on drawing A0285-G-140
31. The enclosure/s are to be installed on a concrete foundation slab, with a minimum thickness of 7” (175mm) or separate pads designed to minimised collection of water and organic matter around the base of the containers.

5.2.10. Crane Replacement (Option)

5.2.11. The existing crane within the genset hall is rated at 33,070 lbs (15 tonnes). The crane is no longer reliable to use and needs to be replaced. The reliability of the existing crane shall be considered when the Contractor is formulating installation methods for the new plant.

5.2.12. The Principal may choose to have the crane replaced as part of this Contract. The Contractor shall provide alternative pricing to replace the crane with a similar crane rated at 33,070 lbs (15 tonnes). If the mass of alternators being supplied as part of this contract or existing set 5 alternator exceed the 33,070 lbs (15 tonnes) rating, the replacement crane shall be suitably rated to enable lifting of the alternators.

5.2.13. The structural integrity of the crane rails and support beams shall be reviewed to ensure that the revised crane size can be supported.

5.2.14. Design Loadings

32. The following clauses describe the design loadings should be used for the building elements.

5.2.14.1. Imposed Vertical Loads

33. The table below summarizes all vertical loads including both superimposed dead and live loads.

Level/Area	Use	Distributed Live Load	Point Load
Generator Hall Floor	Trench covers and areas around gensets	100 psf (4.79 kPa)	1000 lbf (4.45 kN)
Control Room (Catwalks for maintenance access)	Raised access floor	40 psf (1.92 kPa) Personnel Loading & 200 psf (9.58 kPa) equipment loading*	600 lbf (2.66 kN)
Switchroom Ground Floor (suspended slab)	Switchgear support, and maintenance access*	40 psf (1.92 kPa) Personnel Loading & 200 psf (9.58 kPa) equipment loading*	1000 lbf (4.45 kN)
Roof	Roofing – consider non access	20 psf (0.96 kPA)	300 lbf (1.33 kN)

*Allowance for installation access of equipment over the floors should be made.

34. In all cases, a minimum superimposed dead load of 10.4 psf (0.5 kPa) is applied.

5.2.14.2. Wind Loads

35. The site specific wind speed for the site is 157 ft/s (48 m/s). Pressure or drag factors are to be determined from ASCE 7-10
36. The roof and wall cladding are to be designed to 83.6 psf (4 kPa), for the span required.
37. More specific structural loadings requirements is provided in Structural Design Features Report prepared by Calibre Consulting for the project.

5.2.15. Materials & Design Requirements

38. The materials supplied for the power house building and foundation works are to comply with the following American/ International standards:
    a. ASCE 7-10 Minimum Design Loads for Buildings and Other Structures
    b. ACI 318-11 Building Code Requirements for Structural Concrete structures
    c. ACI 301-16 Specification for Structural Concrete for Buildings
    d. ANSI/ AISC 360-16 Specification for Structural Steel Buildings
    e. ASTM A240 Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

5.2.16. Foundations

39. No site investigation of the ground conditions at the site have been carried out.
40. For preliminary design bearing pressures 5,2223 psf (250 kPa) should be based on previous experience of projects on Pacific atolls, refer to project design features report for details. The contractor will be responsible for carrying out and determining suitable foundation parameters for the project.

5.2.16.1. Testing

41. Testing at the power house site is to be carried out by a qualified Geotechnical Engineer with experience in Pacific islands.
42. The testing should include the minimum following requirements.
    a. Dynamic Cone Penetration (DCP) tests, to at least 10-13 ft (3-4 m) below existing ground level at various locations around the PS1 building.
    b. Bulk Density Tests, at least 2 locations
    c. Test pits, completed in two locations. The test pits are to be excavated to the maximum possible depth to review the following items:
    d. Ground water (tidal influence) level
    e. Location of hard 'pan' or rock layers
    f. Any changes in sand density or type.

5.2.17. Durability & Corrosion Protection

5.2.17.1. Steelwork

43. The steelwork for the works is to provide the protection for environmental classification class C5M, very high. Classification in accordance with ISO 9223.

5.2.17.2. Design Life & Years to first maintenance

44. The design life for the structural elements are as follow:
    a. Concrete Foundations 50 years
    b. Temporary Foundations 15 years
    c. Trench Covers 25 years
45. The protection system is to provide level of protection to first maintenance as follows:
    a. Structural Steel 15 years
    b. Steel profiled roofing & cladding 15 years

5.2.18. Existing Underground Services

46. All existing underground services in the proximity of the works are to be physically located and documented. Known underground services are shown indicatively on drawing A0285-G-140; however, contractors are advised that other undocumented services may be present and suitable precautions must be taken.

5.2.19. Fire Safety

47. Refer to the technical memo prepared by Calibre Consulting relating to the recommendations for the fire safety for the power house. The recommendations of this technical memo are to be implemented.
48. The following items are to be installed in the powerhouse:

a. Thermal/heat detection system with manual call points which complies with NFPA 3 & 4
b. Manual isolation/shut-off value for fuel supply to powerhouse and generators
c. Flame detectors for all generators connected to fire alarm system
d. Fire extinguishers inspected for suitability
e. Emergency lighting to be installed in the building to comply with NFPA101.
f. Illuminated fire exit signage installed to comply with NFPA101.

5.3. Gensets

5.3.1. General

49. The gensets supplied under this contract shall be unitised and consist of a gen-drive engine, alternator and skid (base frame). The gensets will have remote cooling, oil and fuel systems installed to support the operation of the gensets.

5.3.2. Site Power Rating

50. The gensets shall be nominally rated at 2,500 kWe.
51. **The Contractor shall advise in the Compliance Matrix** the Prime Power output (PRP) ratings of the gensets offered as defined in ISO 8528-1. The power output shall be expressed in kWe at the genset alternator terminals, excluding the electrical power absorbed by the essential independent auxiliaries, under the specified site conditions whilst operating at 60 Hz and at 0.8 power factor.

5.3.3. Genset Performance Requirements

5.3.3.1. General

52. To enable the integration of high levels of renewable energy sources, the diesel gensets are required to have high levels of operational flexibility to maximise the energy penetration of renewable energy while ensuring the system security of supply is maintained. The following clauses provide further details of genset performance requirements.

5.3.3.2. Block Loading / Load Acceptance

53. The Principal requires gensets that can accept significant step loads without impacting on system frequency and voltage. To facilitate this, engines with high BMEP will not be accepted. Further details on this requirement is detailed in clause 5.3.7.2. **The Contractor shall provide details in the Technical Schedules** of the block load acceptance for the gensets.

5.3.3.3. Genset Full Load Start Time

54. In periods of high solar generation, the diesel gensets may be shutdown with the BESS system supporting system frequency and voltage stability. It will be necessary for the gensets to quickly come online and accept load when required. Therefore, the gensets shall be able to be started and brought on-line without a warm-up period, and full load to be applied within 60 seconds from start signal. Further details on this requirement is detailed in clause 5.3.7.1.

5.3.3.4. Ramp Rate

55. As detailed above, the Principal requires very short time periods for the gensets to move from starting to full load. To facilitate this and to respond to a varying load resulting from varying output from the solar PV sources, the gensets are required have rapid ramp up and ramp down to ensure frequency and voltage stability. Typical expected ramp rates are 3-4% / second. **The Contractor shall provide details in the Compliance Matrix** of the ramp rate of the gensets being offered.

5.3.3.5. Low Load Operation

56. In periods of high solar generation, the diesel gensets will be required to run at low loads to maximise solar PV energy penetration. The Principal accepts that running genset at low loads results in lower efficiency for the genset, but it typically provides a net reduction in fuel consumption with the renewable energy replacing the diesel requirement at a given time.
57. The gensets shall therefore be capable of running at loads <10% of the Site Prime Power Rating for extended periods (approximately 8 hours). As a result of the solar output profile, gensets will be able to have higher loads applied each day. Further details on this requirement is detailed in clause 5.3.7.1.

5.3.4. Genset Performance Tests

5.3.4.1. General

58. The gensets supplied under this contract will be used for prime power generation, hence fuel consumption is a very significant factor in the Principals consideration of the life cycle cost evaluation of the offers initially and operations subsequently.
59. The Principal requires that a Genset Performance Test is undertaken on each genset. The tests may, or may not, be witnessed by the Principal to confirm satisfactory operation and performance of the gensets with emphasis placed on Guaranteed Site Power Rating and Guaranteed Site Fuel Consumption. The Contractor shall meet the costs for one (1) Principal's representative to attend the genset factory testing.
60. The testing of the gensets shall include a detailed test report for each genset in hard and electronic (PDF) formats. The reports shall be issued at least three (3) days prior to despatch of the equipment.

61. The Contractor shall give the Principal fourteen days' notice of when each generating set is ready for testing to enable arrangements for witness of tests by the Principal's representative/s if required.
62. The Contractor shall supply all equipment required to perform all tests and record the results. All tests shall be to the accuracy limits set out in ISO 3046 Part 3. Fuel consumption shall be determined by fuel mass delta by a calibrated electronic weighing scale. All instruments shall have NATA (or international equivalent) calibration certificates. Generally, the test instruments will be supplied by independent, nationally recognised, testing authorities and be valid at the time of the test.
63. All load tests shall be carried out on a load bank or other electrical load test assembly provided by the Contractor.
64. The Contractor shall provide the Principal with a complete written report on each genset test including all readings taken.
65. Engines shall be 'run in' as per the manufacturer's recommendations prior to testing.

5.3.4.2. Steady State Performance

66. Gensets under tests shall use distillate fuel as per the standard detailed in Appendix 1 or approved equivalent. The tests shall consist of an uninterrupted, continuous run at not less than the following:
    a. One (1) hour at 40% adjusted site rating
    b. Two (2) hours at 60% adjusted site rating
    c. One (1) hour at 100% adjusted site rating
    d. One (1) hour at 110% adjusted site rating
    e. One (1) hour at 80% adjusted site rating
    f. One (1) hour at 10% adjusted site rating
67. If the test run is interrupted testing shall recommence from the start.
68. The genset rating and fuel consumption shall be adjusted if site conditions during test are outside parameters provided in clause 5.1.2.
69. The Contractor shall take all readings necessary to verify the genset performance, including Guaranteed Site Power Rating and Guaranteed Site Fuel Consumption. These readings shall include all items as per the sample genset test sheet in Appendix 4. All readings shall be taken at 15 minute intervals and recorded in Microsoft Excel files. Governing dynamic behaviour shall be recorded using a chart recorder or other method approved by the Principal. Both the Contractor and the Principal will certify readings.

5.3.4.3. Load Acceptance Performance

70. Load acceptance testing of the gensets shall be done according to ISO 8528-2/5 and ISO 3046-4. The test set up and conditions shall be collected during the tests. Frequency and voltage shall be recorded during the tests.

71. Data resolution shall be no less than 50 samples per second for test results. Data shall be recorded for a minimum of 10 seconds for each test. The automatic voltage regulator (AVR) to be supplied under this Contract shall be used for testing purposes. Under-frequency voltage roll-off shall not be applied by the AVR during the testing.
72. The test report shall include the test results provided as Microsoft Excel files along with oscilloscope records.

5.3.4.4. Performance Guarantees

73. The Contractor shall provide the required performance guarantees by completing and signing the Compliance Matrix.
74. The tested site power rating shall be the power rating as measured in clause 5.3.2 adjusted to site conditions as necessary. If the tested site power rating is more than 3% below the Guaranteed Site Power Rating in the Compliance Matrix or the nominated operating parameters are exceeded the genset shall be deemed to have failed the power test. If a genset fails the power test, the Principal shall have the right to either reject the genset or have necessary modifications made at the Contractors expense.
75. The tested site fuel consumption shall be the fuel consumption as measured in Clause 5.3.7.9 adjusted to site conditions as necessary. If the tested site fuel consumption at 60% of Guaranteed Site Power Rating is more than 3% above the Guaranteed Site Fuel Consumption at 60% of Guaranteed Site Power Rating in the Compliance Matrix, the genset shall be deemed to have failed the fuel consumption test. If a genset fails the fuel consumption test, the Principal shall have the right to either reject the genset or have necessary modifications made at the Contractors expense.
76. If a genset fails a test, subsequent re-testing of the genset shall be at the Contractors expense.

5.3.5. Genset Site Stability Tests

77. The Contractor shall undertake testing on each genset as part of the SAT during commissioning to verify the performance of the gensets and auxiliary equipment in site conditions. The tests shall consist of an uninterrupted, continuous run at not less than the following:
    a. Twelve (12) hours at 70% site power rating
    b. One (1) hour at 110% site power rating
    c. Two (2) hours at 100% site power rating
    d. Nine (9) hours at 60% site power rating
78. The testing at 100% and 110% shall be undertaken during the middle of the day to ensure the genset is being tested at the highest possible ambient temperature.
79. If the test run is interrupted testing shall recommence from the start.

5.3.6. Manuals

80. The Contactor shall provide electronic manuals (in PDF) or online access to electronic manuals. Where online access is provided the Contractor shall provide a 20 year access to the online system. **The Contractor shall provide details in the Compliance Matrix** of the electronic/online manual system.
81. The Contractor shall provide two full sets of printed manuals for the gensets. **The Contractor shall include in the Compliance Matrix** the cost to provide additional sets of manuals. The relevant parts of the manuals provided shall be replaced at the Contractors expense, where amendment of the manuals is necessary for any reason, during the Contract.
82. The manuals shall include but not necessarily be limited to the following:
    a. installation instructions including initial start-up procedures
    b. operating manuals including equipment functions, normal operating temperatures and pressures, protection set points, schematic diagrams, system flow diagrams, test procedures, lubricants, water treatments and troubleshooting charts.
    c. workshop manuals including manufacturer's accepted practices, procedures and precautions during maintenance operations, disassembly and assembly sequence, component tolerances, screw thread torque and special tools required.
    d. maintenance manuals including inspection, servicing, adjustment and maintenance procedures and schedules.
    e. spare parts manuals including exploded drawings cross referenced to parts lists and identifying numbers.
    f. detailed drawings of any parts, accessories or any and all fixtures that are not included in the spare parts manual/s.

5.3.7. Engine

5.3.7.1. General

83. The engines shall be heavy duty, reciprocating, diesel fuelled, internal combustion engines suitable for 60Hz prime power generation applications. The engines shall be 'medium speed' and shall operate at 720 or 900 rpm. The engines shall be capable of driving alternators in parallel with other machines with different synchronous speeds.
84. The engines shall be four stroke, compression ignition, direct injection, water cooled, cold start, turbo-charged, with or without charge air after-cooling, multi-cylinder inline or V format.
85. Charge air cooling if provided shall be facilitated by way of water-air charge air cooling. Air-air charge air cooling shall **not** be accepted.
86. As a minimum, the engines shall be suitable for continuous prime power operation at loads as low as 40% of the Guaranteed Site Power Rating. Engines that can run for extended periods (8-9 hours) during the day at low loads (<10%) are preferred. The load profiles are such that engines will be able to be run at higher loads (>60-70% for 1-2 hours) daily to burn off any carbon build up in the cylinder. **The Contractor shall advise** any implication

on engine operation, including maintenance, that this requirement imposes, and Compliance Matrix for maintenance shall account for this requirement.

87. The engines shall ideally be suitable for cold start and immediate acceptance of load from cold start at site ambient conditions. **The Contractor shall advise** any specific requirements for the engine and any implications on engine operation, including maintenance, that this requirement imposes, and Compliance Matrix for Maintenance shall account for this requirement. Should the engine not be suitable for cold start, the contractor to advise any hot start requirements and costs.
88. The engines shall be supplied with facilities to instantaneously and securely stop the engine. Fuel shutoff solenoids and actuators shall be energised to run and configured to return to the closed no fuel position, i.e. de-energisation will stop the engine.
89. Engines shall be provided without auxiliary belt drives.
90. If engine bearing brinelling can occur from the engine not operating for extended periods, the Contractor shall supply suitable means for automatically rotating the engine or maintenance procedures to enable this to be undertaken.
91. High reliability options shall be provided where-possible for components such as starter motors, turbochargers and cylinder heads to an equivalent 'off-shore' specification.
92. Engines offered shall be suitable for continuous prime power operation with a service life of no less than 100,000hrs, inclusive of generally accepted service and maintenance regimes with one (1) in-frame overhaul.

5.3.7.2. Engine Rating

93. **The Contractor shall advise in the Compliance Matrix** the:
    a) ISO 3046 -1:2002 –I - ISO standard power able to be exceeded by 10 % (ICXN) at nominal 720/900 rpm for the engines being offered, and
    b) ISO 3046 -1:2002 (–) - ISO service standard power able to be exceeded by 10% (SCXN) (Guaranteed Site Power Rating) at nominal 720/900 rpm for the engines offered.
94. De-rating of the engine for site conditions shall be in accordance with ISO 3046, typical calculations are shown in Appendix 2. Where ISO 3046 allows de-rating by testing and this applies to the engine offered, documentary evidence shall be supplied to support the claim.
95. To maintain suitable step load acceptance, engines provided shall have a BMEP no greater than 41,770 psf (2,000 kPa). If the BMEP is greater than 41,770 psf (2,000 kPa) at the SCXN rating, the SCXN rating shall be reduced to match BMEP or 41,770 psf (2,000 kPa). Calculations for determining the adjusted rating are shown in Appendix 3. **The Contractor shall advise in the Compliance Matrix** the BMEP at the SCXN rating.

5.3.7.3. Engine Control

96. The engines shall be supplied fitted with an electronic governing system (ECM). Engine steady state speed governing shall be in accordance with ISO 8528.1: 2005 (E)

Performance Class G2. **The Contractor shall advise in the Compliance Matrix** the steady state stability limits.

97. Protection systems for the engine are detailed in clause 5.13.13.2.
98. **The Contractor shall advise in the Compliance Matrix** full functional details of the ECM, including communication protocols, all user programming and monitoring tools, both software and hardware as appropriate, licensing requirements and operating system compatibility

5.3.7.4. Engine Cooling

99. The engine coolant system shall utilise a common coolant circuit to transfer heat from the jacket water, lube oil cooler and other on engine components. Heat transfer from the charge air may utilise the common system or employ a separate coolant circuit.
100. Circulating pumps shall be gear driven, sized to operate against an external pressure drop of at least 1,045 psf (50 kPa). Coolant circulation systems shall be fitted with a self-contained thermostatically controlled valve (thermostat) to bypass the radiator when the engine is cold.
101. **The Contractor shall advise in the Compliance Matrix**, all requested design and performance data for the engine cooling system.
102. **The Contractor shall advise the Compliance Matrix** the coolant specification and treatment requirements. The Principal prefers the use of pre-mix coolants. Coolant treatment additives and elements shall be readily available in the Majuro region.

5.3.7.5. Engine Exhaust

103. The engine shall be fitted with a flanged elbow or similar at the turbocharger outlet to allow fitting of exhaust pipework.
104. The Principal prefers that the turbo charger and turbo charger elbow to be insulated using lagging. The Contractor shall provide details if this is acceptable or expected to cause short/long term performance issues with the plant.
105. **The Contractor shall advise in the Compliance Matrix**, all requested design and performance data for the engine exhaust system.

5.3.7.6. Air inlet system

106. The air inlet for the engine may be installed external to the genset hall. The Contractor shall determine the most appropriate method that will still guarantee the performance and longevity of the engine.
107. The inlet air shall be filtered with heavy duty filters that are designed to minimise salt ingress into the inlet air.
108. If the engines are fitted directly with heavy-duty inlet air filters, they shall be fitted with pressure differential indicators to show when servicing is required and Cyclone type pre-filters. Filter elements shall be readily available in the Majuro region.

109. Filter housings shall be arranged to ensure the filter elements can be changed simply and safely on site by local power station staff. Consideration shall be given to providing clear access to the filters and not requiring staff to climb on top of other engine components to gain access.

110. Air filter housing support bracketry or inlet ducting shall be designed to limit impedance to overhead lifting equipment used to access the alternator and other major components on the engine (e.g. cylinder heads).

111. **The Contractor shall advise in the Compliance Matrix** all requested design and performance data.

5.3.7.7. Engine starting system

112. The starting system shall be chosen to match the engine selected. The starting system shall be unitised with one unit per generator to reduce redundancy issues with common plant. The starting system shall be capable of at least ten (10) starts per hour. The Principal has a clear preference for an air start system and will only accept electric start systems if air start is not available for the gensets being offered. **The Contractor shall provide details in the Compliance Matrix** of the starting system proposed.

113. If an air start system is proposed, the system may have common air compressors and associated equipment with a minimum of N-1 contingency. Other components for the air start system shall be unitised. The air quality must comply with ISO 8573-1:2010. The starting air must fulfil at least the following quality requirements according to ISO 8573-1:2010:

a. Purity regarding solid particles: Quality class 6
b. Purity regarding moisture: Quality class 7
c. Purity regarding oil: Quality class X

The Contractor shall advise in the Compliance Matrix details of the air compressor, pressure relief valves and receivers. Any hazardous plant such as pressure vessels, compressed air receivers and pressure relief values must comply with the statutory laws of the land, regarding their design and use. Design registration certificates to be supplied by the Contractor in accordance with any statutory law requirements. In order to protect the engine's starting and control equipment against condensation water, the air receiver(s) shall be fitted with good drainage facilities. Receiver(s) arranged in horizontal position must be installed with a slope downwards of min. 3°-5°. An oil and water separator shall be mounted between the compressor and the air receivers and shall be equipped with automatic drain facilities.

114. If electric start systems are used, the batteries and chargers shall comply with clause 5.16.1.6 and 5.16.1.4. The engines shall be supplied without engine mounted battery charging alternators.

115. The genset starting system shall incorporate a system to isolate the starter to allow safe access to the plant. For air start systems, isolation valves must be lockable and clearly identified. If an electric start system is used, Anderson-style pull-apart battery

isolation plugs or similar shall be used to isolate the battery cables. One plug shall be rigidly mounted to support frame while other plug will have suitable handle attached which allows for ease of isolation. Plugs shall be mounted in position which provides easy access.

5.3.7.8. Maintenance, Tools and Spare Parts.

116. Servicing shall not be required at intervals less than 1000 hours of engine operation. All equipment requiring routine inspection, servicing or adjustment shall be easily accessible.

117. Suitably qualified personnel will carry out all maintenance and repairs. **The Contractor shall advise in the Compliance Matrix** details of the manufacturer's recommended maintenance program (with due consideration of normal wear of the engines in similar applications) including work to be carried out at various intervals to 100,000 hours, the estimated time to carry out the work and the estimated cost of spare parts required. Where maintenance 'on condition', including fuel burned or kWh produced is required, Contractors shall base the requirements on an average load factor of 70%.

118. The Contractor shall ensure that any changes to engine maintenance regimes or practices are notified by OEM maintenance bulletins or equivalent.

119. **The Contractor shall list in the Compliance Matrix** the prices of all special tools (including CMMS) required for service, maintenance, disassembly and assembly of the engines. Special tools include those that are normally available exclusively from the engine manufacturer. The Principal shall have the right to purchase any or all of these tools at the quoted price for the period of the Contract.

120. **The Contractor shall provide details in the Compliance Matrix** of any CMMS systems available to manage maintenance on the engines. The Contractor shall also advise if the offered CMMS system is able to manage maintenance for other auxiliary and ancillary equipment within the power station.

121. **The Contractor shall advise in the Compliance Matrix** the current prices of all recommended spare parts required (with due consideration of normal wear of the engines in similar applications) for the servicing and maintenance of the engines for the first 100,000 hours of operation.

122. **The Contractor shall advise in the Compliance Matrix** how they propose to ensure the availability of any items required as spare parts for the engines offered under this Specification and what typical delivery periods may be expected. Preference will be given to Contractors with inventory holdings in the Pacific region.

5.3.7.9. Engine Fuel

123. The engines shall be suitable for operation on distillate fuel as specified in the MEC Diesel Fuel Standard shown in Appendix 1. The engines shall be capable of operating on diesel fuel with sulphur levels ranging from 500ppm to 15ppm. The engines chosen shall be fuel optimised (not emissions optimised) to reduce the fuel consumption.

124. **The Contractor shall advise in the Compliance Matrix** the Guaranteed Site Fuel Consumption of the engines offered. The Contractor will be required to verify site fuel consumption during Testing/Commissioning as per Clause 5.3.4.2.

125. A full flow fuel filter/s shall be fitted. Under normal operating conditions, the fuel filter shall be capable of efficient operation for at least 1,000 hours before replacement. The degree of filtration shall be at least 0.4 mil (10 microns).

126. All fuel lines mounted on the engine are to be effectively secured and manufactured to prevent fuel oil or fuel oil mist from reaching a source of ignition on the engine or its surroundings. The use of flexible hoses shall be minimised and only used where rigid tubes are unsuitable.

127. **The Contractor shall advise in the Compliance Matrix** all requested design and performance data

5.3.7.10. Engine Lubricating oil

128. The disposal of oil and filters are a significant issue for the Principal due to the remote site location. The Principal prefers engines that limit the amount of waste oil produced and filters that will need to be disposed of. Filter elements installed in engine housings are preferred over spin-on filters.

129. Suitable oil filtration shall be used to meet the requirements of the engine. Consideration shall be given to auxiliary equipment that can extend oil change intervals and reduce disposable filter requirements. The installation of any auxiliary systems shall not have any impact on the engine warranty. Any oil burn systems proposed shall be supported by information detailing the service history in similar applications. **The Contractor shall advise in the Compliance Matrix** details of the oil system used on the engine and in particular details of any auxiliary oil treatment equipment.

130. **The Contractor shall advise in the Compliance Matrix** any oil sampling and analysis equipment requirements for lubricating oil. This shall include any details on Spectrometric Oil Analysis Programs.

131. Systems shall be installed to allow waste oil to be pumped from individual engine sumps to the station bulk waste oil storage system.

132. The engines shall be suitable for operation using readily available lubricating oil types. **The Contractor shall advise in the Compliance Matrix** what standard of oil is required in the engines for the service intervals proposed.

133. **The Contractor shall advise in the Compliance Matrix** the expected oil consumption of the engines offered.

134. All equipment on the engines shall be lubricated from the engine's lubricating system.

135. The lubricating oil shall be drawn from the sump by a gear pump driven directly from the engine's crankshaft and passed through a filter before being delivered to the lubricating oil gallery. Oil coolers shall be used if final oil temperature exceeds required limits.

136. The engines shall be fitted with automatic oil makeup to ensure the oil level within the sump is maintained at the correct level. The oil level regulator shall be a REN RABK or Murphy LM2000 or equivalent. Further details on the oil make up tank is detailed in clause 5.8.2.3.

137. The engines shall be fitted with oil level protection. It shall consist of 2 stage (alarm and shutdown) high and low oil level protection.

138. An outlet with a suitable needle type valve shall be provided to allow filling of oil sample bottles while the engine is running.

139. A readily accessible dipstick marked with “Low” and “High” levels for when the engine is NOT running shall be provided.

5.3.7.11. Engine Crankcase Ventilation

140. The crankcase ventilation systems shall be an open type. Systems that return crankcase outputs to the inlet manifold shall not be accepted.

141. The system shall be efficient in separating oil from the crankcase emissions and shall ensure that there is no visible oil plume or mist; separated oil shall be returned back to the crankcase.

142. The system shall not contaminate the induction air pathway and shall be configured to facilitate final discharge of crankcase fumes at a point remote from the engine.

143. A suitable monitoring and alarm system shall be installed on the crankcase breather/s to provide indication of excessive wear in the engine (i.e. high crankcase pressure or excessive oil misting).

144. **The Contractor shall detail in the Compliance Matrix** the open crankcase ventilation system suitable for each engine size, to be fitted by the Contractor on acceptance by the Principal.

145. Oil level regulation equipment shall operate to ensure there shall be no pressure differential between the oil make-up system ventilation point on engine and crankcase entry point.

5.3.7.12. Guarding – moving parts and hot surfaces

146. The engine shall be supplied with guarding of all moving parts and hot surfaces when delivered to meet this Technical Specification. Guarding shall be constructed and installed in accordance with relevant legislation and OHSA CFE 1910.212. The guards shall be substantial fixed covers that remove all potential for inadvertent contact with moving parts during normal operation of the engine.

147. Where guards are required to be removed for maintenance purposes; the fasteners shall be substantial and easily accessible. All guards shall be designed so they can be replaced by an individual using standard hand tools.

148. Each guard shall be fabricated from solid, perforated or expanded steel plate designed for easy installation and removal and inspection of any belts. Necessary

supports and accessories shall be supplied with each guard. The mass of any guard or clause shall not exceed 44 lbs (20 kg). Guards shall be designed to prevent accumulation of grit and dust within the guard. Guards for outdoor installation shall be made from carbon steel that has is hot-dip galvanised after construction, 316-grade stainless steel or approved aluminium alloy.

149. Guards for pulleys and sprockets shall be provided with a removable plug/access opening for tachometer readings at the pulley, sprocket or shaft centre. This shall be suitable for a digital tachometer.

150. Safety guards for horizontal shafts, shaft couplings, belt sheaves, etc. shall be of the inverted 'U' design with sides extending to the equipment base or base plate.

151. Heat shields for shall be provided to protect against hazards associated with hot surfaces.

152. These shall be installed by the engine Contractor and constructed from suitable material as specified above.

153. The Contractor shall nominate if the exhaust manifold and/or turbo housing can be lagged with insulation blankets or other thermal lagging.

5.3.7.13. Engine Noise

154. **The Contractor shall provide in the Compliance Matrix** the noise levels for the engines. The levels supplied shall be the maximum expected noise levels, without fan, intake and exhaust noise, at points 1m above ground level in accordance with ISO 6798.

5.3.8. Alternator

5.3.8.1. General

155. The alternators fitted to the gensets shall be constructed in accordance with NEMA MG-1 and IEC 60034. The alternators shall be horizontal, foot mounted, IP23 self-cooling, brushless, self-exciting, self-regulating, and star connected with the star point connected to a separate insulated terminal.

156. The alternators shall be suitable for direct connection to a 3 phase, 4 wire 13.8kV, 60 Hz, alternating current system with the neutral earthed through a high impedance earthing resistor.

157. The alternators shall be two (2) bearing with a flexible coupling for connection to the engine. The bearings shall be insulated against shaft currents if required.

158. The alternators shall be suitable for stable operating in parallel with all installed alternators. Reactive power sharing shall be carried out by static V.A.R. compensation arrangement (cross current compensation).

159. The alternators shall be designed to the following parameters:

Parameter Description	**Units**	**Requirements**
Winding Configuration		Star Connected

Winding Insulation Class		H
Winding Pitch		5/6
Number of poles		8 / 10 (Supplier to specify to match speed of engine proposed)
Frequency	Hz	60
System nominal voltage	kV	13.8
Rated voltage	kV	15
Nominal Rated Power (based on 2,500 kWe)	kVA	3,440
Rated Power factor		0.8

160. **The Contractor shall provide full details in the Compliance Matrix** of the alternators offered including overall weight of the alternator.

5.3.8.2. Rating

161. The alternators shall be rated at 13.8kV, 60 Hz. The power rating of the alternator shall be chosen to match the diesel engine connected to the generator. The alternator shall be capable of supplying 110% site power output for one continuous hour in any twelve-hour period of continuous running. The kVA rating of the alternators shall be 110% of the kWe rating at a power factor of 0.8. The alternator efficiency for determining the rating shall be assumed to be the efficiency at 110%. i.e. kWe = Alternator Efficiency @ 110% x kWb.

162. The alternator shall be rated such that the temperature rise at 110% rated power of the alternator shall be limited to that allowable under Class F (i.e. 105 degrees Celsius rise).

5.3.8.3. AVR/Control/Load sharing

163. The alternator/s will normally run in parallel with other alternators connected to the system. The excitation / voltage regulation control and governor shall enable the total system kVAr and kW to be shared proportionally between alternators according to their rating. Further details of the control system are detailed in clause 5.13.5.

164. The alternators shall be suitable for connection to a Basler DECS100 type automatic voltage regulator (AVR).

5.3.8.4. Terminal box

165. An alternator terminal box shall be mounted on top of the unit with cable entry and connection facilities provided from both the left and right hand sides. Marine quality aluminium gland plates shall be provided for the termination of single core cables.

5.3.8.5. Bearings

166. The alternators will be configured with two (2) bearings and shall use bearings capable of 50,000 hours of operation without replacement. Bearing housings shall be suitable for continuous running and have a guaranteed life of no less than 100,000hrs without being replaced. **The Contractor is to provide details in the Compliance Matrix** of bearings used in the alternator.

167. Bearings are to be fitted with temperature monitoring RTDs that are wired to a central wiring termination box located on the genset under-base

5.3.8.6. Coupling

168. Two bearing alternators will be coupled to the drive engine crankshaft with a flexible coupling such as a “Centaflex” with keyless taper lock connections. The alternator shaft shall preferably have no keyways or be supplied with a flush blanking key. As a minimum, the flexible coupling should be capable of operation to 50,000 hours. **The Contractor shall provide details the Compliance Matrix** on the coupling proposed.

169. The alternator frame shall be bolted to the engine flywheel housing with a suitable adaptor housing.

170. Torsional vibration analysis of the coupled alternator and engine shall be performed by the Contractor.

5.3.8.7. Corrosion protection and Alternator Heaters

171. The alternators shall be designed to be operated in a marine environment and have additional corrosion protection applied to the windings of the alternator. **The Contractor shall provide details in the Compliance Matrix** of the winding corrosion protection system.

172. The alternator shall have a zinc based undercoat system applied. It shall also be painted in a top coat, coloured to match the drive engine colour. The top coat shall be compatible with the zinc undercoat system as supplied to provide protection in a Very-High marine environment.

173. All removable panels shall be unbolted from the alternator and all surfaces (internal and external), painted in the top coat. The alternator frame shall be painted with all machined surfaces and equipment masked (or removed) to ensure that they remain free from paint. Suitably coat the machined surfaces with a corrosion inhibitor after painting. The alternator shall be re-assembled using stainless steel fasteners.

174. The alternator heaters shall be designed to ensure maximum moisture rejection when the alternators are not operating and take into consideration the high average humidity. **The Contractor shall provide details in the Compliance Matrix** of the heaters to be used in the alternator.

5.3.8.8. Winding Temperature measurement

175. The Contractor shall provide temperature sensors (Pt100 RTD's) to allow the monitoring of the alternator stator winding temperatures. The RTD's shall be embedded and located at points where the highest temperatures are likely to occur.

176. The exact location of the RTD temperature sensors shall be determined by the alternator manufacturer.

177. The RTD temperature sensor leads shall be wired to a separate external terminal box fitted in an approved position and adequately labelled to indicate the location of each RTD.

178. The alternator RTDs shall be wired into the genset controls and protection systems.

5.3.8.9. Air filtering

179. The inlet air to the alternator shall be filtered to reduce the amount of salt present in the air within the alternator. **The Contractor shall provide details in the Compliance Matrix** of the filtering system to be used.

5.3.9. Skid

5.3.9.1. General

180. The genset under-base shall meet the following criteria:

a. Be of durable construction
b. Be capable of supporting the entire generator set during operation and transport with consideration of the weight of the equipment and within the limits of the torsional and alignment parameters required by the coupled genset.
c. Have a fabricated steel construction that are joined using welding techniques and processes that comply with AWS D1.1.
d. Be capable of being resiliently supported in a manner suitable to the type and application where the genset shall be utilised
e. All cables mounted to or through the skid shall be appropriately supported and protected from mechanical damage,

5.3.9.2. Cable termination box

181. *The genset under-base shall incorporate a termination box that is used to house all the cable terminations for the genset control and protection systems.*

182. *This box shall be IP 56 rated and sized to house all required cable connections.*

183. *All cable entries to this box shall be made using appropriately-sized cable glands.*

184. All cables shall be appropriately supported and protected from mechanical damage *including vibration. The termination box may be supported from the under-base or on the concrete floor adjacent to the genset with final location chosen to minimise the impact of vibration on cables and electrical equipment.*

5.3.9.3. Resilient mounts

185. *The genset shall be mounted on resilient vibration isolation mounts that effectively dampen the vibrations of the genset during operation.*

186. *The mounts may be installed between the genset and the under-base or between the under-base and the floor.*

187. *The system employed shall be suited for the weight; rating and duty of this installation shall and be capable of withstanding contact with diesel, oil and coolant.*

5.3.9.4. Protective coating

188. The protective coating on the under-base shall be suitable for long term operation in the specified conditions. The coating system used shall incorporate an epoxy primer, high build epoxy mid coat and polyurethane top coat. Dry film thicknesses for each coat must not exceed the maximum recommended by the coating manufacturer.

189. For new steel prepared off-site, all surfaces to be coated shall be abrasive blast cleaned. Profile height must be no less than $1^{37}/_{64}$ mil (40 microns). Any preconstruction primer must be subject to the approval and recommendation of the protective treatment Contractor.

190. Welds shall be stripe-coated by brush prior to spraying, to ensure penetration and adhesion of the coating. The application must be with airless spray or approved equivalent, and strictly in accordance with the manufacturer's instructions and this specification.

191. Colour top-coating of all nominated surfaces must be with the applicable colour topcoat to a minimum dry film thickness of 3 mil (75 microns). The colour topcoat shall be the same colour as the engine. The finished coating must be free from runs, sags and defects.

5.4. Crankcase Ventilation System

192. The crankcase breather from the engines shall vent externally to the building with the separator and piping sized to minimise backpressure. The system shall be designed to prevent contamination of the building or surrounds from oil mist.

193. The pipework shall be installed so that it is angled upwards to allow oil condensate to drain back to the engine. Should pipework be designed such that all oil condensate cannot be drained to the engine, suitable collection points shall be incorporated into the pipework and fitted with valves to allow them to be drained as part of a regulator maintenance schedule.

194. The external vent shall be above roof level and shall incorporate a suitable rain diffuser to prevent water entering the system.

5.5. Genset Cooling System

5.5.1. General

195. The radiators are to be air cooled type with vertical axial air flow, discharging fan drives designed to avoid problems of fatigue due to vibration, pressure and differential expansion. The radiators must be of industrial standard to match the engine design life. **The Contractor shall provide in the Compliance Matrix** the radiator manufacturer's data/specification sheet and other supporting documentation.

196. The preferred arrangement is that of a non-stacked core design. The system shall be designed to maintain the engine jacket water (high temperature water) at a constant temperature through the use of temperature monitoring and a variable speed drive fan/motor package.

197. Charge air cooling (low temperature water) shall be designed to deliver charge air to meet engine manufacturer requirements under all the stated design conditions. Therefore, a fixed speed fan is preferred to deliver coolest possible charge air under worst case conditions.

198. The equipment provided for the cooling system shall include but not be limited to:

a. Radiators including expansion tanks
b. Radiator support structure
c. Radiator support structure access ladders and platforms (if required)
d. Expansion tank
e. Pipework and valves
f. Temperature and pressure indication and switches
g. Level indicators and switches
h. Protective devices

199. If required to enable quick starting on the engines, jacket water heating equipment may be installed. Heating shall be achieved through the use of electric heating elements. The energy consumption of the jacket water heating system shall be minimised. **The Contractor shall provide in the Compliance Matrix** details of the jacket water system proposed.

5.5.2. Power Consumption

200. Radiators shall be designed to minimise the pressure drop across them under normal operating conditions. The total system shall be designed to minimise fan power consumption.

201. 'Energy Efficient' motors shall have a minimum efficiency as scheduled in accordance with IEEE 112 test method B.

202. VSD's shall be used on the HT (and LT if suitable) circuit to reduce power consumption of the fan motors. The VSD's shall be suitable for the environment in the location that they are installed. Consideration shall be given to installing VSD's in the switchroom or control room. If VSD's are installed remote to the radiators, noise filtering shall be installed to ensure correct operation of the VSD's.

5.5.3. Noise Levels

203. The radiators shall be carefully designed to minimise the generation of excessive sound levels. The maximum sound pressure level of the radiators shall be 85 dBA @ 1 metre away and 1 metre above ground level in accordance with ISO 6798. **The Contractor shall provide details in the Compliance Matrix** the designed noise level from the radiators.

5.5.4. Construction

204. The radiator cores and fans shall be supported on a suitable frame. All ferrous metals shall be hot dipped galvanised

5.5.5. Radiators

205. The radiators arrangement shall incorporate working platforms/spaces, access ladders, safety rails and shall have fall arrest attachment points to comply with the appropriate Standards to allow safe servicing and maintenance of the radiators.

206. The radiators shall be treated to minimise corrosion and shall be sized for the maximum specified output (i.e. 110% of genset output) at the most severe specified ambient conditions with fouling factor of 20%.

207. Each radiator tank in each bank shall be fitted with suitable valves for venting air from the system.

208. Covers shall be fitted to protect the tubes and fins from damage during transport, installation, operation and maintenance. Screens shall be fitted across the radiator cores to protect the tubes and fins from damage during transport, installation, operation, and maintenance

5.5.6. Fan Motors

The fan motors shall: be totally enclosed, fan cooled, weather-proof and comply with NEMA MG 1; be suitable for direct on line starting; be enclosed to IP55 when mounted vertically; and have class “H” insulation to NEMA MG 1.

209. The maximum normal operating speed shall not be greater than 1140 rpm (six pole fan motor). P.A.M. or T.A.P. motors shall not be accepted. The motors shall operate continuously from a three phase 480V and 60Hz supply.

210. The motor(s) shall be of a high efficiency type.

211. The motor shall be provided with an isolating switch which is to be mounted externally on the radiator. The isolating switch shall be able to be locked in the open position to enable safe access to the motor.

212. The fan motor bearings shall:

a. Be of the ball, roller or sleeve bearing type.

b. Be capable of withstanding the thrust load when motor is mounted in the vertical position.

c. Have seals providing IP55 protection.

d. Be sealed so as to prevent leakage of lubricant along the shaft.

e. Be capable of withstanding a temperature of 392°F (200°C) in excess of motor temperature when operating at the specified conditions.

213. To prevent damage to bearings, motors shall be transported with anti-brinelling clamps or blocks fitted.

5.5.7. Fans

214. Weather-proof, aerofoil blade axial flow, directly driven fans that comply with shall be used to supply cooling requirements of the radiators. The fan blade pitch shall be adjustable.

215. Use of vee belts, gear boxes and mechanical variable speed devices to drive fans shall not be acceptable. Fans shall be attached to motor shafts by means of taper lock type coupling for ease of removal. Prior to attachment of the fan to the motor, the shaft shall be liberally coated with a copper based anti-seize compound.

216. Fans shall be readily removed, requiring only the removal of the discharge duct and outlet grill.

5.5.8. Coolant

217. A coolant suitable for the engines supplied and the operating conditions shall be provided. Preference is for the coolant to be pre-mixed and provided in 55 gallon (208 litre) drums or 264 gallon (1000 litre) IBC's.

218. The Contractor shall supply suitable IBC's of sufficient volume to enable capture of recovered coolant from both circuits of each generator cooling system during maintenance activities.

5.5.9. Pipework

219. Pipework construction shall be in accordance with clause 5.10 and the following specific requirements.

220. Pipework for the two cooling circuits shall be designed to suit the genset and radiators selected. The pipework material shall be painted carbon steel or stainless steel. Galvanised pipework shall not be used.

221. The pipework shall include suitable expansion bellows to cater for any pipework movement and vibration of the genset.

222. The pipework shall also include suitable isolating valves on the inlet and outlet of each cooling circuit to enable isolation of the cooling circuits. Butterfly valves with handles that give a positive indication of the valve position are preferred. The valve material shall suit the pipework material selected.

223. Suitable drain valves will be installed in the pipework to enable the engine and/or radiator to be drained. The valves shall be suitable for flexible hoses to be connected to enable the coolant to be pumped into IBC's.

5.6. Genset Exhaust System

5.6.1. General

224. Individual exhaust systems shall be installed on each generator and shall be designed to suit the engine on the generator. The silencer and stack shall be installed external to the generator hall. The outlet of the stack shall be above the roof level of the main power station building.

225. The Principal is considering the possibility of a future installation of a waste heat recovery system using the generator exhaust systems. **The Contractor shall provide details in the Compliance Matrix** of modifications that would be required to the exhaust system to accommodate an exhaust gas boiler in the future.

5.6.2. Exhaust Silencer

226. The silencer can be mounted horizontally or vertically with each silencer installed on its own individual support frame. The support frame shall be constructed with hot dipped galvanised steel and fasteners.

227. The silencer shall be constructed of a material suitable for long term performance in the operating environment specified. Particular focus shall be on corrosion resistance. The silencer shall be fitted with a drain valve and lifting lugs. The design shall ensure that moisture cannot accumulate on any horizontal surfaces of the silencer.

5.6.3. Exhaust Stack

228. The exhaust stack shall be all 304 grade stainless steel (or equivalent) and fitted with a high efficiency rain diffuser. Use of rain caps which open and close shall not be used. The exhaust stack shall be uninsulated however attenuated stacks may be used to help achieve necessary noise reduction.

5.6.4. Exhaust Bellows

229. Suitable stainless steel expansion joints shall be installed in both the vertical and horizontal planes to ensure pipe expansion does not place excessive pressure on the turbo elbow or silencer.

230. All exhaust expansion joints shall be flanged, constructed of multiply 321 stainless steel bellows and fitted with internal flow liners.

5.6.5. Exhaust Pipework

5.6.5.1. Materials

231. All piping in the hot gas path shall be constructed of 304 grade Schedule 10 stainless steel.

5.6.5.2. Supports

232. The exhaust pipework connecting the generator to the silencer shall be installed at a height such that pedestrian access below the pipework is unrestricted.

233. The piping shall be fully supported on suitable fixed and sliding supports that accommodate expansion and ensure correct alignment of the exhaust system pipe work.

234. Exhaust pipe work shall be reinforced where it is supported.

235. All supports shall be free standing and all external supports shall be fully galvanised

236. Pipe stress analyses of all pipe work subject to substantial thermal stress shall be carried out prior to erection commencing.

5.6.5.3. Flanges

237. Stainless steel flanges shall be used throughout the exhaust system. Flanges shall be correctly bored to suit pipe outside diameter.

5.6.5.4. Gaskets

238. The gaskets shall be a high temperature reinforced and manufactured from non-asbestos material. The temperature rating of the gaskets shall be chosen dependant on the installed location. Gasket material shall not exceed $^{1}/_{8}$” (3mm) in thickness.

5.6.5.5. Fasteners

239. High tensile Grade 8.8 black steel bolts and nuts shall be used throughout the exhaust system. All bolts shall have a high temperature anti seize compound applied to the threads prior to tightening. Flat washers shall be fitted under bolt head and nut, spring washers shall also be fitted.

5.6.5.6. Lagging

240. All exposed piping installed within the building shall be thermally insulated with a high temperature insulation and metal sheathed. Metal sheathing shall be supported from the pipe. External to the building the piping shall not be insulated unless required for guarding.

241. Insulation shall be suitable for service temperatures up to 1202°F (650°C) and shall be no less than 3” (75mm) thick. The insulation shall be made from a non-asbestos and non-hazardous material.

242. Insulation sections shall fit the exhaust piping and silencer accurately without gaps and shall be adequately secured. Flexible expansion joints shall be blanket insulated.

243. Flanged joints in the exhaust piping shall be insulated by application of removable moulded section muffs of similar composition to the pipe insulation.

244. Insulation shall be sheathed throughout with 20 mil (0.5mm) stainless steel sheet steel of a grade suitable for the environment.

245. Where piping penetrates walls, floors or ceilings, approved pipe sleeves, trimmers, flashing and escutcheon plates shall be provided.

5.6.5.7. Guards

246. All pipework and silencers within reach of personnel shall be protected by guards or insulation. No external touchable surface temperatures to be greater than 140°F (60°C). A thermography report shall be provided as part of the commissioning process.

5.6.5.8. Drains

247. ½" Nominal Pipe Size (NPS) (15mm NB) drain pockets shall be provided in the exhaust system. Pipes shall be graded towards the drain pockets.

5.6.5.9. Thermowells and sample points

248. A plugged ½" NPS (15mm NB) socket shall be provided in the exhaust pipe adjacent to the turbo charger outlet.

5.6.5.10. Final Cleaning

249. Prior to final assembly all exhaust system components, pipes and fittings shall be visually inspected and all foreign objects, construction slag and dusts removed

5.6.6. Exhaust Noise

250. The exhaust system shall be designed to provide a minimum of 'Residential' grade attenuation. The maximum sound pressure level of the exhaust shall be 85 dBA @ 1 metre away and 1 metre above ground level in accordance with ISO 6798. **The Contractor shall provide details in the Compliance Matrix** of the designed noise level from the exhaust silencer/stack.

5.7. Fuel System

5.7.1. General

251. The generator fuel supply system shall be complete with all necessary piping, valves, strainers, fuel meters, day service tanks, float switches, supports, hoses and fittings.

252. The existing RFO service tank and associated pipework currently located on the roof of the fuel room shall be recovered and disposed in accordance with clause 5.1.1.

253. All fuel pipework shall be installed above ground unless separately specified.

254. The fuel system shall fully comply with the EPA Spill Prevention, Control and Countermeasure (SPCC) Rules (40 CFR 112) and NFPA 30 Flammable and Combustible Liquids Code.

255. All fuel filters and strainers shall be washable and able to be re-used.

5.7.2. Connection point

256. The connection point for the fuel system shall be the service tank in the PS2 Fuel / Oil Bund. The service tank shall be re-configured as required to facilitate the fuel supply to PS1.

257. The existing fuel supply line from the bulk fuel storage to PS1 shall be capped at the PS1 building to enable re-connection if required in the future. All fuel pipework between PS2 fuel bund and PS1 shall be new and installed in the existing pipework trench.

5.7.3. Fuel forwarding pumps

258. A fuel forwarding pumping system shall be installed adjacent to the intermediate service tank to facilitate filling of the day tanks. The fuel shall be filtered at this point with a suitable filter. The design for the fuel forwarding pump system shall incorporate redundancy for the pumps and filters.

5.7.4. Alternative Connection Point (option)

259. The Principal may choose to have an alternative connection point for the fuel system to limit any impact on the fuel system for PS2. The Contractor shall provide alternative pricing to change the proposed arrangement including the following:

a. A new intermediate tank installed between the bulk fuel storage and PS1. The tank shall be located between the existing PS2 Fuel / Oil Bund and the road. This tank shall be a dual skinned tank to remove the requirement for bunding. The intermediate tank shall be connected directly to the bulk fuel storage and be manually filled as per current arrangements for PS2. Fuel from this tank shall be pumped to PS1 with fuel forwarding pumps as detailed in clause 5.7.3 with the exception of the filter equipment.

b. Fuel treatment plant to be installed in PS1 to remove any contamination including water from the fuel being supplied from the intermediate service tank. Treated fuel shall be pumped directly to each genset day tank.

5.7.5. Day fuel tanks

260. Individual day tanks shall be installed for each new generator. The volume of the day tank shall be designed to suit the supplied gensets. The existing day tank supplying existing gensets 1 & 2 shall be re-used and incorporated into the new fuel system. A new day tank for existing set 5 shall be installed adjacent to the set 5 radiator.

261. The day tanks shall be installed at the rear of the power station adjacent to the radiators. The day tanks shall be bunded if required by the SPCC rules.

262. The day tanks shall have a minimum of two (2) independent overflow controls to prevent overfilling.

263. The day tanks shall be fitted with float switches to automatically start and stop filling of the tank. High level and low level alarms shall also be fitted.

5.7.6. Return fuel cooling

264. The fuel temperature in the day tank shall remain below the flash point of the diesel fuel. Fuel coolers can be installed if required to maintain a suitable fuel temperature.

5.7.7. Fuel metering

265. Fuel metering shall be installed on each generator. The number and type of fuel metering shall be determined based on what fuel usage data can be obtained from the engine ECM. Consideration shall be given to installing meters on both intake and return lines if unable to source fuel consumption data from the ECM.

266. A fuel meter shall be installed adjacent to and downstream of the fuel forwarding pumps to measure the total fuel used by the station. This meter will be cross-referenced with fuel meters on individual gensets to determine if there has been any loss through leaks especially on underground pipework.

5.7.8. Fuel solenoids

267. Fuel shut-off solenoids shall be installed on the intake lines to each generator. This solenoid shall be a normally closed (energise to open) solenoid that is closed in the advent of a fire on the gensets.

268. Solenoids shall also be installed to control fuel filling of the day tanks. A suitable mechanical bypass shall be installed as redundancy in the advent of a solenoid failure on the day tank fill line.

269. All solenoids shall be electrically operated,.

5.7.9. Pipework

5.7.9.1. General

270. Pipework construction shall be in accordance with clause 5.10 and the following specific requirements.

5.7.9.2. Materials/Construction

271. Pipe work shall be ‘all welded construction’ fabricated from suitable steel materials. Preference is for stainless steel pipework to be used. Alternatively, mild steel pipework shall have a high quality corrosion protection system applied to ensure long term service in the operating environment specified.

5.7.9.3. Valves

272. All fuel system valves shall be stainless steel flanged body type ball valves. Fire safe valves shall be used wherever required by relevant standards

5.7.9.4. Flanges

273. All fuel system flanges shall be ANSI (150) (PN20) pattern raised face type. Pipes of less than 1½" NPS (40mm NB) shall be fitted with full face socket weld type flanges; Weld neck flanges are preferred on pipe work above 1½" NPS (40mm NB).

274. Threaded connections shall only be used where flanged all welded are unable to be used.

5.7.9.5. Gaskets

275. Raised face gaskets rings shall be pre-formed and manufactured from a compressed non-asbestos fibre material (CNAF). Gasket material shall not exceed $^{5}/_{64}$" (2mm) in thickness. Tank gaskets shall be cut to suit the sealing faces of hatch covers.

5.7.9.6. Fasteners

276. UNC 316 Stainless steel bolts and nuts shall be used throughout the fuel system. All bolts shall have a suitable anti seize compound applied to the threads prior to tightening. Flat washers shall be fitted under bolt head and nut, spring washers shall also be fitted.

5.7.9.7. Cleaning and Flushing

277. Prior to construction, all pipes over 1½" NPS (40mm NB) shall be internally abrasive blast cleaned. All pipe work sections less than 1½" NPS (40mm NB) shall be thoroughly inspected prior to construction and if required chemically cleaned.

278. All individual pipe work sections shall be thoroughly inspected after construction, cleaned and flushed. On completion of hydrostatic testing the pipe work systems shall have a final flush using fuel fed from the fuel forwarding pumps to a point immediately prior to the final day tank strainer/filter. When all contamination is cleared the day tank strainer/filter, fuel meter, control solenoid and bypass arrangement shall also be flushed. The day tank strainer/filter shall be inspected after filling the tank.

5.8. Oil System

5.8.1. General

279. The oil system shall comprise of a new oil supply system and a waste oil system,

280. The two systems shall be complete with all necessary piping, valves, pumps, service tanks, storage tanks, float switches, hoses and fittings.

281. All oil pipework shall be installed above ground unless separately specified.

282. The oil systems shall fully comply with the EPA Spill Prevention, Control and Countermeasure (SPCC) Rules (40 CFR 112) and NFPA 30 Flammable and Combustible Liquids Code..

283. All oil filters and strainers shall be washable and able to be re-used.

5.8.2. Tanks

5.8.2.1. Bulk New Oil

284. A bulk new oil tank shall be used to provide storage of new oil for the gensets in PS1. A new oil tank shall be supplied and installed adjacent to the existing waste oil tank. The tank shall be bunded or a dual skinned tank used to prevent any oil spills. The volume of the tank shall be selected to suit the engines supplied but shall be a minimum of 1,320 gallons (5,000 litres).

285. Oil shall be decanted manually from 55 gallon (208 litre) drums or from 264 gallon (1000 litre) IBC's into the bulk oil storage.

286. The bulk new oil storage shall be piped to the individual gensets via an oil forwarding pump. The oil forwarding pump shall be located in the existing Fuel Room.

5.8.2.2. Bulk Waste Oil Tank

287. The existing bulk waste oil tank located on the southern end of the power station shall be replaced with a new 1,320 gallon (5,000 litre) waste oil tank. The waste oil tank shall be bunded to prevent ground contamination. The waste oil will be manually transferred to the bulk waste oil storage at the fuel farm periodically by the Principal.

288. The waste oil tank shall have the means of visually identifying the oil level within the tank using a sight glass or similar.

289. The waste oil tank shall be fitted with a high level alarm via a suitable float switch. The alarm shall be connected to the power station control system.

5.8.2.3. Oil Service Tanks

290. Individual oil service tanks shall be installed for each generator if required. The service tanks shall be installed adjacent to the generator within the generator hall. The preferred location is on the rear wall of the generator hall. The capacity of the oil service tank shall be chosen to suit the oil system function. Oil makeup systems shall be installed on each engine to maintain adequate oil levels in the engines.

291. The oil service tanks shall be filled from the bulk new oil storage using a pump that is remotely operated (not automatic). Control equipment shall be installed adjacent to the service tank to facilitate the filling of the tank (e.g. Start/stop buttons, valves).

5.8.3. Oil pumps

292. A new oil pump shall be installed in the fuel room adjacent to the bulk new oil storage tank to facilitate filling of the service tanks. The pump shall be an internal gear pump. Oil from the bulk new oil storage shall be filtered prior to being pumped to the service tanks. The pump shall be sized to ensure transfer of oil is completed in a reasonable time frame.

293. A waste oil pump/s shall be installed so that the oil can be transferred from the engines to the bulk waste oil storage tank. The pump/s can be permanently mounted or mobile and moved between each generator. A system shall be implemented to reduce the risk of oil being pumped out of a running engine.

5.8.4. Secondary Oil Filtration

294. If secondary oil filtration is proposed, the system shall utilise a centrifugal type filter. The filtration equipment and associated pumps shall be unitised with one unit per genset. Preference will be for systems that utilise the engine sump for oil storage and circulate oil through the filtration equipment.

5.8.5. Pipework

5.8.5.1. General

295. Pipework construction shall be in accordance with clause 5.10 and the following specific requirements.

5.8.5.2. Materials/Construction

296. Pipework shall be all welded construction fabricated from suitable steel materials. Preference is for stainless steel pipework to be used. Alternatively, mild steel pipework shall have a high quality corrosion protection system applied to ensure long term service in the operating environment specified.

297. Flexible hoses can be used to connect equipment where required (e.g. pumps).

5.8.5.3. Filter Fill points

298. A filter filling point shall be fitted adjacent to the oil service tanks if required. This shall be done to facilitate pre-priming of new oil filters prior to installation on the engine. A suitable drip trap shall also be installed to reduce oil spillage.

5.8.5.4. Cleaning and flushing

299. All pipe work sections shall be thoroughly inspected prior to construction and if required shall be chemically cleaned. All individual pipe work sections shall after construction and prior to assembly be cleaned and flushed. Final flushing procedure shall incorporate 200 mesh strainers up stream of all tanks and the engine connection.

5.9. Station Waste Water system

300. Waste water from the station shall be collected into a central collection point (sump). This waste water will be collected from washing down engines and any other locations within the power station building.

301. The existing washdown bay that is located between PS1 & PS2 shall have its drain directed to the central collection point.

302. The waste water shall be treated using a suitable oil/water separation system. The waste water shall be pumped from the sump through the oil/water separator. The oil/water separator shall be capable of processing 264 gallons/hour (1,000 litres/hour) (nominal). If required, an intermediate tank shall be installed between the sump and the oil water separator, however the Principal prefers to limit the number of components in the

system. **The Contractor shall provide details in the Compliance Matrix** of the oil/water separator proposed.

303. The treated water shall be of suitable quality to discharge to ground with hydrocarbon contamination levels less than 10 ppm. The oil that is extracted shall be transferred to the bulk waste oil storage tank.

304. The separation system shall be chosen to reduce the amount of regular maintenance required to ensure continued efficient operation.

5.10. Pipework and Valves

5.10.1. Scope

305. This section of the Specification details the requirements for all fuel, oil, waste and cooling piping including the following:

a. Fabrication
b. Installation/Erection
c. Piping design
d. Pipe support brackets
e. Inspection and Testing
f. Piping material selection
g. Welding techniques
h. Valve selection

306. Any conflict between the requirements of the Specification and other documents relating to the contract shall be referred to the Principal for resolution prior to work commencing.

307. Throughout this section, the word “pipe” applies also to “tube”

5.10.2. Fabrication

308. Work shall be carried out by qualified trades in conformance with all relevant industry standards and codes.

309. All materials employed in piping systems shall be new and conform to the piping and valve specifications.

310. Piping and fittings shall be accurately aligned at all joints. Concentricity is to be within 1mm. All flanges shall be parallel.

311. Stainless steel and carbon steel must not be fabricated in proximity to each other without proper screening and/or separation. Iron free grinding/cutting discs must be used on stainless steel.

312. No chemicals or solvents etc. to be used for any purposes whatsoever without prior approval.

5.10.3. Erection

313. All piping systems shall be installed to dimensions shown on piping arrangement drawings. Piping shall be assembled and erected so that a minimum of cold springing and cold forming occurs. In the instance where designed layout dimensions differ from the field dimensions to such an extent as to require considerable cold springing or cold forming, the contractor will make the field modification after approval.

314. Piping shall be erected on adequate temporary or permanent supports and shall be installed to permit free expansion or contraction, except where specifically restrained by an anchor or guide.

315. All permanent supports located outdoors shall be hot dipped galvanised. Stainless steel is required in areas subject to immersion or splash.

316. Hangers and supports for horizontal lines shall be spaced so that the deflection of the pipe between supports does not exceed the difference in elevation due to pitch or slope in the line thus ensuing self-draining.

317. Suitable supports shall be provided at changes in direction of pipe, and at valves and concentration of loadings.

318. Pipe lines to suction and discharge connections of pumps etc. shall be supported in a manner that will minimise strain in, or misalignment of, the equipment.

319. All erection procedures shall comply with Occupational Health & Safety Act (or equivalent) requirements, with regulatory body approval being obtained when necessary.

5.10.4. Testing

320. After installation, and prior to insulation or painting, all piping systems shall be tested to approval and to the satisfaction of the relevant Statutory Authority where required.

321. General equipment such as engines, pumps, vessels, compressors, etc. shall not be subject to the piping system test pressure. They shall be disconnected and/or blanked off.

322. Control and other equipment not capable of withstanding test pressure shall be removed or blanked off.

323. Testing will be generally in accordance with the requirements of ASME B31.3 with test pressures and test type being specified on job-by-job basis, in accordance with the relevant code.

324. Lines shall be drained and blown out until dry after testing.

325. Where water is unsuitable for hydrostatic testing because of incompatibility with projected service alternatives can be used, subject to approval.

326. Duration of pressure testing will be specified on an individual job basis but shall not be less than 30 minutes, or the time taken to inspect the complete line, whichever is greater. Pneumatic testing is to be avoided unless absolutely necessary.

327. Open ended vents, drains and like piping must be checked thoroughly by visual examination after installation.

5.10.5. Configuration

5.10.5.1. Falls

328. All piping shall be arranged with falls to allow venting and drainage of the lines for cleaning, repair and maintenance.

329. Pipework predominantly carrying liquids shall be assessed to be carrying a proportion of gas and shall avoid reverse grades or pockets in the pipe obvert. Provide obvert level eccentric reducers at pipe size changes. Provide vents at unavoidable high points.

330. Pipework predominantly carrying gasses shall be assessed to be carrying a proportion of liquid and shall avoid reverse grades or pockets in the pipe invert. Provide invert level eccentric reducers at pipe size changes. Provide drains at unavailable low points.

5.10.5.2. Line and Level

331. Pipework shall be installed true to line and level, and where possible shall be parallel to building lines, and grouped together when following the same route. Vertical pipes shall be installed to be truly vertical at operating conditions.

332. Pipework shall be arranged to minimise cross-overs, and to facilitate drops, (or risers) to equipment in a neat and organised arrangement.

5.10.5.3. Flanges, Joints and Unions

333. The piping shall be arranged to allow removal of all valves and equipment by provision of flanges, joints or unions.

334. Where necessary for isolation of vessels for confined space entry, provide spectacle blanks, complete with compatible flanges and test points.

335. Piping arrangement shall be planned to facilitate removal of equipment for inspection or servicing.

336. Removable spool pieces shall be provided at pump suction and discharge to permit removal of pump.

337. Suction lines to pumps shall be designed to avoid any air pockets. Wherever pockets are formed, drains shall be installed.

338. Any reduction in size of suction lines at the pump nozzle shall be gradual through an eccentric reducer with flat side at top.

339. In general, minimum head room measured to bottom of pipe shall be as follows:

a. Roadways 236” (6000mm)

b. In all other areas at grade 98” (2500mm)

c. Within buildings or over elevated platforms 83” (2100mm)

340. Underground piping shall conform to the following requirements:

a. All pipework shall be protected using a Denso Petrolatum Tape System including primer, tape (55% lapped) and outer wrap. Apply in accordance with the manufacturers’ recommendations.

b. All underground pipework to be welded with no flanges, fittings or the like buried.

c. Piping passing areas where trucking or other traffic is expected shall be protected to prevent damage.

5.10.5.4. Access

341. Valves and other items requiring attention during operation (e.g. periodic instrument calibration) shall be readily accessible from platforms or fixed ladders.

342. Isolating valves and by-passes which do not require adjustment during operation but are either open wide or shut, need to be located directly accessible from platforms.

5.10.5.5. Flexibility

343. To accommodate the thermal expansion of piping or equipment, the following means shall be preferred, in the order shown:

a. Taking advantage of the inherent flexibility of the piping layout.

b. Utilising a designed expansion loop.

c. Utilising an expansion joint, if no other means are practicable.

5.10.5.6. Process

344. All lines shall have a continuous fall of 1 in 300 (minimum) unless otherwise specified. The isolating valves on all process branch lines shall be branch diameter from main run.

5.10.5.7. Vent, Drain and Sample Connections

345. The minimum size of vent and drain connections shall be $^{19}/_{32}$” (15mm). Vents shall be bird-proof.

346. Plugs or blind flanges shall be provided for all single valved vent, drain and sample connections unless piped to receptacles or drains.

347. All high points of lines in all services shall be provided with valved vents. Vessel vents may be located in overhead piping, provided no valves or blinds are located between vent connection and vessel.

348. Valved drains shall be provided at low points to empty lines or equipment after hydrostatic test, or to dispose of condensate formed during start-up, operation or shutdown.

349. Drains emptying into open drain receptacles or floor drains shall terminate adjacent to the drain fittings and the discharge shall be visible from the location of the drain valves. They shall have the end cut at 45°.

350. No sample or drain connection shall discharge to the ground, except where adjacent to floor drain or trench.

5.10.5.8. Valving

351. Isolating valves shall be provided at each pump connection and in general at each branch take-off.

352. All valves shall be of a type which easily distinguishes if they are open or closed.

353. All valves shall be lockable.

354. Valve seals shall be suitable for the application.

5.10.5.9. Relief and Safety Valves

355. Relief and safety valves shall be installed in a vertical position and shall have a minimum of piping between the protected line or equipment and the valve inlet.

356. Relief and safety valves discharging to atmosphere shall extend at least 118” (3000mm) above the platform/roof or any adjacent platform.

357. Relief and safety valve lines discharging to atmosphere shall be provided with a $^{25}/_{64}$” (10mm) minimum weep hole at the low point in the line.

358. Thermal relief valves shall be fitted wherever hydrocarbon can be locked-up between valves.

5.10.5.10. Flanges and Fittings

359. Except for piping requiring periodic dismantling or removal for cleaning, the use of flanges/ unions shall be kept to a minimum. Sufficient unions and/or flanges shall be provided to allow the easy removal of any item of equipment. Demonstration of this attribute may be ordered by the Principal at the Contractors cost.

360. Flexible connections shall be provided to all plant that vibrates e.g. Reciprocating engines.

361. Where permanent strainers are not provided, temporary strainers shall be provided for suction lines to pumps and compressors for use during preliminary circulation. These strainers shall be located close to the pump or compressor. All temporary strainers shall have a free hole area of at least 3 times the cross-sectional area of the pipe size.

5.10.5.11. Insulation

362. Pipework shall be insulated where specified.

5.10.6. Piping Supports

5.10.6.1. General

363. Supports shall be provided for all piping in order to sustain the weight of the piping system while permitting essential freedom to thermal expansion movements.

364. Supports shall be incorporated in the original design so as to avoid the necessity of temporary supports for the following cases:

a. Where regular maintenance required removal of equipment, such as relief valves etc.

b. Where flanged connections must be broken for the insertion of blinds.

c. Where lines must be dismantled for cleaning.

365. Preference is for pipes to sit on common supporting systems rather than individually hung.

5.10.6.2. Location of Supports

366. Anchors or guides shall be located as follows:

a. As near as possible to concentrated weights such as large valves etc.

b. Near elbows (NOT at) for changes of direction in the horizontal plane. For this case the next adjacent support should be 75% of the span shown in the accompanying table.

c. Near existing building steel to minimise additional structural materials. They must not be welded to structural steelwork without prior approval.

d. Adjacent to expansion loops/expansion joints, thus localising flexural or pressure effects.

e. To minimise stress on sensitive equipment, e.g. pumps, blowers, relief valves etc.

f. To take into account relative movement of high vessels versus piping as necessary.

g. To take into account hot/cold line effects.

h. On vertical runs, guides are usually placed at span intervals of 200% of the typical horizontal span, but due consideration should be given to the weight of the vertical riser, the ability of the structure to support that weight, and the buckling tendency of the pipe.

5.10.6.3. Design of Supports

367. Supports which permit pipe expansion shall accommodate movements for all operating conditions. Additional provisions shall be made for the initial self-adjustment of high temperature lines.

368. Guides shall be designed to eliminate the possibility of jamming due to movement.

369. Anchors shall provide sufficient fixation to transmit substantially all load effects into the foundations. The anchors shall be bolted to foundations with stainless steel ‘dynabolts’ or ‘chemset’ anchors.

5.10.6.4. Pipe Support Hardware

370. All mild steel supports shall be hot dipped galvanised and painted with an appropriate primer and cold gal at all cut edges. Generally, all supports for 1¼" NPS (32mm NB) or smaller pipework shall be 'Stauff' high pressure hydraulic type.

371. The design and fabrication of all piping supports shall be in accordance with the applicable codes.

372. Due allowance should be made in support selection and size when pipes are insulated. The insulation shall be continuous.

5.10.6.5. Pipework Spans

373. Pipework spans shall be in accordance with the relevant standards. Pipe spans shall be based on water filled pipe/tube and application of the most rigorous criteria of the two listed below:

a. Max. deflection = 1/1000 of span

b. Max. stress due to weight loading = 417,800 psf (20 MPa)

374. Support spans for the following conditions need special consideration:

a. Load concentrations due to valves, fittings, branches etc.

b. Liquids with SG appreciably greater than 1.

5.10.6.6. Pipework Spans

375. Pipework spacing shall be in accordance with the relevant standards. Flanges locations shall be staggered and allow for a clearance of at least 1" (25mm) between a flange and adjacent pipe. Minimum pipework spacing (centre-centre) is 4" (100mm). Flanges must be 2" (50mm) clear of adjacent structures.

376. Side movement of pipework due to thermal expansion/contraction must be allowed for and spacing altered accordingly.

377. If insulation is used, the thickness must be added to the spacing dimension.

378. Increased spacing may be needed for instruments, valves etc. and spacing should be altered as necessary.

5.10.7. Piping Materials

379. Piping materials shall be as detailed in the specification.

5.10.7.1. Weld Passivation

380. All welds on both shop and field fabricated stainless steel pipework shall be passivated using a chloride-free pickling paste. This shall have around 5% hydrofluoric acid for descaling and 20% acid for oxidising the surface (passivating) thus forming the protective inert layer.

381. The weld must have cooled down to ambient temperature or just above (warm) prior to application of paste.

382. If paste is applied while weld is too hot, it will dry quickly, and not have a chance to react. The paste is to be left on for a minimum of one (1) hour, and then washed off with liberal amounts of water, ensuring that no residue remains.

5.10.7.2. Painting and Labelling

383. All pipework shall be labelled with adhesive labels which show the direction of flow. Labelling shall comply with ASME A13.1.

384. All steel pipework shall be painted with the paint system suitable for a C5 high corrosion marine environment. The colours of the pipework shall indicate the liquid that is contained by the piping system. The colours shall match existing pipework colours at the site and shall be confirmed with the Principal.

5.11. Modular Containerised Gensets

5.11.1. General

385. Alternative generation shall be installed for the duration of the replacement of the switchgear and control equipment in the power station. The generation will be used as emergency backup however may be required to run in the advent of the failure of other gensets or when critical maintenance is required. The installation of these genset/s shall be completed prior to the decommissioning of the switchboards in PS1.

386. The containerised gensets shall be installed in acoustic enclosures based on 20ft ISO shipping containers as per ISO 668. The genset enclosures shall include all auxiliary systems (e.g. Exhaust, cooling etc) required for the operation of the genset. The enclosures shall be bunded to avoid any possible spills of diesel, oil and waste water. **The Contractor shall provide the Compliance Matrix** details of the containerised gensets proposed to be used.

5.11.2. Rating

387. The total rating of the combined gensets shall be approximately 3,500 kWe. The gensets shall be suitable for direct connection to a 3 phase, 4 wire 480V, 60 Hz, alternating current system. Step-up transformers shall be used to convert the connection voltage to 13.8kV.

5.11.3. Noise Levels

388. The genset enclosures, radiators and exhaust shall be carefully designed to minimise the generation of excessive sound levels. The maximum sound pressure level of the radiators shall be 85 dBA @ 7 metres away and 1 metre above ground level in accordance with ISO 6798. **The Contractor shall provide in the Compliance Matrix** details of the designed noise level from the containerised gensets.

5.11.4. Connection Point

389. The containerised gensets shall be connected into the spare bay in the existing switching station as shown on drawing A0285-E-212. The spare bay consists of 100A fuses and a 400A isolating switch. The fuses shall be upgraded to 200A and three (3) additional fuses shall be provided as spares.

390. The Contractor shall install a RMU to facilitate the connection of the temporary gensets and allow a single cable connection to the switching station.

5.11.5. Cabling

391. All HV and LV cabling will be the responsibility of the contractor. Cables shall be rated to the voltage that they are carrying.

392. The installation of the cables shall be done in a safe manner and meet the requirements of NEC 2017. The cables can be installed above ground as long as adequate mechanical protection is provided.

5.11.6. Step-up Transformers

393. The Contractor shall install a 13.8kV / 480V step-up transformer for each containerised genset. The transformers shall be rated to the output of the gensets and shall be no less than 1,500kVA. The transformers shall have a minimum of 5 taps at +/- 2.5% steps.

394. Temporary bunding for the transformers shall be supplied by the contractor. Transformers may be supplied within a container.

5.11.7. Earthing and Protection

395. The earthing for the containerised gensets and step-up transformers shall be designed to ensure all safety requirements are met for step and touch potentials. The earthing system design shall also ensure the containerised gensets can operate in parallel with the gensets from PS1 & PS2 and limit any circulating currents or inadvertent tripping.

396. Any protection systems required for the temporary genset/s and step-up transformers shall be installed as part of the temporary generation. Protection relays shall be installed on the containerised gensets and not in the switching station.

5.11.8. Fuel Supply

397. The temporary genset/s shall be connected into the PS1 fuel supply manifold. The designer shall determine the best location to make this connection. The fuel supply installation shall have necessary safe guards to avoid diesel fuel spills.

5.11.9. Operating Mode

398. The gensets shall be manually started and stopped using controls on the genset and via a remote interface. The remote interface shall be able to be accessed via a PC. Preference is for a web-based interface.

399. Synchronising and load sharing between the gensets shall be automatic once the start signal is initiated. The switching and synchronising for the gensets shall be undertaken at the generator main LV circuit breaker/s.

400. The control system for the gensets shall be able to be configured so the gensets can be run as base load or be load following.

401. Once the power station works are completed the gensets may be re-purposed by the Principal for network support or as base load generation at other locations. The gensets shall therefore be able to be operated individually.

5.11.10. Operations and Maintenance

402. Servicing of the temporary genset/s shall be done manually by the Principle and the necessary equipment to safely maintain the genset/s shall be included with the gensets.

403. The required consumables (i.e. air filters, oil filters etc.) shall be provided with the gensets. The quantity of consumables shall be suitable for 2,000 hours of continuous operation on all gensets.

5.12. Battery Energy Storage System (BESS)

5.12.1. BESS General

404. The BESS is to provide spinning reserve, frequency support, and VAr export capability, with the diesel generator plant in the adjacent power station.

405. The BESS is to be designed so as to be capable of delivering $2MW_{AC}$ (±5%) continuously for 30 minutes at Beginning of Life (BOL), in the expected ambient conditions of Majuro.

406. The BESS is not required to provide fault current or overload capability.

407. The BESS will execute real and reactive power requests from the power station control system and will continuously communicate its status and operating parameters to the Master Control System (MCS).

408. The BESS shall be connected via a step-up transformer, supplied with the BESS package, to the 13.8kV main switchboard (MSB) in power station 1 (refer to drawing A0285-E-211).

409. Battery racks, the power conversion system, LV switchgear, and BOS components, are to be installed in a sealed, climate-controlled, corrosion-resistant shipping container, or other purpose-built enclosure, mounted on a concrete foundation(s).

410. The BESS' step-up transformer(s) shall be installed either outside on a concrete foundation in a suitably rated stainless-steel housing, or inside the BESS container.

5.12.2. BESS Enclosure

411. The enclosure is to be painted white, or shielded from direct sunlight, to minimise heat gain from sunlight.

412. The enclosure is to be designed and insulated to minimise HVAC loads.

413. Any metal exposed parts on the enclosure are to be treated with a corrosion resistant coating suitable for environmental classification class C5M, very high marine. Classification in accordance with ISO 92239224.

414. The enclosure is to be sealed so as to prevent air, water, dust, and pest ingress.

415. Cooling and clearances within the enclosure are to comply with manufacturers' guidelines and warranty statements and are to be sufficient to avoid battery and power conversion system derating at full load ($2MW_{AC}$) in ambient conditions of up to 95°F (35°C) and full sun.

416. Components are to be arranged within the enclosure so as to minimise DC cable size and electrical losses.

417. The enclosure is to be equipped with sufficient GPOs for the operation of auxiliaries, plus a minimum of 2x15A additional outlets.

418. The enclosure must contain lighting with integrated battery back-up for independent operation of a minimum of 6 hours in the event of a power supply and or BESS failure.

419. The enclosure is to be fitted with an appropriate fire suppression system as per the battery manufacturers recommendations. The fire suppression system must be manually operated and designed to require little to no ongoing maintenance and testing.

420. A laminated layout drawing is to be mounted in each enclosure, to assist site staff with identification of battery strings and inverters.

421. BESS auxiliary loads (HVAC, lights, GPO's, etc.) are to be powered by a 277/480V supply from the AC switchboard in the PS1 switchroom via a 480V / 208V transformer.

422. Any air-conditioner condenser coils exposed to outside air must be coated with an anti-corrosive treatment or made of corrosion-resistant materials.

5.12.3. BESS Modules

423. Battery cells are to use commercially-proven Li-ion technology (LFP, NMC, NCA, or LTO) from a manufacturer with significant experience in utility-scale battery energy storage.

424. The BESS shall be designed such that the total nominal capacity of the battery modules must be fully delivered within the DC voltage window of the proposed power conversion system.

425. Nominal battery capacity at BOL is to be selected such that a minimum of 0.6MWh of usable energy capacity and 1.2MW of usable power capacity remains after 10 years or 3,000 equivalent full discharges[1], whichever comes first. 1% spare battery modules are to be supplied.

[1] = Total energy discharged ÷ nameplate capacity

426. The capacity retention described above is to be warranted by the manufacturer. The conditions of the offered warranty are to be described in the tender.

427. At 70-77°F (23±2°C), DC roundtrip efficiency of battery modules (inc. parasitic loads) at BOL is to be greater than 90% at 1C, and greater than 88% at 2C.

428. The battery management system (BMS) is to be pre-integrated with the battery cells/modules by the battery manufacturer.

429. The BMS shall provide the following minimum protection functionality:

a. Over voltage protection
b. Under-voltage protection
c. Over temperature protection
d. Cell balancing

430. At a minimum, the BMS shall provide the following alarms:

a. Over/under voltage and voltage imbalance
b. Over temperature and temperature imbalance

431. Each battery cell/module shall be manufactured and tested within 9 months preceding delivery to site.

432. Battery cells/modules/racks are to be transported to site in accordance with manufacturers' guidelines.

433. Module self-discharge shall not exceed 10% per month at 70-77°F (23±2°C).

5.12.4. BESS Power Conversion System

434. The PCS is to comprise three-phase, bi-directional inverter modules capable of operating at a power factor from 0 leading to 0 lagging.

435. Modular inverter capacity is preferred, as this reduces the risk of losing all PCS capacity in the event of a single fault.

436. The PCS shall synchronise to the grid frequency and is not required to act as a grid-forming/voltage source.

437. Total harmonic distortion in grid-connected mode shall be less than 4% at unity power factor.

438. Peak efficiency must be greater than 98%, and greater than 95% at rated output ($2MW_{AC}$ continuous).

439. A manufacturer's warranty is to be provided for a minimum of 5 years.

5.12.5. BESS Transformer

440. The Contractor shall supply and install a transformer for connecting the BESSPCS to the power station 13.8kV bus. The transformer shall be rated to the output of the BESS,

nominally 2.5 MVA. The transformer shall have a minimum of 5 tap positions with steps of +/- 2.5%. Bunding for the transformer shall be supplied by the contractor.

441. If mounted outdoors, the transformer shall be supplied with a stainless-steel enclosure.

5.12.6. BESS CONTROL

442. The BESS control system must be capable of receiving commands from the MCS. The BESS shall connect to the Master Control System via fibre-optic cable and an open protocol such as MODBUS.

443. At a minimum, the BESS shall communicate the following parameters to the MCS:

a. Real power output
b. Real power capability (charge and discharge)
c. SOC
d. State-of-Energy (i.e. estimated AC energy stored)
e. Reactive power output
f. Alarms

5.13. Control Systems

5.13.1. General

444. A new Master Control System (MCS) for the complete power system shall be implemented into PS1 and shall be fully automated including integration of diesel gensets, remote solar PV installations and the bus connected BESS. The MCS shall manage all functions required to operate the power system without the requirement for active monitoring or manual operation by local staff.

445. The MCS shall be designed with the power station as the central point. It shall be designed to allow for maximum penetration of renewable energy into the power system while ensuring a high level of power system reliability.

446. The MCS will need to cope with the various scenarios that are likely to occur on a daily basis with a varying load. To achieve this, the power system as a whole will need to be able to cope with a range of supply and load events, including, but not limited to:

a. Variations in load
b. Variations in solar output across the day
c. Loss of generation from solar PV installations
d. Sudden loss of load (i.e. feeder trips)

447. The Contractor shall provide operational support for the control system. This shall include addressing any issues during the defect's liability period but also optimisation of the MCS to ensure maximum renewable energy penetration is achieved. The optimisation

of the MCS shall include two (2) formal revisions at 6 months and 12 months after Practical Completion.

5.13.2. Existing Control Systems

448. The control system in PS2 currently acts as the Master Control System for the MEC system, however all engines in both power stations can be controlled from either power station control system. There are Ethernet and fibre optic communications links between the power stations, and at the time of writing this specification, the control systems use the Ethernet, as the fibre link is not fully commissioned.

5.13.2.1. Existing PS1 Genset Control

449. The gensets in PS1 are currently started, stopped, and scheduled manually, as there is no facility to undertake these tasks automatically. Additionally, the gensets are all synchronised manually, and load sharing is undertaken on a manual basis, as there is currently no automated system to assist with this process.

5.13.2.2. Existing PS2 Genset Control

450. The Deutz gensets in PS2 are currently started, stopped, and scheduled manually, however the existing control system has some capability to undertake these tasks, but it is not fully operational. The Deutz gensets are able to synchronise automatically, however load sharing is undertaken on a manual basis, even though there is an existing capability to undertake this automatically. There are load restrictions on the Deutz engines due to some engine health issues. The minimum load on the existing Deutz engines is notionally currently set at 500kW, but they are primarily loaded to a minimum 2MW operating load. Ramp up to full load usually takes around 30 minutes, dependant on the temperature of the engine at the time of starting.

5.13.2.3. Solar PV Systems

451. The existing solar PV installed on the network are shown in drawing A0285-E-210. The solar is connected directly to the distribution network and is uncontrolled. The output from the existing solar PV systems is treated as a negative load. The reservoir PV system will be controlled and will be integrated with the Master Control System by the Contractor.

452. When designing the Master Control system, the Contractor shall assume the output to follow typical PV profiles as would be expected for this location.

5.13.2.4. Station Load Profiles and Network Modelling

453. Daily load profiles and load flow studies are available in Mitton ElectroNet Marshal Islands Majuro Power System Load Flow Study report. Contractors shall use this report to build an understating of the existing system load profiles. Scenarios modelled in the report may not represent the scope of this project and/or the associated solar PV project. The information contained in the report should be treated as information only and does not supersede this specification.

454. A DIgSILENT PowerFactory model has been prepared and this will be made available to the Contractor to undertake any modelling required as part of detailed design.

5.13.3. Master Control System Operating Philosophy

455. This project will facilitate the connection of approximately 3.5 MW_{AC} of solar PV bringing the total installed capacity of PV on the system to 4.5 MW_{AC}. The typical daytime load on the station is approximately 8 MW resulting in a typical power penetration level of solar PV into the system of 50%. Power penetration levels will be higher at times (typically weekends) and may extend to be as high as 66%.

456. The MCS shall be designed to maximise renewable energy input into the power system thus reducing diesel consumption and consequently emissions. However, system reliability is the primary consideration and shall not be sacrificed in favour of increased renewable penetration.

457. The MCS design shall consider the following factors (but not limited to):

a. spinning reserve
b. voltage and frequency stability
c. kVAr generation
d. discharge and recharge rates of BESS
e. low load capability of gensets
f. ramp rate capability of gensets
g. load acceptance capability of gensets
h. full load start time of gensets

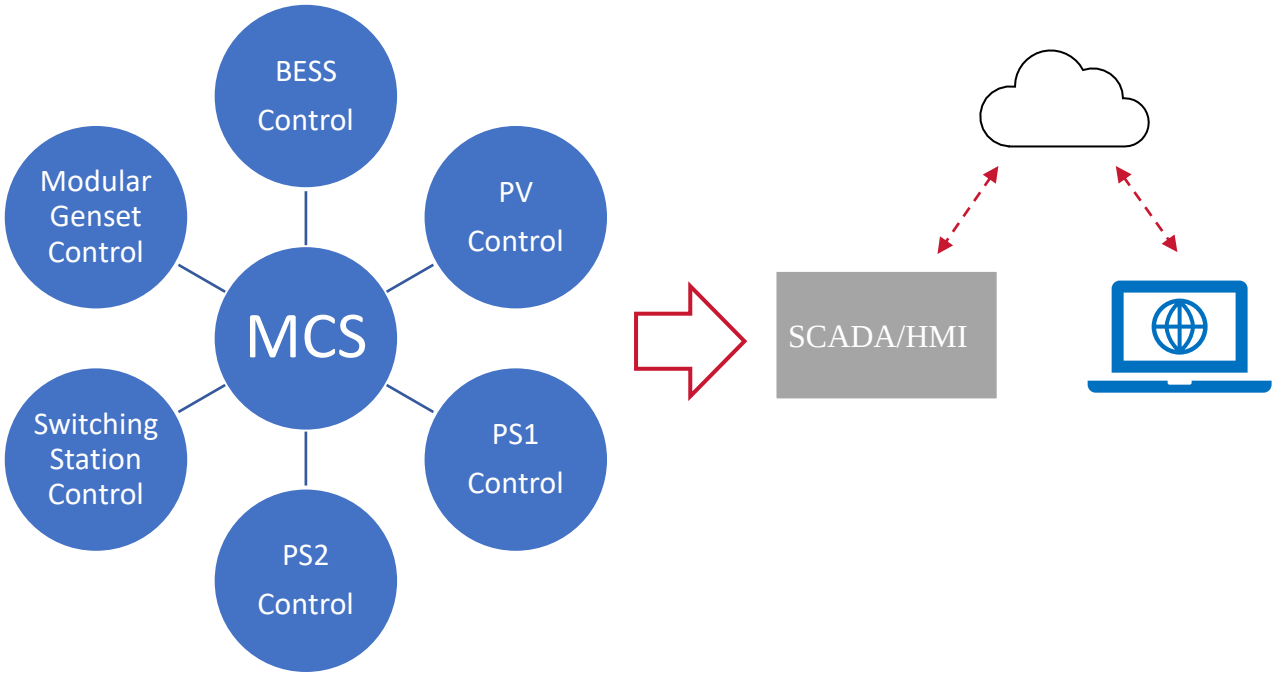
458. The proposed MCS methodology shall be centred on ensuring there is sufficient generation and/or battery storage capacity available at all times to cover expected system events. System disturbances resulting from cloud events on the PV or tripping of the PV systems due to a fault shall not result in loss of supply to the community.

459. The MCS will monitor the status of all components of the power system to determine the ideal generation mix to maximise solar PV energy penetration into the power system. The MCS will monitor and control the output of the reservoir PV system, power station load, genset spinning reserve, BESS ‘spinning reserve’ and any other considerations to ensure that there will be sufficient generation capacity in the advent of a loss of generation from the solar PV due to cloud events or tripping of the PV systems due to a fault.

460. The MCS shall be designed such that no single event on the system will result in loss of supply to the community.

461. The MCS shall take into consideration the operating limitations of the diesel gensets as detailed in section 5.3.3.

462. A graphical representation of the control system integration is as follows:



463. The methodology detailed shall be treated as proposed only. **The Contractor shall provide full details in the Compliance Matrix** of the proposed MCS operating philosophy in the tender.

464. The Contractor shall undertake network modelling required to verify the control system philosophy and to undertake control system design. Any models developed shall be provided to the Principal on completion of the contract.

5.13.4. PS1 Control Panels

465. All existing control panels in the control room shall be removed. New control panels shall be installed in the current location of the engine control panels in the control room as shown on drawing A0285-S-424. The following new panels shall be installed:

a. Communications Panel
b. Station Control Panel
c. MCS / Solar PV / BESS Control Panel
d. Alternator No. 5 Control Panel
e. Engine No. 5 Control Panel
f. Alternator No. 10 Control Panel
g. Engine No. 10 Control Panel
h. Alternator No. 9 Control Panel
i. Engine No. 9 Control Panel
j. Alternator No. 8 Control Panel
k. Engine No. 8 Control Panel

466. Details of the requirements for each control system are detailed in the following clauses.

467. The controls for the engine and alternator for the existing genset 5 shall be transferred to the new control panels. All requirements detailed for protection, control and metering shall include genset 5.

5.13.5. PS1 Station Control System

468. The PS1 control system shall allow operation of the power station to be fully automatic. The power station control system shall be integrated with the MCS or be integral to the MCS. The functions undertaken by the station control system shall include but not limited to:

a. scheduling of gensets (including existing genset)

b. automated switching of feeders (in the advent of black station or load shedding. To be incorporated with MCS)

c. operation of all ancillary systems (e.g. fuel, oil and waste management)

d. management of alarms

e. collection of alarms, events and metering data for SCADA and metering systems

469. Further information on the necessary automation of station systems has been included in the relevant sections of this Specification.

470. All alarms as detailed in the Specification shall be managed by the power station control system. All alarms shall trigger an audible alarm in the station and also publish the alarm to the SCADA/HMI system.

5.13.5.1. PS1 Generation Automation

471. The Contractor shall provide all necessary equipment for the control of the gensets including existing genset 5.

472. All gensets shall be connected using the same control system. The control system shall allow for full integration with the Engine Control Modules.

473. Automatic Voltage Regulators (AVR) shall be installed for the two new gensets and existing genset 5. The AVR shall be a Basler DECS100 or equivalent.

474. The control system equipment shall also include necessary equipment for accurate load sharing and synchronising of gensets.

475. All other control and alarm requirements for the gensets as detailed in clause 5.13.13.2 shall be included in the generation automation system.

5.13.5.2. PS1 Existing Gensets Control

476. The control systems for the existing genset 5 shall be integrated into the new station control systems.

477. The control system shall be designed to enable the full integration of future gensets when two (2) additional gensets are installed in the main hall and existing genset 5 is replaced.

5.13.6. PS2 Control System

478. The internal control system for PS2 shall remain unchanged. The control of the gensets and ancillary services will be undertaken by the PS2 Control System with little if any modification.

479. The operating mode/s of the gensets within PS2 shall be considered in the design of the MCS. The PS2 control system shall be linked to the MCS so there is a level of automatic control enabled. It shall not be a requirement to fully automate the integration between the two power stations and/or the MCS. The minimum level of integration and automation shall be at least to the same level that currently exists on site.

5.13.7. Solar PV Control

480. The solar that will be installed as part of this project will be in multiple sites across the Majuro community. The solar PV will be connected directly to the distribution network typically via 13.8kV / 480V transformers. The majority of the solar PV installations will have no connection to the control system. The only solar PV system that will be controlled by the MCS is the new 2.6MW solar system/s at the reservoir.

481. The solar system at the reservoir shall be connected to the power station control system via a fibre optic cable. The Master Control system will monitor and control the solar inverters to curtail PV output at times of excess generation. The solar inverters that will be installed at the reservoir will have full control capability. The solar inverters at the reservoir will have a centralised PV power plant controller (PPC) that will control downstream inverters. The communications protocol will be Modbus. The Contractor shall liaise with the PV installation contractor to ensure compatibility of the control systems. The Contractor shall be responsible for the integration of the reservoir solar PV control system into the power system MCS. As well as controlling the reservoir PV, the MCS will poll the system at minimum 30 second intervals and report system level power, energy and any errors or warnings.

5.13.8. BESS Control

482. The MCS will act as the master controller and provide signals to the BESS when it requires services. The primary function of the BESS is to provide ‘spinning reserve’ to the station control system. The BESS system shall be designed to support the network for the time required to ramp up or start additional diesel generation. The BESS system is expected to enable some diesel gensets to be taken off line during periods with substantial solar PV generation. There is no requirement to achieve ‘diesel off’ and there shall always be a minimum of one diesel genset online at all times.

483. The BESS control system will undertake any controls required to manage the batteries e.g. managing state of charge

484. The control requirements between the MCS and BESS is expected to be limited with BESS providing availability data to the MCS and the MCS providing signals to the BESS to export or import load.

485. The MCS will ensure the power factor on the diesel gensets remains above 0.8. The MCS will provide control signalling to the BESS control system to inject kVAr's into the power system if required.

5.13.9. Communications Systems

486. The Contractor shall design and install communications cables as required to allow fast and reliable communications between all equipment required to be controlled by the MCS. The Principal has a preference for Ethernet CAT 5 or 6 cabling (or fibre optic) to be used where suitable, but the contractor shall confirm this during the design phase.

487. To communicate with the solar PV at the reservoir, a fibre optic cable connection shall be installed from the power station control room to an existing fibre optic cable owned by National Telecommunications Authority (NTA). The Contractor shall assume connection can be made at the road on the North side of the power station site. A separate contractor will be responsible for connecting the solar PV PPC to the NTA fibre at the remote end.

488. A fibre optic cable connection shall be installed between the main control room in PS1 to the BESS. The communications cable selected shall be designed to be suitable for the equipment selected and the communication protocols and information required to be transmitted.

489. The Contractor shall utilise existing fibre optic communications cables and equipment for the communications between PS1 and PS2. Existing fibre optic cables have been installed from PS1 control room to the switching station and from the switching station to PS2 control room.

490. The communication between the new engine ECM's and the power station control system shall be undertaken by using a single communications cable chosen to suit the communication protocols and information required to be transmitted. Discrete control cabling shall only be used for other protection and control equipment installed on the gensets, auxiliary systems and ancillary systems.

5.13.10. SCADA/HMI Systems

491. A SCADA/HMI system shall be installed to monitor and display the station and genset information to assist the operators to monitor the power station. Information that shall be monitored and displayed includes:

a. Station/s alarms and events
b. Feeder alarms and events
c. Genset alarms and events (including from engine ECM)
d. Power station, genset & feeder metering
e. BESS alarms, events, metering

f. Reservoir solar PV events, metering and status

492. A suitable Human Machine Interface (HMI) shall be installed and shall be fully integrated into the control system/s implemented. There shall be HMI's installed in both PS1 and PS2 to ensure power system operation can be viewed from either location.

493. A SCADA system shall also be installed to provide remote access to the control system to monitor the power system as well as reviewing alarms and events. The HMI & SCADA systems shall integrate seamlessly.

494. The SCADA/HMI system shall also include a database to record all power station information so that historical data can be reviewed and analysed.

495. Suitable security protocols shall be implemented to ensure only approved access can be gained to the SCADA/HMI systems.

496. **The Contractor shall provide details in the Compliance Matrix** of the SCADA and HMI systems proposed as well as the database and reporting system proposed for analysing SCADA data.

497. The distributed PV systems installed under the PV contract will be monitored via the internet, with data integrated into the SCADA. The SCADA will poll the system at minimum 1 hour intervals and report power, energy and any errors or warnings for each site.

498. In addition, a dedicated screen connected to an internet enabled computer shall be provided to enable viewing via a web browser of detailed PV system information. The web browser interface shall be provided by the PV contractor.

5.13.11. Engineering Access

499. Remote access to all control systems including engine ECM's shall be provided. This access shall allow remote engineering resources to access equipment systems and assist with fault finding.

500. Suitable security protocols shall be implemented to ensure only approved access can be gained to the system.

5.13.12. Metering Systems

501. All load data and energy generated, exported and consumed on site shall be metered. The data shall be logged in a suitable database and be able to be analysed using software solutions. The metering data shall also be displayed via the SCADA system. **The Contractor shall provide details in the Compliance Matrix** of the database and reporting system proposed for metering data.

502. Suitable digital meters shall be installed in the control panel doors to display the metered data parameters as detailed in the following sections.

5.13.12.1. Genset Metering

503. The energy generated (kWh) by each generator shall be measured individually. The metering point shall be in the MV switchboard on the incoming circuit. In addition to

the energy measurements, the power (kW) from each generator shall be measured continuously and logged as a 1 second average. The generator auxiliary energy (kWh) shall also be measured individually for each generator. This shall include the cooling system and any other auxiliary systems associated with each generator. The metering point shall be located in a LV distribution board.

5.13.12.2. BESS Metering

504. The energy imported and exported (kWh) for the BESS shall be metered. The metering point shall be in the MV switchboard on the incoming circuit. In addition to the energy measurements, the real (kW) and reactive (kVAr) power exported/imported shall be measured continuously and logged as a 1 second average.

5.13.12.3. Station Ancillary Systems Metering

505. All energy consumed (kWh) to run ancillary services to the station shall be metered. The metering point shall be in the LV distribution board/s.

5.13.12.4. Station Export Metering

506. The energy exported (kWh) from the PS1 switchboard to the switching station shall be metered. The metering point shall be in the MV switchboard on the outgoing circuit/s. In addition to this, the real (kW) power, reactive power (kVAr) and current shall be measured continuously and logged as a 1 second average.

5.13.12.5. Feeder Metering

507. The feeders from the switching station shall be metered via existing equipment in the switching station MV switchboard. The data shall be incorporated into the metering data from PS1. The total real (kW) power and reactive power (kVAr) exported from the switching station shall be metered as well as the current on each individual feeder. These shall all be measured continuously and logged as a 1 second average.

5.13.12.6. PS2 Metering

508. The existing metering systems for PS2 shall remain as they are currently configured. The power and energy exported from PS2 to the switching station shall be metered via existing equipment in the switching station MV switchboard. The data shall be incorporated into the metering data from PS1. The total real (kW) power and reactive power (kVAr) exported from the switching station shall be metered as well as the current on each individual feeder. These shall all be measured continuously and logged as a 1 second average.

5.13.13. Protection Systems

5.13.13.1. General

509. The protection systems for the power station shall be integral to the control system. The safety of people and plant will always take precedence over continuity of electricity supply. The hierarchy of protection shall be:

1. Safety of people
2. Safety of plant
3. Continuity of supply

510. All CT's & VT's shall be housed either within the MV switchboard or at a suitable location near the alternator. They shall be sized as necessary for the expected outputs of each generator. The location of CT's and VT's are shown in drawing A0285-E-211.

511. All protection relays shall be fully tested as part of the Commissioning Plan. The testing shall include secondary injection testing.

5.13.13.2. Engine Protection

512. Protection systems shall be provided as part of the ECM or implemented through separate discrete components. All protection systems required by and recommended by the manufacturer shall be implemented. As a minimum the following critical engine protection elements shall be implemented:

a. Over speed (over frequency)
b. Under speed (under frequency)
c. Low lubricating oil pressure
d. High lubricating oil temperature
e. High and low lubricating oil level
f. Low coolant level
g. High coolant temperature
h. High exhaust gas temperature

513. The engine protection system shall have multiple stages of fault response to reduce the likelihood of total loss of generation while ensuring the safety of staff and plant are maintained. An example of a staged fault response is:

a. Alarm:
    i. When a condition is outside normal operating range but where no damage will result from indefinite continued operation.
    ii. Other plant is started if possible and the faulted plant is then tripped off line, cooled down and then stopped.
    iii. Plant with an alarm condition may be re-started if required (e.g. due to more serious faults on other plant).
b. Trip:
    i. When a condition is outside acceptable operating range but where no damage will result from short term continued operation (e.g. ten minutes).

ii. The faulted plant is tripped off line, cooled down (typically for five minutes) and then stopped.

iii. The faulted plant will not be restarted until the fault condition is cleared.

c. Shutdown:

i. When a condition is outside acceptable operating range and where damage will result from continued operation.

ii. The faulted plant is tripped off line and stopped (without cool down)

iii. The faulted plant will not be restarted until the fault condition is cleared.

514. The plant is required to operate to the greatest acceptable limits to maximise plant availability and thus minimise loss of supply.

5.13.13.3. Genset Electrical Protection and Spare CB Bays

515. Protection relay elements for electrical protection shall be installed in the MV switchboard. The minimum required protection functions shall be:

a. Overcurrent
b. Earth Fault
c. Differential Protection
d. Over Voltage
e. Under voltage
f. Over frequency
g. Under frequency
h. Reverse power
i. Loss of Field
j. Negative Sequence
k. Directional Overcurrent
l. Reactive Power
m. Under-impedance
n. Inadvertent energisation
o. Over-fluxing
p. Positive Sequence
q. Neutral Over Voltage 2 stage 59N1, 59N2 (across high impedance transformer resistor)
r. 3rd Harmonic Neutral Under Voltage 27TN (across high impedance transformer resistor)
s. 3rd Harmonic Ratio Voltage 59D (across high impedance transformer resistor, and neutral displacement voltage of generator)
t. Alternator Temperature Monitoring
u. Synchro Check

v. Neutral Earth Resistor

w. Trip Circuit Supervision

x. CB Fail

516. Consideration shall be given to any other protection functions that can be enabled to reduce the risk of damage to the gensets in the advent of a fault.

517. The existing protection systems for gensets 5 shall be integrated into the protection systems. The designer shall determine the most suitable method to achieve this and maintain adequate protection for the assets.

5.13.13.4. BESS Protection

518. Protection for the MV circuit connected to the BESS shall have overcurrent, earth fault, transformer guard, CB supervision and CB fail protection systems installed.

519. Protection for components within the BESS system shall be integral to the BESS control system and are detailed in clause 5.12.

5.13.13.5. Bus Protection

520. A High Impedance Differential protection scheme shall be installed to protect the main switchboard bus. CB supervision and CB fail protection shall also be installed.

5.13.13.6. Station Supply and Earthing Transformer Protection

521. The following protection elements shall be installed to protect each station supply/earthing transformer.

a. Overcurrent

b. Earth fault

c. Transformer guard

d. CB supervision

e. CB fail

522. The circuit to the station supply transformer from the earthing transformer RMU shall be protected by way of an appropriately sized fuse installed in the fuse switch.

5.13.13.7. Switching Station Supply.

523. The existing protection systems for the feeders out of the switching station shall be integrated and graded with the protection in the new MV switchboard in PS1. Feeder protection settings shall be reviewed as part of the required works and the feeder protection tested to ensure it is operating correctly.

5.13.13.8. Gensets Fire Detection

524. A fire detection system shall be installed to monitor the gensets in case of a fire on the engine or alternator. The fire detection system shall incorporate flame detection as a minimum and shall be connected to the building based fire protection systems.

525. In addition to any response by the building fire system, any detection of a genset fire shall be deemed to be a Shutdown event (as per clause 5.13.13.2) and the impacted genset immediately shut down with the day tank outlet solenoid closed immediately and the audible alarm sounded.

5.14. MV Switchboard

5.14.1. Scope

526. This section of the Specification covers the design, manufacture, testing at works, supply, delivery, installation and commissioning of:

- One (1) only 13.8kV, three (3) phase, 60Hz, switchboard fixed circuit breakers and integrated protection systems, as described in this Specification.
- One (1) set of special tools, gauges, and appliances necessary for the installation, erection, testing and maintenance of the supplied switchboard and circuit breakers,
- At least one (1) set of spare parts to suit the supplied switchboard and circuit breakers, but Contractors are requested to recommend a suitable spare parts quantity based on the number of circuit breakers offered,

527. The switchboard proposed shall have integral earthing switches with each circuit breaker.

528. The equipment shall be entirely suitable for continuous operation under the conditions specified and shall be in accordance with this Specification and the switchboard and circuit breaker design parameters defined in the Schedule of Specific Requirements.

529. The Principal shall not be bound to purchase any or all of the special tools, spare parts or earthing truck listed above, but the Contractor shall supply any item at the prices stated if called upon to do so at the time of acceptance of Tender.

530. **The Contractor shall provide details in the Technical Schedule** of the MV switchboard proposed to be supplied. The information supplied shall be typical only but of sufficient detail to allow the Principal to assess suitability for the application specified.

5.14.2. General

531. The 13.8kV switchboard with integrated circuit breakers shall be an indoor type, metalclad, three phase, 60Hz with vacuum insulated circuit breakers. The switchboard and associated circuit breakers shall be supplied complete with all accessories that are required by the Specification.

532. The switchboard and equipment shall be designed to the parameters as detailed in Technical Schedule 6a.

5.14.3. Service Conditions

533. The equipment shall be entirely suitable for continuous operation, without corrosion, deterioration, or degradation of performance, under the conditions listed in Clause 5.1.2.

534. The switchgear be located in the power station MV switchroom, intended to be airconditioned, during normal operations, to a temperature not exceeding 77°F (25°C). There may be times when the air conditioning is not functional, but it is expected that the room temperature during these times will not exceed 104°F (40°C).

5.14.4. Auxiliary AC & DC supplies

535. Auxiliary AC supply will be 277/480V solidly earthed. Auxiliary DC supply will be 48V DC.

5.14.5. Busbars and Busbar Connections

536. Busbars shall be of high conductivity, hard drawn copper such that temperature rise does not exceed 104°F (40°C) for continuous operation at rated current and of uniform cross-sectional area and rating for its entire length.

537. The busbars shall be designed, and provision be made so that the extension of the busbars will require a minimum of outage duration. All tapes, shrouds, etc necessary for jointing busbars during installation shall be supplied.

5.14.6. Circuit Breaker and switchboard insulating system

538. The 13.8kV switchboard busbar arrangement will be air insulated or resin insulated, with appropriately rated insulated tape or epoxy material used in areas where reduced clearances require such additional insulation and be completely self-contained in separate segregated sections of the switchboard with busbar clearances in accordance with the relevant Standards.

539. The 13.8kV circuit breakers shall employ vacuum as the insulating and interruption medium.

540. A device for checking the vacuum pressure level, during service, with visual indication of the available pressure, or lack thereof, in the circuit breaker interruption chamber, and the minimum and maximum limits admissible for correct operation, shall be provided. It shall be properly fitted to prevent leakage.

541. Two adjustable "voltage free" contacts shall be incorporated in this device to "alarm" abnormally “high” and “low” gas pressure level. Wiring shall be terminated in the auxiliary marshalling box fitted with high and low fixed alarm contacts.

5.14.7. Requirements for Vacuum Circuit Breakers

542. An appropriate means shall be provided for checking contact wear in-situ.

543. The maximum current chopping shall be minimal and expected to be less than 5 amperes for unity power factor. Evidence of tests shall be supplied to demonstrate this criterion has been met. It shall not be necessary to fit surge arresters to limit switching overvoltage generated by the vacuum interrupters.

544. The level of X-rays emitted under all operating and test conditions shall not constitute a health hazard to any personnel working on the particular switch panel or

adjacent panels. Contractors are to specify the level of radiation expected under overvoltage and test conditions and where the exposure level would be experienced.

545. The detailed procedure for replacing a vacuum bottle shall be provided in the instruction manual.

546. Tenders shall include the following information:

a. Source of the vacuum bottles,
b. Statements of the experience of the vacuum bottle's manufacturer,
c. History of performance of the particular vacuum bottles
d. Evidence of testing (including accelerated ageing tests) of the particular vacuum bottles.
e. Level of X-radiation emitted under all likely operating and test conditions.
f. The vacuum bottle shall be sealed for life. Contractors shall state the method by which the Principal may carry out in-situ tests on the integrity of vacuum in the bottles.

547. Tenderers shall state the consequences of loss of vacuum on:

a. The voltage withstand capacity of an open circuit breaker.
b. The ability of the circuit breaker to switch load current
c. The ability of the circuit breaker to switch fault current.

5.14.8. Requirement for Arc Fault Venting

548. The switchboard is required to protect all personnel from the effects of internal arc faults. The switchboard must include internal systems that can detect internal arcing and switch off the power supply so as to limit the fault duration, including but not limited to electromechanical detectors and/or optical detectors. The switchboard must also include fully enclosed metal vents or ducts between the switchboard and the external environment that shall divert any hot gases that are the result of internal arcing faults away from personnel within the switchroom.

5.14.9. Circuit Breaker Operation Counters

549. Each circuit breaker shall be fitted with a non-resettable operation counter to record each opening operation.

5.14.10. Circuit Breaker HV Cable Compartment and Cable Terminations

550. The cable compartment/box shall be air insulated and accessible only by unbolting metal panels.

551. Cable boxes shall be downward pointing. The cable boxes shall be arranged for cable entry to be vertical from below the switchgear.

552. The cable boxes shall be supplied complete with all glands, armour clamps, ferrules, expansion fittings etc. Full details of cable boxes such as dimensional drawings, cable box type with HV power cable terminated shall be included in the Tender to allow full assessment of the Contractors proposal.

553. The cable box entry for single core cables shall be designed to minimise the possibility of eddy current heating.

554. Cable boxes shall permit the termination of the required number of HV cables as required.

555. The cable boxes shall be dust and vermin proof. They shall be fitted with a removable gland plate for each cable to allow the cable to be laid into or removed from the box without the need to thread the cable through the gland entry.

556. Where a bolted connection, which is preferred, is provided, flat terminal palms shall be provided for fixing cable lugs. The height of the cable box from the centre line of the lower fixing hole of the terminal palm to the base of the box shall be a minimum of $34^{41}/_{64}$" (880mm).

557. Tenderers whose equipment would normally use HV cable plugs for terminating HV cables shall include in their scope of supply all materials, installation tools and equipment, instructions and drawings necessary for proper termination and insulation of the HV power cables.

558. Undrilled gland plate shall be fitted. The gland plate shall be made of $^{15}/_{64}$" (6mm) brass as a preference, or aluminium of suitable thickness.

559. The minimum distance from the bottom of the cable gland to floor level shall be $11^{13}/_{16}$" (300mm).

5.14.11. Circuit Breaker Dependent Power Operation

560. Clause 5.5 of IEC 62271.200 is applicable with the following additions:

a. The switching device contacts shall be positively driven in both directions.

b. Where necessary, the mechanism shall be designed to permit maintenance of the associated switching device. If this requires the manual slow operation of the switching device, the facility provided shall be quite separated and distinct from that associated with normal operation.

c. Any separate component associated with maintenance slow operation shall be labelled "FOR MAINTENANCE PURPOSES ONLY".

5.14.12. Circuit Breaker Stored Energy Operation

561. Clause 5.6 of IEC 62271.200 is applicable with the following additions:

a. Pneumatic or hydraulic operating mechanism requiring a central air compressor plant or pump will not be accepted.

b. No movement of the main contacts is permissible before the release of stored energy. However, in the case of earthing switches, such movement is permissible provided that the contact movement shall not reduce any electrically stressed gap to below that which will withstand the rated insulation levels.

c. For manual operation it shall only be possible to operate a mechanism by using a dedicated operating handle applied in the correct manner.

d. Clear indication shall be given of the direction of motion of an operating handle to complete the operation.
e. Motor-charged spring-operated, stored energy mechanisms shall be provided with means for charging the springs safely by hand.

5.14.13. Circuit Breaker Manual Operation

5.14.13.1. Independent Manual operation

562. Clause 5.7 of IEC 62271.200 is applicable with the following additions:

a. It shall not be possible to charge the closing springs with the switching device in the closed position.
b. During an ‘open’ or ‘close’ operation, none of the energy from an incomplete operation shall remain in the mechanism. In addition, movement of an operating handle against an interlock shall not commence the charging of any spring.
c. Except for independent manual, independent motor and dependent manual operation:
    i. It shall be possible to re-charge the closing springs when the switching device is closed and if the springs can be and are released the device shall not open nor shall this operation result in mechanical damage to any component. If the springs are recharged after the switching device has been closed, they shall not be discharged by the shock of a short circuit interruption or accidental knocks and impacts.
    ii. A visible mechanical indicating device shall be mounted on the switching device to indicate the state of the spring and shall be inscribed “SPRING CHARGED” in red letters on white background, when the spring is charged, and “SPRING DISCHARGED” in black letters on white background, when the spring is discharged.
d. Provision shall be made for this information to be displayed remotely.

5.14.13.2. Dependent Manual Operation

563. It shall not be possible to remove an operating handle from a dependent manual operating mechanism unless an ‘open’ or ‘close’ operation is completed.

5.14.14. Circuit Breaker Operation of Release

564. Clause 5.8 of IEC 62271.200 is applicable with the following additions:

a. Stored energy operation mechanisms shall be fitted with a local manual release for opening and closing operation with the compartment door closed.
b. No movement of the spring charging handle shall occur as a result of the release of spring energy to operate the mechanism.

5.14.15. Interlocking Devices and Padlocking Facilities

565. Clause 5.11 of IEC 62271.200 are applicable with the following additions:

5.14.15.1. Interlocking Devices.

566. Interlocking shall be by mechanical, key or electro-mechanical, in order of preference, and when manually operated, they shall be provided with labels which are readily visible, and which contain clear concise instructions for operation.

567. Clearly labelled mechanical interlocks shall be provided to prevent:

a. The removal from or replacement of a circuit breaker to the service and earth positions with the front door open.

b. The opening of the circuit breaker compartment front door unless the circuit breaker is in the out of the service position or in the earth position.

c. Tripping by attempting isolation.

d. The removal of a circuit breaker secondary wiring plug connection from its socket on the stationery housing when the circuit breaker is in the racked-in position.

568. The electrical tripping of a circuit breaker that has been prepared for an earthing operation shall be inoperative both during closing and when closed. In addition, it shall not be possible to return to normal service duty without restoring the operation of the electrical tripping circuit.

5.14.15.2. Circuit and Busbar Earthing Interlocks

569. Where earths are applied through a circuit breaker, it must not be possible to trip it electrically whilst it is being used to apply the earth. It shall also be possible to padlock a circuit breaker to prevent the removal of an earth by mechanical means.

570. Each circuit earth shall be mechanically interlocked with its associated circuit breaker such that the circuit earth cannot be applied until the circuit breaker is open and fully isolated. Conversely, it shall not be possible to remove the circuit isolation whilst the circuit earth is applied.

571. Busbar earth switches shall be interlocked such that the busbar earth(s) cannot be applied unless all potential sources of in-feed to the section of busbar (including all outgoing feeders on the section) have been opened and isolated. Conversely, it shall not be possible to remove any point of isolation from the busbars whilst busbar earths are applied. Most importantly, the interlocking shall be fail safe.

572. Where busbar earthing is achieved by closing the circuit breaker onto an already prepared circuit earth, a padlockable captive device, labelled “MOVE BEFORE BUSBAR EARTHING” (black letter on Signal Red background) shall be provided to remove the normal interlock, which must be moved before it is possible to engage and close the circuit breaker.

5.14.15.3. Padlocking Facilities

573. It shall be possible to meet all padlocking requirements by means of a padlock.

574. Padlocking facilities, each requiring the use of a single padlock without additional loose devices, shall be provided so that:

a. A switching device can be prevented, independently of other operations, from being closed by local manual operation of the mechanism when it is open. This facility shall not lock mechanically any closing mechanism having electrical release.
b. A switching device can be prevented, independently of other operations, from being opened by local manual operation of the mechanism when it is closed. This facility shall not lock mechanically any trip mechanism having electrical release.
c. Busbar, circuit or VT shutters can be independently locked closed to provide a point of isolation which must remain undisturbed whilst other operational work (earthing or testing) is being carried out.
d. Any test access cover can be independently locked closed.
e. Circuit and busbar earthing facilities can be independently locked to prevent inadvertent earthing.
f. A voltage transformer assembly fitted with an isolating feature can be locked in the isolated position.
g. VT secondary fuses/links when removed can be padlocked off to prevent reinsertion. Any bar used for this purpose should be captive and non-conductive.
h. When in use, it shall not be possible to remove any covers, when part of an interlocking/padlocking facility.

5.14.16. Circuit Breaker Position Indication.

575. Clause 5.12 of IEC 62271.200 is applicable with the following additions:

a. All switching devices with non-visible main contacts shall be fitted with positively driven mechanical indication of the operating position.
b. Only one indicator shall be visible at any one time and should not be wholly visible until the operation is completed.

5.14.17. Protective, Control and Indicating equipment

5.14.17.1. Current Transformer requirements

576. Current transformers shall comply with the requirements of IEC 60044.1

577. All current transformers shall have short time ratings not less than those specified for the complete switchboard. They shall also all be capable of withstanding the making capacity of their corresponding circuit breaker.

578. All current transformers shall have a thermal rating of at least 120% of the highest CT ratio on both the primary and secondary windings, and this information shall be displayed on the nameplate.

579. The current transformers shall be of the bar primary type, using cast resin or similar insulation.

580. The individual cores of current transformers in the same enclosure shall be magnetically and electrically separate from each other except for a common primary bar.

581. Multiple ratios shall be obtained by the use of multiple secondary tapping.

582. All current transformer tapping's shall be brought out to a readily accessible terminal block.

583. Shorting terminals shall be provided in the secondary circuits of all current transformers having multiple tapping's to facilitate tap changing on live equipment.

584. Where current transformers are not capable of withstanding the high voltage dc or ≤ 0.1 Hz cable test, bolted links shall be provided to permit their isolation for cable test.

585. All current transformers are to be accommodated within the switchgear, instead of current transformers fitted over the high voltage cables.

586. All current transformers fitted to circuit breakers shall be installed with the P1 terminal located nearest to the circuit breaker contacts.

587. Each current transformer shall be provided with two (2) nameplates, one of which shall be mounted on or adjacent to the current transformer in a readable position and the other in the LV compartment in a position clearly visible with the panel door open.

5.14.17.2. Voltage Transformer requirements

588. The voltage transformers shall be constructed from three single-phase transformers complying with the requirements of IEC 60044.2.

589. Voltage transformers shall be of the 'dry' type utilising cast resin or similar insulation.

590. Suitably rated fuses shall be provided on the HV side and in each phase of the low voltage windings.

591. All live HV parts, and the HV fuses shall only be accessible when the voltage transformer is fully disconnected.

592. Provision shall be made for locking the voltage transformers in the "Service" and "Isolated" positions.

593. Secondary winding fuses shall be fitted as close as practical to their corresponding windings and shall be accessible with the switchboard fully energised.

594. All individual metering and protection circuits shall be separately fused.

595. Star connected secondaries shall have all three phases plus the star point (neutral) brought out. The star point shall be earthed via a link.

596. Each voltage transformer shall be provided with two (2) nameplates, one of which shall be mounted on or adjacent to the voltage transformer in a readable position and the other in the associated LV compartment in a position clearly visible with the panel door open.

5.14.17.3. Local Circuit Breaker Electrical Control

597. Each circuit breaker shall be provided with:

a. Local 'trip-close' push buttons or switch. When push buttons are provided, they shall be coloured RED for tripping and GREEN for closing

b. An operation selector switch which shall have three positions as below.
    i. ‘Local’. In this position tripping and closing of the circuit breaker shall only be possible by means of the local ‘trip-close’ push-buttons or switch on the circuit breaker and the protective relays.
    ii. ‘Maintenance’. In this position tripping and closing of the circuit breaker shall not be possible.
    iii. ‘Remote’. In this position tripping and closing of the circuit breaker shall only be possible by means of remote devices and the protection relays.
c. The switch shall also provide clean contacts for indication of switch in ‘Local’ and ‘Maintenance’ positions to the SCADA system.

5.14.17.4. Protection & control Marshalling cubicle

598. Each 13.8kV circuit breaker shall be fitted with a marshalling cubicle or enclosure suitable to terminate all wiring required for the correct functioning of that circuit breaker and its associated protection and control equipment. The marshalling cubicle shall be securely mounted, integral with the circuit breaker, located in a readily accessible position, and facilitate ease of termination and connection of multicore cables.

599. The cubicle shall be provided with:

a. Anti-condensation heaters supplied by 277V AC.
b. Lighting controlled by a door switch.
c. Shorting link type terminals for CT wiring.

600. The cubicle shall be provided with a vertically hinged door or doors that are secured by an approved locking facility that can be locked closed by a padlock. The door/s shall cover the full height and width of the cubicle and be capable of being opened greater than 120° to permit access to all parts of the cubicle.

601. The equipment accommodated in the cubicle shall be mounted on a hinged panel and all terminals shall be effectively shrouded to provide safe access to equipment and terminations located behind the panel.

602. All equipment shall be labelled to show its function using white-black-white traffolyte or equivalent labels.

603. All secondary wiring shall be marked with a circuit number at both ends by approved ferrules that cannot fall off if the wire is removed from the terminal.

5.14.17.5. AC Supplies

604. A single three phase, four wire, 480V 60Hz supply shall be cabled directly to terminals to be provided in the auxiliary marshalling box or enclosure for running motor control circuitry and other auxiliary apparatus.

5.14.17.6. DC Supplies

605. A nominal 48V d.c supply shall be used for the switchboard for protection and alarm monitoring. Provision shall be made for terminating this supply in each cubicle.

5.14.18. Check and Test Facilities

606. Means shall be provided to allow a check, by means of an approved voltage detector, to verify the main circuit is not live and to allow for phasing out.

5.14.18.1. Voltage Presence Indicating System (VPIS)

607. A voltage presence indicating system in accordance with IEC 62271-206, shall be provided for each phase of each busbar and each main circuit to indicate the busbar and the cable side of the circuit are in service or isolated, and to allow phase comparison to be carried out between adjacent main circuits.

608. If cable compartments are at the rear, an additional indication of voltage presence shall be provided for each circuit at the rear of the panel.

609. The indicating system shall be designed for maximum service reliability, maintenance free and shall not need external power.

5.14.18.2. Test Facilities

610. Each circuit breaker shall allow for the following tests:

a. Circuit fault location and testing
b. Phase identification
c. Voltage testing on circuits
d. Testing the integrity of a vacuum interrupter when the requirements are specified in the manufacturer’s instructions.
e. Protection testing including primary and secondary injection

611. These test facilities may be provided by the insertion of a portable test device. For withdrawable equipment the test device may be inserted into orifices vacated by the withdrawal of the associated switching device.

612. For testing connections, all parts of the main circuit which cannot be disconnected from the test connections, and any associated devices shall be capable of withstanding the dc withstand voltage for 15 minute period.

613. To assist in cable fault location the contact resistance measured from the terminals for connecting test leads to the connection to the main outgoing cables shall not be greater than 100 micro-ohms.

614. Integral test contact shall be so designed and constructed as to ensure that component parts do not become detached during normal use.

615. Test access cover shall be clearly identified. Test access for plug-in test device shall not be positioned on the top surface of the equipment.

616. Where equipment carries a mimic of the main circuit, the test point shall be clearly shown as part of the mimic.

617. The opening of test access covers, designed specifically for access to test contacts, shall not be possible when the equipment is in any position other than "EARTH ON".

618. When it is necessary, for testing purposes, to remove a cover not designed solely for test access, e.g. a cable compartment cover, an interlock shall be provided to prevent removal of the cover when the equipment is in any position other than “EARTH ON”.

619. In all cases it is preferred that the test access should be at the front of the switchgear. When the test access is at the rear of the switchgear a mechanical/electro-mechanical interlock or linkage shall be provided which enables an operator to be sure that the correct access has been opened and provides a physical indication at the front of the switchgear that a test access is open.

620. When the test access cover is open, all parts which may be live shall be so shielded or protected that an operator using the normal test devices cannot make contact with live parts.

621. It shall not be possible to close or replace the test access cover with any test device in position.

622. It shall not be possible to close associated switchgear with the test access open.

623. Test facilities intended for voltage testing instruments shall have a minimum access of $2^{23}/_{64}$” (60mm) diameter.

5.14.18.3. Test Devices

624. Provision shall be made to secure test devices positively in position when in use. Where the test device is in the form of a plug-in bushing, then the method of securing the device in position and its removal shall not require the use of any tools and, additionally, dismantlement of any part of the device shall require the use of non-standard tools. Plug-in bushings shall be designed and constructed to ensure component parts do not become detached during normal use.

625. Portable testing devices shall be identified by manufacturer and type, uniquely serial numbered, marked with their test voltage and current rating and provided with a suitable container.

5.14.19. Construction

5.14.19.1. Tanks, Covers, housings, and Enclosures

626. All circuit breaker tanks and enclosures shall be constructed from robust metallic material and protected from the elements by coating or galvanising.

627. In general, all equipment housings should be constructed/reinforced to withstand without distortion transport, handling or excess pressure during fault conditions. Circuit breaker tanks or enclosures shall be designed to withstand the stress of the vacuum. Contractors shall state in their Tender if the circuit breakers offered complies with this requirement.

628. All surfaces on which water could accumulate shall be sloped and drained to prevent the accumulation of any water.

629. Where the equipment housing is constructed of corrosion resistant material the joints shall have similar corrosion resistant properties to the parent metal.

630. All exposed bolts, nuts and washers shall be hot-dip galvanised or stainless steel.

5.14.19.2. Protective Coatings

631. All external surfaces of the equipment are to be treated with a coating that provides protection against corrosion induced by water, salt laden atmosphere and low levels of industrial pollutants.

632. The protective coating shall comply with the following requirements:

a. Finished coatings shall be oil resistant, heat resistant and non-corrosive.

b. All coatings shall be painted to the Manufacturer's standard unless otherwise specified.

c. All coatings shall be capable of being maintained on-site.

d. The materials used, and method of application shall be suitable for the base metal to be coated, shall be supplied by a reputable Manufacturer, and shall be applied in accordance with their recommendations for this particular application.

633. The Contractor shall guarantee that after three years from acceptance the extent of corrosion at any one site on the equipment shall not exceed an area of five square centimetres nor penetrate the base metal by more than one tenth of the thickness of the base metal.

634. The Contractor shall supply sufficient details to allow evaluation of the protective coating by the Principal, and shall include:

a. Description of base metals to be coated.

b. Make and type of materials used for cleaning, priming and finishing.

c. Details of the surface cleaning process used for removing rust, oil, grease, dirt and other foreign matter and of the surface preparation process.

d. Recommendations for on-site repair of damaged coating, e.g. scratches, chips, etc. from handling, necessary to achieve the estimated life of the protective coating.

5.14.20. Fittings

635. In addition to the standard fittings called for in other parts of the Specification, the following additional shall be provided.

5.14.20.1. Circuit Breaker Lifting Facilities

636. Lifting lugs shall be provided suitable for lifting each complete circuit breaker assembly when assembled and ready for service. The lugs shall be arranged so that any slings attached thereto do not foul any part of the circuit breaker and when suspended by them, the circuit breaker shall hang without tilting.

5.14.20.2. Earthing Lugs

637. A suitable stainless-steel earthing lug with a $^{9}/_{16}$" (14mm) diameter hole shall be provided for each circuit breaker and for each switchboard bus section.

5.14.20.3. Gland Plates

638. All drop boxes are to have a $^{15}/_{64}$" (6mm) Brass gland plate complete with earth stud.

5.14.21. Earthing

639. The earthing conductor (or earth busbar) referred to in sub-clause 5.3.2 of IEC 62271.200 shall be secured to the enclosure and located so as to provide convenient facilities for use with any earthing leads.

640. The earth busbar shall have a cross sectional area not less than 0.1 sq. in. (70mm^2) and shall be of flat high conductivity hard drawn copper busbar. The earth busbar shall run the full length of the switchboard.

641. The metallic parts of a withdrawable or removable part which are normally earthed shall be connected to the earthing conductor on approach to, and whilst engaged in the "Service" and "Earth" locations. The earth connection shall be completed prior to engagement of the main circuit contacts by not less than 1" (26mm).

642. Provision shall be made for each cable sheath/screen earth terminal to be connected to the earthing conductor.

5.14.22. Rating and Terminal Marking Plates

643. The Rating and Terminal Marking plates shall be supplied and the location and wording of labels will be to the Principal's approval.

644. The name plates shall be stainless steel stamped with the equipment number and title, as specified by the Principal, in a minimum of $^{1}/_{2}$" (12mm) high letters.

5.14.23. Inspections and Tests

645. The Contractor shall successfully carryout routine testing on the equipment, as required by relevant Australian Standards, as well as any additional type or special tests requested by the Principal which may be required to verify that the equipment conforms to the Specification, the Tender, subsequently approved construction drawings and performance data.

646. Complete and accurate records of all tests shall be kept by the Contractor and copies supplied to the Principal. Three (3) certified copies of all test results for all components shall be supplied to the Principal immediately upon completion of the tests and before the delivery. All test certificates shall state the equipment serial numbers. An indication only that equipment has passed a test or exceeded a required value is not acceptable. The circuit breakers and switchboard shall not leave the works until the test certificates have been received, considered and approved by the Principal.

647. The proper functioning of all protective, indicating and alarm devices shall be demonstrated to the satisfaction of the Principal.

648. The Contractor shall notify the Principal at least three weeks in advance of commencement of testing at the Contractors works and the Principal reserves the right to witness all such tests.

649. The Contractor shall advise the tests they consider should be carried out at site and on commissioning.

650. The Principal shall have the right to carry out such other tests as they deem necessary to prove the compliance of the equipment with the Contract. In the event of these check tests proving that the equipment is satisfactory, all costs will be borne by the Principal, but in the case of faulty plant, the Contractor shall bear the costs of replacing or modifying the equipment and further tests in connection therewith. Any expense by the Contractor in having representatives present shall be borne by the Contractor.

5.15. Station Auxiliary Switchboard

5.15.1. General

5.15.1.1. Scope of Works

651. The design, manufacture, supply and installation of a type-tested low-voltage switchgear assembly for the Majuro Power Station No. 1. The ASSEMBLY shall be of indoor, front entry only modular design. Drawing A0285-E-213 shows the proposed SLD for the ASSEMBLY. The concept design provided is indicative only and shall be confirmed through the design process.

652. The ASSEMBLY shall be capable of internal arc fault containment. The arrangement of the busbars and functional units of the ASSEMBLY in vented compartments shall be designed to promote rapid extinction of the arc and to prevent the arc or arc products affecting other parts of the ASSEMBLY.

653. The ASSEMBLY, and all associated equipment shall be capable of continuous operation for all criteria as outlined in this Specification.

654. **The Contractor shall provide details of the Station Auxiliary Switchboard proposed in the Compliance Matrix**.

5.15.1.2. Design

655. The Contractor is responsible for complying with codes, specifications, reports and required Standards. The ASSEMBLY shall be constructed and installed in accordance with ANSI C37.20.1 and NEC 2017. The Contractor shall also be responsible for complying with instructions and procedures supplied by the manufacturers of components.

656. The layout of the ASSEMBLY indicated in the drawing A0285-E-310 is the arrangement preferred by the Principal for compatibility with the switchroom design.

5.15.1.3. Testing

657. The Contractor shall be responsible for the testing of the ASSEMBLY and all components installed under this specification. These tests include but are not limited to the following:

a. Insulation resistance;
b. Earth continuity;
c. DC polarity;
d. ACB operation;
e. Metering.

658. All insulation tests on the bus system and major switching components shall be carried out prior to the installation of electronic components in the ASSEMBLY.

659. The Contractor shall provide a test and inspection plan for approval by the Principal within fourteen days from acceptance of the tender.

660. On completion of manufacture and preliminary testing of the ASSEMBLY by the Contractor, the Contractor arrange for a Factory Acceptance Test. The Principal will confirm with the Contractor if they are to attend the Factory Acceptance Test. The Contractor shall provide all necessary testing facilities and resources to the Principal's representative for the Factory Acceptance Test.

661. The Supplier shall provide the Principal a minimum of fourteen (14) days' notice for the Factory Acceptance Test.

5.15.2. Construction

5.15.2.1. General

662. The existing main Station Auxiliary Switchboard shall be replaced with a new switchboard. The new Station Auxiliary Switchboard shall be located in the same general location as the existing switchboard in the MV switch room. If switchboard is not mounted against the eastern wall of the switchroom, sheet metal panels or similar shall be installed between the switchboard and the wall to prevent access behind the switchboard. The sheet metal panels shall be the painted the same colour as the switchboard.

663. For the purpose of this section of the specification, the abbreviation ASSEMBLY is used for the type-tested low-voltage switchgear assembly

664. The ASSEMBLY shall be constructed of folded and welded panel quality sheet metal not less than $^{5}/_{64}$" (2mm) thick and shall be sufficiently rigid to accept normal switch operating forces without deflection.

665. The ASSEMBLY shall be suitable for a free-standing installation.

666. The ASSEMBLY shall be designed for bottom cable access.

5.15.2.2. Application

667. The ASSEMBLY and associated equipment described in this section of the specification shall be installed in a medium voltage diesel power station to provide all auxiliary and ancillary low voltage power for the plant. The station generated volts shall

be 3 Phase, 13.8kV (Phase to Phase) at 60 Hz with two (2) 750kVA 13.8kV / 480V Dyn11 Station Supply Transformers supplying the ASSEMBLY.

668. The ASSEMBLY will typically be operated with a split bus with each local supply transformer supplying half of the station load. However, the ASSEMBLY shall be rated such that the two Station Supply Transformers can run in parallel.

669. The Black Start Genset incomer shall be connected to an essential services bus. The essential services bus circuit breaker shall have mechanical interlock (or equivalent) with the Black Start Genset circuit breaker to avoid any synchronisation issues. The Principal may require the Black Start Genset to have an automatic start function. This will require the automation of the essential services bus circuit breaker and black start genset circuit breaker. See clause 5.16.2.4 for more details.

5.15.2.3. Site Ratings

670. The ASSEMBLY shall satisfy the following ratings:

Parameter Description	**Requirement**
Nominal Voltage	480V
Operational Frequency	60Hz
Short Time Current (Icw)	50kA, 1Sec.
Rated Current Main Busbars	2500A Continuous
Rated Current Incoming ACB Droppers	1600A Continuous

5.15.2.4. Protection

671. The minimum degree of protection shall be IP42.

672. Louvered vents shall be provided where required to meet the temperature requirements.

673. Where it is necessary to provide ventilation, openings shall be protected with stainless steel insect gauze and washable filter elements.

5.15.2.5. Separation

674. The ASSEMBLY shall be of metal-enclosed, multi-cubicle type construction with the following minimum separation:

a. Busbars separated from functional units (e.g. circuit breakers)

b. Separation of functional units from each other

c. Separation of functional units from terminals.

675. Mounting panels shall not form part of any separation.

5.15.2.6. Busbars

676. The busbars and busbar connections in the ASSEMBLY shall be fully enclosed, air insulated copper bars with the rated current specified, taking into consideration the ratings of the components of the electrical equipment within the ASSEMBLY, their disposition and application. This current must be carried without the temperature-rise of its several parts exceeding 122°F (50°C) above an ambient of 104°F (40°C) and shall be achieved without the provision of forced ventilation.

677. The busbar system, including the insulation and supports, shall have minimum creepage distances and clearances as recommended in ANSI C37.20.

678. The busbars, all connections thereto and bus support insulators, shall be capable of withstanding the mechanical and thermal stresses arising from a fault withstand current of 50 kA for 1 second.

679. Each phase of the main busbars and vertical droppers shall be colour coded in each compartment.

680. The ASSEMBLY shall have metal access covers installed where access to the bus is required for maintenance or other requirements. The metal covers shall be readily accessible and removeable.

5.15.2.7. Busbar Supports

681. All busbar supports shall be manufactured from non-hydroscopic fibreglass polyester and shall have a comparative tracking index to suit the service conditions and rating.

5.15.2.8. Mounting Panels

682. Equipment mounting panels shall be constructed from $^{5}/_{64}$” (2mm) zinc anneal with 1” (25mm) welded returns.

683. The mounting panels shall be positioned on threaded captive studs and secured by dome nuts.

684. Mounting panels shall be readily removable with the equipment mounted.

5.15.2.9. Doors

685. Doors shall be constructed of not less than $^{5}/_{64}$” (2mm) thick panel quality sheet metal with returned edges. All doors shall be hung on robust "lift-off" type hinges.

686. All doors shall have a minimum opening angle of 120^{o}.

687. Doors shall have tool operated latches installed. The tool operated latches shall be B&R IP020 Turnbuckle – ¼ turn tooled latch or equivalent.

688. The doors shall be adequately stiffened and contain a neoprene door gasket with a metal retainer.

5.15.2.10. Gland Plates

689. Removable pre- punched $^{1}/_{8}$” (3mm) aluminium gland plates shall be provided in the bottom of all panels.

690. The gland plates shall be suitably secured to each panel with setscrews or hexagonal type fasteners. The floor of each panel shall be threaded to accept these fasteners.

5.15.2.11. Neutral Bar

691. A Main Neutral copper busbar, insulated from earth, running the full length of the ASSEMBLY, shall be provided and have not less than one third the current rating of the main busbars.

692. A removable M.E.N Link shall be provided for connecting the neutral bar to the earth.

693. In each compartment of the ASSEMBLY, spare holes shall be provided in the neutral bar to facilitate site terminations.

694. The Main Neutral shall be identified in each compartment of the ASSEMBLY.

5.15.2.12. Painting

695. Metalwork shall be suitably prepared for painting by grinding and sanding all welds and removing all blemishes. All cut outs and penetrations shall be completed before application of coatings.

696. All metal work shall be chemically treated, primed and undercoated before the application of the topcoat. The topcoat shall be a 2 pack type coated gloss finish.

697. The exterior, bus chambers and the internal faces of doors and covers shall be finished with the colour grey.

698. The interior of compartments containing electrical components shall be finished with the colour white.

5.15.2.13. Fasteners

699. All fasteners and their accessories used throughout the ASSEMBLY shall have metric threads. Stainless 304 or 316 fasteners shall be used for mounting of all components.

700. Where fasteners protrude into adjacent compartments, they shall be of minimum length required for the mounting purpose to prevent injury or contact with live parts.

701. The use of pop rivets and self-tapping screws shall not be permitted.

5.15.2.14. Wiring Penetrations

702. Penetrations between compartments to provide inter-compartment wiring access shall be adequately sized and fitted with PVC bushes. Allowances shall be made in the sizing of penetrations to allow for a 50 percent increase in the number of wires.

703. Penetrations shall have ready access from both sides without the removal of any equipment.

5.15.2.15. Manufacturer’s Name Plate

704. A nameplate shall be attached to the end of the ASSEMBLY with the following details:

a. Manufacturer;
b. identification No;
c. rated operational voltage;
d. rated insulation voltage;
e. rated current of main bus;
f. rated current of vertical droppers;
g. short Circuit Withstand capacity;
h. temperature rise;
i. degree of protection;
j. weight.

5.15.2.16. Lifting Arrangement

705. The Contractor shall ensure there is a suitable system employed for the safe and effective loading, unloading and installation of the ASSEMBLY in the switch room. Consideration of the available lifting equipment on site shall be undertaken prior to finalising the design of the lifting arrangements for the ASSEMBLY.

5.15.3. Earthing

5.15.3.1. Main Earth Bar

706. A copper main earth bar of not less than 2" x ¼" (50 x 6.3mm) shall be provided in the vicinity of the main neutral bar running the full length of the ASSEMBLY. The earth bar shall be identified in each compartment by green and yellow markings.

707. In each compartment of the ASSEMBLY, spare holes shall be provided to facilitate site terminations. Spare holes provided shall be ½" (13mm) diameter.

708. Effective earthing of the ASSEMBLY structure shall be provided by connecting the main earth bar at two points to the framework of each compartment. The connection surfaces shall have all paint and corrosion removed, and have a conductive lubricant applied prior to connection.

5.15.3.2. Door Earthing

709. The effective earthing of all doors shall be provided by connecting a flexible tinned copper earth cable between each door and the ASSEMBLY chassis.

710. The flexible connection shall not be less than 7 AWG ($10mm^2$).

5.15.3.3. Air Circuit Breakers (ACB)

711. All ACB chassis shall be effectively earthed by connecting the chassis to the main earth bar.

5.15.3.4. Removable Covers

712. Care shall be taken to ensure removable covers such as gland plates, extension covers and access plates are effectively earthed.

5.15.4. Equipment

5.15.4.1. Mounting of Equipment

713. All equipment shall be rigidly mounted and secured with anti-vibration washers with attention to possible vibration problems from energised components and transport. The equipment installation shall be in accordance with the equipment manufacturers' handbooks or instructions.

714. All equipment shall be fixed in a logical and neat arrangement and be such that any item can be easily maintained using normal tools without dismantling or removing other equipment.

715. Where holes are tapped directly into panels, care shall be taken to ensure the minimum requirement of full threads can be accommodated within the thickness of the material. Where nuts and bolts are used, and the nuts are not readily accessible, a transitional mounting rail shall be used.

716. All studs and terminals of door mounted equipment shall be effectively shrouded to prevent inadvertent contact with live metal when the door is in the open position. All shrouds shall be removable and capable of re-installation.

5.15.4.2. Wiring Duct

717. Control and power wiring shall be concealed in black, closed, slotted PVC duct mounted in a neat and symmetrical manner. The ends of the duct, lids and slots shall have all sharp edges and burrs removed.

718. Enclosed metal wiring ducts shall be provided in the rear of the ACB compartments for routing the CT and supply volts wiring.

5.15.4.3. Mounting Rails

719. Rail mounted equipment if required shall be mounted on $1^{3}/_{8}$" (35mm) aluminium DIN rail.

5.15.4.4. Power Meters

720. Digital power meters shall be installed in the doors of both incomer panels. The meters shall measure the following parameters as a minimum:

a. 3 phase volts
b. 3 phase current
c. Power factor
d. kWh (per clause 5.13.12.3)

5.15.4.5. Current Transformers (CT)

721. Current transformers shall comply with the requirements of ANSI C37.20.1.

722. Current transformers shall be rigidly mounted to prevent any movement during short-circuit conditions. The method of mounting shall be such that any undue pressure on the transformer windings is eliminated.

723. Current transformers shall be mounted in such a way as to allow easy removal and access to the secondary terminals. The rating plate shall be visible without removing any equipment other than enclosure covers or access doors.

724. The primary circuit of current transformers shall form part of the ASSEMBLY wiring or busbar system and shall not rely on the site-connected cables to provide the primary winding.

5.15.4.6. Air Circuit Breakers (ACBs)

725. Withdrawable 1,250 Amp ACBs shall be provided for the Station Supply Transformer incomers and they shall be connected to the Main Bus via 1,600 Amp vertical droppers. A withdrawable 2,500A ACB shall be provided for the Bus Section Breaker. The busbar connecting the Bus Section Breaker shall be rated at 2,500A.

726. IP54 type doorframes supplied with the ACB shall be installed on each ACB compartment door.

727. Arc Shute covers and partitioning fixtures supplied with the ACB shall be installed for each ACB.

728. Copper bars of a rating not less than 1,600 Amps shall be provided on the incoming ACBs for termination of incoming cables. The termination bars shall be adequately dimensioned for mounting of all current transformers and have sufficient area for terminating two 789 kcmil (400mm^2) long palm crimp lugs per phase. A separate termination facility shall be provided on each phase for connecting auxiliary supplies as required.

5.15.4.7. Moulded Case Circuit Breakers (MCCBs)

729. All other incoming and outgoing circuits from the switchboard shall use MCCBs.

730. The MCCB's shall be fitted with operating handles to enable breaker status indication and switching. The operating handles shall be lockable in both the open and closed position.

5.15.4.8. Miniature Circuit Breakers (MCBs)

731. All MCBs shall be installed in accordance with the manufacturer's specification. Where the MCBs have a common supply, they shall be connected to the manufacturer's proprietary bus or comb system. The bus shall be insulated and capped at each end.

732. Bus volt circuit breakers shall be provided in accordance with the drawings and have a ready removable shroud to prevent accidental contact with the circuit breakers' terminals. The bus volt circuit breakers shall have a minimum short circuit rating of 35 kA.

5.15.4.9. Equipment Identification

733. All equipment shall be identified by plastic engraved labels attached adjacent to the appropriate component. A clear, neutral curing silicon adhesive shall secure the labels. Labels shall be positioned as shown on the drawings. In addition, labels whose locations are not shown shall be positioned so that they can be easily read and shall not be obscured by components.

734. The text, colour, size and location of labels shall be in accordance with the specification drawings. In general, with the exemption of warning labels external labels on the generator and station panels shall be black text on a white background, while the external labels on feeder panels shall have white text on a blue background.

735. Internal labels shall be engraved with black text on a white background.

5.15.5. Internal Wiring

5.15.5.1. General

736. All power, control and earth wiring within the ASSEMBLY shall be carried out with V-90 grade 0.6/1.0kV PVC insulated, stranded flexible tinned copper cable.

737. Cables connecting the bus to the bus volt circuit breakers shall be carried out with 1.0kV, double insulated, flexible tinned copper cable and have a short circuit capacity no less than the short circuit rating of the ASSEMBLY. The minimum cross-sectional area of this cable shall be7 AWG (10mm^2). The cables used for this purpose shall not be terminated in the bus compartment but shall be connected to either the vertical droppers or the incoming side of the Generator ACBs as appropriate. Care shall be taken to ensure the route of these cables is of minimum length and that the grouping with other cables is avoided.

5.15.5.2. Wiring Methods

738. Wiring shall be installed in a neat and logical manner and enclosed in PVC ducts with removable clip-on covers. The duct shall be closed slotted.

739. The supplier shall provide details of the duct to be used with their tender.

740. Where ducting is not possible, cables shall be neatly loomed and wrapped with spiral wrapping or other equivalent product and secured to the framework to avoid strain to components and connections.

741. Spiral wrapped cable looms shall also be provided between hinged panels and fixed sections of the framework. The cable looms shall be bunched into small enough groups and be of adequate length so that the doors can be swung without applying any strain on the wiring or the equipment. Each loom shall be anchored to the framework and door appropriately.

742. Power supply wiring shall not be run in the same duct or loom as signal and communication wiring. Internal wiring layout design shall ensure maximum separation between power and signal cabling with particular attention to variable speed drive connections.

743. Control wiring conductors shall be terminated so that there is no exposed live metal at the termination.

744. Control wiring and connections shall be identical for equipment of the same type and current rating to ensure complete interchangeability of demountable equipment.

745. The wiring between terminations shall be point to point with no intermediate links or joints. There shall be appropriate length in wiring to allow for connection to adjacent control devices or neighbouring terminals.

746. Cable ties shall be trimmed with an appropriate tool to ensure all sharp edges are removed.

5.15.5.3. Terminations

747. All power and control wiring shall be terminated with the appropriate size crimp lugs and be crimped with an approved tool.

748. All wiring larger than 10 AWG (6mm^2) shall be terminated with the correctly sized ring type crimp lug where appropriate. In the case where terminations are carried out with bare lugs and or double insulated cables phase identified heat shrink shall be applied to the cable ends and lugs.

749. All tunnel type terminals shall have no more than one cable connected per screw. The looping of connections in tunnel type connections is prohibited.

750. All instrument and control devices shall have a maximum of two cables terminated under one screw.

5.15.5.4. Power Wiring

751. Power wiring shall be rated for the full rating of the circuit breaker concerned at the maximum rated operating temperature of the cubicle irrespective of the rating of the circuit to be connected. The minimum acceptable size for power circuit wiring is 13 AWG (2.5mm^2).

752. All power terminations shall be fully shrouded such that no bare active conductor, including the cable lug, is exposed.

5.15.5.5. CT Wiring

753. The secondary circuit of each current transformer shall be earthed, with provision for removal of the earth connection for testing purposes. The earth connections shall be made in a readily accessible location, preferably at the cubicle earth bar or cable zone. CT secondary circuits shall pass through metering test type terminals. The test type terminals shall be orientated so that if the link becomes loose it closes the connection.

754. The minimum acceptable size for CT wiring is 13 AWG (2.5mm^2).

5.15.5.6. Wiring Identification

755. Both ends of every wire core shall be identified with marking sleeves. The marking system used shall be the Grafoplast, Legrand or equivalent clear plastic sleeve type system designed for the insertion of characters.

756. The sleeves shall be a slide on type correctly sized for the cable dimensions (i.e. sleeves shall be of a size suitable for the diameter of wire used and not be loose on wire). Clip on type sleeves, ferrules and printed sleeves shall not be acceptable. The characters shall be black on a white background.

757. The length of the marking sleeves shall also be kept to a minimum and shall be of a length suitable for the length of the text required.

5.16. General Electrical

5.16.1. DC Supplies

5.16.1.1. General

758. All DC systems shall be replaced including batteries, chargers and DC boards. The designer shall calculate the DC loads for sizing the DC system including additional DC load required by the new 13.8kV switchboard, and all new electrical and mechanical plant.

759. The DC supply voltage is to be chosen to match the equipment installed in the power station including new equipment. Preference is for a single 48 volt DC system supplying a dedicated DC switchboard. If other DC voltages are required (24 & 36V) to supply existing or new equipment, this shall be achieved by using DC/DC converters installed between the main 48 v distribution board and a sub DC board at the reduced voltage.

760. When the power station is running, all DC loads shall be supplied from power supplies to reduce the size of the battery banks and chargers required. The battery banks shall only supply essential ‘standing’ DC loads required to keep the station operational and able to be re-started in the advent of a black station.

761. There shall be redundancy built into the DC systems as they are essential for the operation of the power station.

762. The system shall be designed with alarms/warnings to alert the operator of critical failures in the DC system. These alarms shall be incorporated into the station control and SCADA/HMI system.

5.16.1.2. Power Supplies

763. Power supplies shall be installed to supply the full DC load of the power station when operating.

764. Power supplies shall all have 100% redundancy built into the design. Change over upon loss on one component shall be seamless by using redundancy modules or similar.

5.16.1.3. Station Battery Bank

765. Batteries shall be of the valve regulated lead acid (VRLA) type conforming to UL 1973. Nickel Cadmium batteries shall not be used due to environmental impact on disposal. The battery system shall be designed and installed in accordance with IEEE 1187.

766. Station batteries shall be installed in two separate strings, each string having an individual isolation and protection device. Each string shall be capable of suppling 50% of the 'standing' DC load for a period of 5 hours at the end of the battery design life as per IEEE 485.

767. The battery strings and chargers shall be installed in a separate enclosure constructed with the current MV switch room/cooling room footprint. Consideration should be given to externally venting the battery enclosure to prevent any issues with hydrogen gas build up during charging if required based on battery chemistry.

768. To address OHS risks, batteries shall have a maximum mass of 77 lbs (35kg) and be easily handled as a two-person lift, with the aid of an appropriate lifting device.

5.16.1.4. Station Battery Chargers

769. The battery charger shall be suitable for providing supply to a load while sharing the load with another battery charger, with or without battery connected. Chargers shall be designed for natural convection cooling and be constructed without cooling fans.

770. Battery chargers shall be designed to maintain the station batteries at full charge during operation of the power station. There shall be at least two battery chargers installed to ensure continued DC supply in the advent of a charger failure. Change over upon loss on one component shall be seamless by using redundancy modules or similar. The battery chargers shall be rated to supply both battery strings.

771. The charge voltage and current shall be displayed on the front panel of the battery charger, preferably on square analogue instruments.

5.16.1.5. DC Distribution Boards

772. The DC board/s shall be located adjacent to the battery systems. Due to the length of cabling it may be more suitable to install sub boards for the DC system. One example of this is the DC supply to the control boards may be better positioned adjacent to the control panels.

5.16.1.6. Generator Start Batteries

773. If gensets use electric starting, each genset shall have its own battery bank to allow the starting of the engine. The voltage of the battery bank will be dependent on the engine selected but shall be no higher than 48 VDC. The size of the battery bank shall be determined based on the genset manufacturer recommendations.

774. The batteries shall be located as close as possible to the engine. The battery type selected shall be suitable for operation in the location that they are installed. The batteries shall be contained within an enclosure to protect the batteries from damage and to reduce

the impact of any battery explosions. The enclosure shall be adequately ventilated to ensure there is no build-up of dangerous gases within the enclosure.

5.16.1.7. Generator Start Battery Chargers

775. There shall not be redundancy built into the installation of the genset start battery chargers.

776. The genset start battery chargers shall be suitable for charging a battery with a load connected in parallel. Each battery charger shall display charging volts and current.

5.16.2. AC Supplies

5.16.2.1. Station Supply Transformers

777. Station supply transformer No. 1 shall be replaced with a nominally rated at 500kVA. The final size of the transformer shall be determined by the Contractor based on calculated load on the Station Auxiliary Switchboard. The transformer shall be able to meet the load of the final power station arrangement with a 20% allowance for future load.

778. The transformer shall be a 13.8kV / 480V Dyn11 transformer and shall have a minimum of 5 tap positions with steps of +/- 2.5%. The transformer shall remain in the current location. Connection to the MV bus shall be via a RMU located within the earthing transformer pad mount cubicle (see section 5.16.3.3).

5.16.2.2. AC Distribution

779. The power station AC services shall be provided at 277/480V from the Station Supply Transformers via the Station Auxiliary Switchboard. AC power shall be distributed via distribution boards that shall be installed as necessary throughout the power station to supply auxiliary and ancillary loads.

780. All new distribution boards shall be in accordance with IEEE C37.20.1.

781. Existing motor control centres or distribution boards that are dedicated for supply of auxiliaries for the existing gensets shall not be replaced as part of these works.

782. Existing distribution boards supplying ancillary services shall be upgraded/replaced as required. This shall include but not limited:

a. Ventilation distribution board
b. Workshop distribution board
c. Lighting and power distribution boards (3 off)
d. RFO Module / Waste treatment distribution board

783. If power station equipment is required to be supplied at a different voltage, dry type transformers (or approved equivalent equipment) shall be used and located adjacent to the corresponding distribution board. All existing 480V / 208V dry type transformers shall not be re-used.

784. All 277/480V distribution boards located on the wall between the existing MV switchroom and the utility room shall be replaced by incorporating into the new Station

Auxiliary Switchboard. The 120/208V distribution boards supplied via a dry type 480V / 208V transformers shall also be replaced.

5.16.2.3. Lighting and Power Equipment

785. The light and power circuits and fittings shall be upgraded throughout the power station. This shall include replacement of light fittings and power sockets as required. The Contractor shall liaise with the Principal to determine the extent of the work required. The Contractor shall provide a Provisional Cost for this work.

786. The Principal prefers that all lighting circuits and equipment is supplied at 120/208V. If suitable light fittings are not available at this voltage, some light circuits may be supplied at 277/480V (e.g. high bay lighting). The light fittings chosen shall consider the requirement to minimise parasitic load on the station. All power circuits shall be supplied at 120/208V.

787. The lighting and power fittings shall be suitable for the environment that they are installed and shall be rated at a suitable IP rating.

788. The lighting systems shall be designed to ensure there is adequate lighting in each section of the power station to suit the environment and the tasks expected to be undertaken. The lighting shall also include emergency lighting that will illuminate in the advent of a 'black station' event. The emergency lighting levels required in the genset hall shall only be suitable to allow power station staff to navigate safely through the genset hall. Emergency lighting in the MV Switchroom and Control Room shall be suitable to allow power station staff to operate the switchgear and control gear. All emergency lighting shall be installed at locations that allow testing and servicing to be done without the requirement for elevated work platforms or similar.

789. Power sockets shall be installed in various locations throughout the power station to enable the use of portable electrical equipment.

790. Air-conditioning plant shall be supplied at 120/208V.

5.16.2.4. Black Start Genset (Option)

791. The existing black start genset is rated at 125 kVA at 480 volts. The genset is in good condition and replacement is not required under this Contract.

792. The existing black start genset is started and stopped manually by power station staff. The Principal may require the existing black start genset to be re-configured to be automatic start.

793. The existing control system on the black start genset is a Thompson Technology MEC 20. The Contractor shall provide alternative pricing to upgrade the control system on black start genset and the station auxiliary switchboard to facilitate automatic starting of the black start genset to reinstate power to the essential supply switchboard in the event of a 'station black' event.

5.16.3. Earthing

5.16.3.1. General

794. The earthing design for the existing and new primary plant is to be reviewed in accordance with IEEE 80:2000 – IEEE Guide for Safety in AC Substation Grounding.

795. The Contractor shall implement any changes required to bring the earthing system up to the required standards as detailed in IEEE 80:2000. This shall include installation of all necessary earthing conductors to all new and existing plant.

5.16.3.2. Neutral Earthing Scheme

796. The earthing system of the existing gensets consists of connecting a single neutral resistor to one of the gensets via manually operated switches.

797. The new earthing system to be deployed for PS1 is to install high impedance earthing on each new generator and low impedance on the main bus. Details of the proposed earthing system can be found in 'Grounding and ground fault protection of multiple generator installations on medium-voltage industrial and commercial systems-Part 2: Grounding Methods Working Group report' which can be obtained through IEEE.

798. A protection CT shall be installed in the genset HV neutral for each new genset and existing genset 5 for differential protection.

799. Each new genset and existing genset 5 shall have a neutral earthing transformer with a low voltage resistor installed. It shall have a VT attached to the LV resistor and connected to the unit generator protection and the LV resistor shall also have a neutral displacement CT placed in series with it whose secondary is also wired to the generator unit protection relay.

800. The high impedance earthing system for each generator shall be designed according to IEEE C37.101 'Guide for AC Generator Ground Protection'.

801. The new low impedance earth system to be connected to the station bus shall consist of a zig zag winding transformer which creates an earth fault current path similar to what the existing low impedance generator resistor presents.

5.16.3.3. Earthing Transformers

802. Low Impedance transformers with zig zag windings shall be installed to provide an earth fault current path. Two (2) earthing transformers shall be connected, one to Bus A and the other to Bus B using the circuit breakers for the Station Supply Transformers. The earthing transformers shall be pad mounted in an enclosure with a 2 switch, 1 fuse Ring Main Unit (RMU). The fuse switch in the RMU shall supply the corresponding Station Supply Transformer.

803. The enclosure for the padmount shall be suitable for installation externally in a marine environment and shall be constructed of stainless steel. The earthing transformers shall be located adjacent to the existing Station Supply Transformers as shown on drawing A0285-E-310.

5.16.3.4. Design Considerations

Earth fault currents

804. Prospective earth fault current for sizing earth grid conductors shall be deemed to be 25kA for 1 second.

Fault durations

805. Fault clearing time of primary earth fault protection shall be 0.5s. Fault clearing time of backup earth fault protection shall be 1.0s. Duration for equipment earthing connection and earth grid conductor sizing shall be 1.0s

Earthing installation

806. Earthing conductors and connectors shall comply with IEEE 80 and IEEE 81 standards. The designer shall calculate and specify the correct earthing conductor risers for connection of the new equipment to the existing earth grid.

Earth Testing

807. The earthing system shall be tested using appropriate tests to verify the existing earth resistance and connectivity prior to energisation of the MV switchboard.

5.16.4. Electrical Installation

The electrical installation shall be in accordance with NEC 2017 and the Specification. Where the NEC 2017 requirements exceed the Specification, the NEC 2017 requirements shall be met.

5.16.4.1. Cabling and Wiring

Handling and Pulling

808. Upon delivery of the cable drums, they shall be visually inspected for damage incurred during transport or storage. The seal on the inner and outer cable end shall be examined and the condition of armouring, serving or sheath inspected for damage, corrosion or leakage of impregnating oil. Any damage discovered shall be reported to the Principal.

809. During installation cables shall be handled with due care. When pulling cables, any winch used shall have automatic tension limiters and the tension shall not exceed that specified by the manufacturers for the particular cable and conditions of installation. Winching ropes shall be attached to the cable armour with steel mesh sleeves and care shall be taken that cable sheaths are not damaged in any way.

810. When laying or snaking the cable, no twists or kinks shall be allowed to occur. Throughout the installation, twisted, kinked, knotted or crossed cables shall not be permitted in any enclosure. Runs shall be neat and workmanlike in appearance. All cabling

shall be laid in neat bundles secured by cable ties such that cables are easily traceable along cable routes.

811. When drawing cable into conduits only chalk type or other approved lubricants not injurious to PVC sheathing may be used. Petroleum based substances such as grease or oil are not permitted.

812. When rollers are used during installation, sufficient units shall be emplaced to keep the cable clear of ground and other obstructions. Vertical rollers shall be used at all changes of direction.

813. Cables shall not be bent to a radius less than that recommended by the manufacturer.

814. Should any damage occur to any part of a cable during handling or installation, the Principal shall be informed, and work shall only proceed after their inspection and authorisation to continue has been given.

Support and Protection

815. Cables shall be continuously supported along their entire length to the approval of the Principal. Cables other than those enclosed in conduit or on ladder under the control room floor shall be tied at 8” (200mm) intervals.

816. Where not installed on cable rack or tray, cables shall be enclosed by conduit or clipped by cable clamps to Unistrut channels. Channels shall be of sufficient width to accommodate all cables in the run plus a 20% spare capacity.

817. Structural steelwork shall not be drilled, welded or cut to facilitate cable installation without the Principal’s written permission.

818. The use of nails for support of cables or cable supports is not acceptable.

Cable Slack

819. Normal slack shall be provided at termination wiring boxes and equipment to facilitate servicing and re-terminating without disconnection. This particularly includes float switches and equipment installed at heights when require cable slack for safe access. (which must have sufficient slack to reach the floor).

820. Main cables in the switchroom should also be laid neatly with ample slack for servicing and re terminating. All cabling shall be laid in neat bundles secured by cable ties such that cables are easily traceable along cable routes.

Cut offs and Jointing

821. During installation, all cables shall be cut from drums in such a manner that cut-offs are a minimum and any surplus cable remaining is in a single length.

822. Cables shall be installed in continuous lengths.

Sealing

823. Cables shall be sealed after cutting in a suitable and approved manner. During construction all cables should be protected from the weather.

Single Core Cables

824. Single core cables forming part of a three-phase system shall be clamped together in trefoil over their entire route to avoid de-rating. For parallel trefoil circuits the phase arrangement in one current will be a lateral mirror image of the phase arrangement of the second circuit.

825. The clamping of single core cables in trefoil shall be of sufficient mechanical strength to withstand the forces generated by fault currents.

826. Single core cables will not be run in a manner resulting in hysteresis and eddy currents in surrounding metal work or cleating.

5.16.4.2. Terminations

827. All cables shall be installed and terminated using fittings appropriate to the situation. The unsheathed part of multicore cables shall be neatly laced with cable ties or other means approved by the Principal.

828. Where screened signal wires are specified, screening shall be continuous from the signal source to the receiver. Earthing of the screen shall be at the main switchboard end only and shall be achieved by connection to the appropriate earth busbar. Clear heat shrink shall be used on screens of all shielded cables.

5.16.4.3. Cable Glands

829. Where possible all glanding shall be into the bottom of the enclosure. Cable glands shall be of an approved weatherproof type similar in style and quality to ALCO WG series. PVC weatherproof shrouds shall be provided and fitted for glands mounted outdoors or in readily visible areas. The shrouds shall be Alco ‘SG’ type or approved equivalent.

830. All gland plates shall be drilled to the sizes required by the cable gland. The gland sizes shall conform, for each cable size, to the manufacturer’s recommendations. Brass glands shall not be used in aluminium alloy boxes as fittings.

831. Where it is required that PVC cables be connected to equipment that is too small to accommodate the gland, or if permanent wiring is provided with equipment (e.g. solenoid valves), then cables shall be terminated in a conveniently located two-way junction box. The connection to the equipment from the junction box shall be made using flexible PVC coated metal conduit and approved fittings.

5.16.4.4. Cable Terminals

832. All terminations shall be made using pre-insulated crimp lugs. On larger cables where this is not practicable, colour coded heat shrink shall be used on uninsulated crimp lugs. Black heat shrink socks/gaiters shall be used on all shielded or screened cables. Crimp lugs shall be crimped with an approved crimp tool. Where hand operated crimping tools are used, the tools shall be of the type which will not release until full compression is applied. Hexagonal crimping dies shall be used on all cables of 5 AWG (16 mm^2) cross section and above.

833. Lugs shall be tinned copper and flexible power cables shall use bell mouth type.

834. Suitable full-sized bolts shall be used for the connection of lugs onto equipment terminals. Where lug holes are not big enough for the size of bolt being used, copper flags shall be provided and fitted.

835. Wire stripping shall be performed using an approved wire stripper. The wire shall be stripped to an extent that prevents the covering entering the terminal connection or crimping lug but does not allow the protrusion of bare wire from the terminal block or lug.

836. No more than one wire shall be connected to one side of any terminal unless approved by the Principal. Bridging for common terminals shall be via central type shorting links and not comb type bridging. The correct size and type of screwdriver shall be used for making terminal block connections.

837. Terminal strips shall be provided within enclosures and equipment for control cable terminations. Terminals shall be Telemecanique AB1-VV or equivalent.

838. Terminal strips shall be provided with the number of terminals required on the drawings plus 25% spare rail capacity.

839. Where control cables and power cables (above 50 V D.C.) are connected to terminal strips in the same enclosure approved protective covers and warning labels shall be installed over power connections.

840. Each terminal shall be identified with a number in accordance with the drawings using permanent clip-on non-flammable terminal markers with black characters on a white background.

5.16.4.5. Cable Ferrules

841. The cores of all cables shall be continuity checked and numbered with white engraved ferrules with black numbers to correspond to the relevant termination diagrams and equipment drawings. Wrap around adhesive markers will not be acceptable. The Contractor shall ensure that the component numbers of the identifier are aligned and that the identifier is clearly visible.

842. Ferrules shall be of a type which will not slip off the ends of the cables and shall interlock to ensure that the numbers remain tightly together. Saddle type ferrules are not acceptable. The type of ferrule shall be approved by the Principal. All cable ferrules shall be of the minimum length required to mark the cable. Ferrules with excessive length will be rejected.

843. The overall cable shall also be labelled with approved tags and identifying references.

5.16.4.6. Cable Ladder, Tray and Duct

844. Cable trays, ladder racks and troughing shall comply NEMA VE 1 and NEC 2107. Cables shall, where possible, shall be run on cable ladder racks or trays of ample width to accommodate the cables specified with a 20% allowance for future cabling.

845. Where cables may be subject to mechanical damage ladder racks and trays shall be fitted with approved covers.

846. The use of ducting shall be minimised. Where cable is run within ducting, the duct shall not be overloaded. The easy removal of a single wire or cable shall be considered to be the limiting criterion.

847. All cables shall be tied at suitable intervals.

848. Multi-core power cables laid in racks or trays shall be in a single layer and shall be spaced not less than $^{1}/_{2}$" (12mm) apart unless specified elsewhere in this specification, (to allow free ventilation).

849. All cable ladder, tray and duct and associated fish plates, bends, tee pieces etc shall be hot dip galvanised after fabrication and shall be free of burrs or projects to prevent cable damage.

850. Minimum thickness of duct shall be $^{5}/_{64}$" (2mm).

851. All tray bends, both horizontal and vertical shall have a minimum radius of 18" (450mm) for power and control cables unless otherwise stated.

852. All nuts and bolts required for the installation of the ladder, tray and duct sections shall be hot dip galvanised steel.

853. Cables shall be fixed to sloping and vertical runs of cable ladder rack by saddles, clamps or nylon cable ties.

854. Rack sections shall be bolted together, and bolts shall not protrude into the rack section which may damage cables during installation.

855. Because of the range of temperatures and length of runs required for some sections of cable supports, it is required that provision be made for expansion and contraction of the tray or ladder, to prevent buckling and distortion. Sliding joints shall be so constructed that abrasion of the mating surfaces does not cause removal of the anti-corrosion coating and suitable facilities for preserving earth continuity shall be made at each sliding joint or gap. Care should be taken to ensure that cables are not fastened to the tray or ladder in such a way that the cable is stressed during movement of the steel work.

856. Where it is necessary to cut or weld cable ladder racks, the exposed metal shall be treated with anti-corrosion coating approved by the Principal.

857. Cable ladder rack routes shall be bonded to the earth grid via 5/8" (16mm) green/yellow PVC covered cable at each end of the run, at the nearest available switchroom earth.

858. Cables shall be spaced on racks to avoid build-up of material during normal operation.

859. Easily accessible peaked covers shall be fitted to ladder, tray and duct, subject to direct sunlight or prone to build up of dust or materials.

860. Where covers are fitted, they shall be clamped to the ladder, tray and duct by means approved by the Principal.

861. Cable ladder racks shall be mounted to maintain 12" (300mm) clearance between racks vertically and at least 6" (150mm) under structural sections.

862. Cable racks shall be installed to maintain a minimum head clearance of 83" (2100mm).

863. Subsidiary cable trays additional to cable ladder racks shall be installed where required to give adequate support to cables. Minimum thickness of cable trays shall be as approved by the Principal.

864. Brackets and supports shall be of hot dipped galvanised steel entirely suitable for the application. Hot dipped galvanised P1000 Unistrut or equivalent will be acceptable. All brackets and fixing shall be jig drilled and designed to allow the rapid interchange of identical equipment.

865. Approved insulating separators shall be installed between the aluminium ladder, tray or duct and steel supports or any other dissimilar metals interface and shall have a minimum thickness of 1/8" (3mm).

5.16.4.7. Framework Protection

866. Frames supporting equipment shall be finished with due regard to the operating conditions. Frames exposed to the weather or other corrosive environments shall be closed section, sealed welded and hot dip galvanised.

867. Fastenings (bolts, nuts, screws, clips, washers, rivets, etc) used shall have a corrosive resistance equivalent to the metal or alloy so that they are not preferentially corroded. Brass, monel metal and stainless steel will generally be accepted. Hot dip galvanised may be accepted where the surface coating would not be damaged. Carbon steel spring clips and self-tapping screws shall not be used or approved.

868. The Contractor shall repair all defective or damaged coatings as soon as possible to avoid deterioration of the base metal. The surface shall be restored to be in accordance with the treatment originally specified.

5.16.4.8. Conduit and Ducting

Conduits – General

869. Except where nominated otherwise noted in the clause “Wiring and Cabling” conduits shall be of minimum size $^{3}/_{4}$” (20mm) diameter. Conduits to be run so as to enable cables to be drawn-in after erection. Sufficient accessible junction boxes shall be used for this purpose.

870. All equipment connected with conduit shall be readily removable without unfastening the conduit.

871. Except when used in accessible surface runs of conduit to facilitate the running of such conduits around beams and other exposed structural members, inspection fittings are not acceptable as draw-in point.

872. During installation, the ends of conduits shall be temporarily plugged to prevent the ingress of dirt. Before cables are installed all conduit ends shall be neatly trimmed. After cable installation all conduit ends shall be sealed top prevent moisture and vermin entry using an expanded foam plug with a 1” to 2” (25 to 50mm) capping of weak mix sand and cement. Where a single cable is installed in a conduit it shall be sealed using a proprietary gland / plug.

873. Where junction boxes are exposed to weather, the lids shall be sealed with an approved gasket. The boxes shall be of ample size to enable the cables to be neatly diverted from one conduit to another without undue cramping.

Conduits – Surface Run

874. Conduits shall be neatly run and securely fastened by means of approved saddles. Saddles shall be provided within 6” (150mm) of all fittings or terminations.

875. The direction of conduit run shall be parallel to the walls, floors and ceilings wherever practicable.

876. Conduit shall be installed so as to avoid all mechanical duct systems and other pipe systems and services and shall in all cases be at least 3” (75mm) from coolant pipes and at least 20” (500mm) from exhaust pipework.

877. The Contractor shall be responsible for the true horizontal or vertical installation of all boxes and fittings.

878. Surface conduits shall be run so as to be as inconspicuous as possible by running in corners and the like. The route of all surface conduits must be discussed with the Principal before installation is commenced.

Metal Conduit

879. All metallic conduits shall be aluminium and manufactured in accordance with ANSI C80.5. Installation shall be in accordance with NEC 2017.

880. All burrs shall be removed from ends and screwed bushes shall be fitted to the ends of conduit rungs.

881. All conduits shall be straight, free from rust and scale and any sets shall be made cold in such a manner as not to distort the walls of the conduits.

882. No threads shall be visible after erection other than running joints. Running threads shall be thoroughly painted with zinc-rich primer.

883. Conduits shall be supported not more than 6’ (1800mm) apart using proprietary metal saddles, such as to hold the conduits in position without sagging.

884. Pressed metal boxes shall be used for flush wall mounting light switches, general purpose outlets, telephone outlets and the like. Boxes shall have adjustable threaded fixing devices to permit flush mounting of the cover plate.

UPVC Conduit

885. All rigid uPVC conduit and fittings shall be manufactured in accordance with NEMA TC-2, TC-3, TC-6 and TC-9. Installation shall be in accordance with NEC 2017.

886. All joints shall be cemented with an approved cement after cleaning with recommended solvent. Fittings all to be of rigid uPVC. Screwed fittings shall not be used.

887. Conduits and fittings damaged during installation or delivery will be condemned and shall be removed from site.

888. UPVC conduit shall be securely fastened with proprietary uPVC saddles at a maximum spacing of 20” (500mm). Where necessary to eliminate sagging in the conduit additional saddles shall be provided. Where uPVC conduit is installed across rafters or joists in roof spaces it shall be fastened to the side of a timber batten. Saddles shall be fitted within 6” (150mm) of all fittings and terminations.

889. Where any straight section of rigid uPVC conduit exceeds 13’ (4000mm) in length an approved expansion joint shall be provided for each 13’ (4000mm) or part thereof along the entire length of the straight section.

890. All sets and bends in rigid uPVC conduit shall be made using internal springs of correct size to prevent wall collapse. Conduits in which any collapse of walls is evident will be condemned.

891. Precautions shall be taken during construction to protect the conduits from damage or movement from position by equipment being used by the contractor.

Flexible Conduit

892. Fully screened, flexible metallic conduit (Anaconda or equal) shall be used in minimum lengths for connections to individual items of plant, e.g. motors.

5.16.4.9. Underground Installation

893. Where cables are required to be run underground, they shall be installed in conduit.

Trenching

894. All trenches, unless otherwise directed by the Principal, shall be excavated in ground as found along the line and to the depths and widths shown on the drawings.

895. The line of the trench must be kept perfectly straight and parallel to the planned alignment. The bottom must be kept level across the trench and the sides as near the vertical as is practicable. Any cavities in the bottom of the trench must be filled with selected sand, properly compacted to the proper grade.

896. The contractor shall take care to erect shoring as necessary to effectively prevent the sides of the trench from running or falling into the excavation and to keep trenches free from water during all cable laying operations.

897. Spoil from the trench excavation not required for backfill in the trench shall be mounded above the backfilled trench.

898. Traffic flow along roadways shall be maintained at all times. Where traffic must cross open trenches, suitable bridging shall be provided by the Contractor.

899. Where trenches are to be excavated across roads, the Contractor shall ensure that the road pavement material is kept separate from other excavated material to allow for same being easily replaced after backfilling. If this is not done, the Contractor shall provide the same consolidated depth of pavement material of the same quality as previously existed, compacted to the same density as surrounding material.

900. The Contractor shall take every precaution that is necessary for the protection from injury of all existing drain pipes, electric and telephone conduits and other existing works and services wherever met with, or which are adjacent to the work, and to avoid damaging such drains, conduits or service connections or any fittings attached thereto.

Maintenance of Trenches Before Cabling Laying

901. The Contractor shall be held responsible for the keeping clean and the maintenance of the trenches in good order and condition between the time of excavation and laying and shall obtain the Principal’s approval before commencing to lay cables.

902. The Contractor at their own expense shall carry out all measures to divert any water interfering with the progress of the works, keep the trenches and excavations free from water while the works are in progress, and prevent any injury to the works by water due to floods or other causes.

903. The Contractor shall have proper and approved pumping equipment for keeping the trenches and excavations free from water while the works are in progress.

Installation

904. All cables shall be installed in the presence of the Principal or their representative and the contractor shall give a minimum of 24-hours' notice of their intention to pull the cables. Any cables not so installed may be required to be excavated and re-laid.

905. After the excavation has been completed and approved the trench shall be cleared of all sharp objects and a foundation layer of bedding sand shall be placed. The depth of bedding sand shall be such that after the cable or duct is laid, the minimum depth of bedding between the underside of the cable or duct and the trench floor is 2" (50mm). The sand shall comply with the requirements below.

906. Cable drums shall be arranged so that the cable is always pulled from the top of the drum using suitable shotters, hooks or come-alongs and a swivel to prevent damage to the cable. The cable shall be pulled just fast enough to keep the drum rotating smoothly and sudden stopping shall be avoided. When pulling cables into trenches, rollers shall be spaced to prevent the cable dragging on the ground. At bends an assembly of rollers and skids or rollers and angle rollers shall be used, and the cable shall not be bent to less than 15 times OD.

907. All changes in direction or grade shall be in easy stages.

908. On completion of a run the pulling equipment shall be removed from the cable and the end re-sealed.

909. Before backfilling, draw wires shall be re-installed in the ducts and the ends sealed with a non-setting mastic compound. Any caps or draw wires in spare ducts, which may have been disturbed, shall be reinstated.

910. After witnessing the cable installation, the Principal will authorise the backfilling of the trench.

Backfill

911. A layer of sand or clean soil free from any hard sharp or abrasive material such as rocks or stones, shall be laid over the cables with a minimum cover of 2" (50mm). The minimum depth of sand including bedding shall be 6" (150mm).

912. The Principal may allow excavated material to be used for this purpose provided the material has the following qualities.

- be capable of being shaped to form a uniform support for the cable
- pass a $^{3}/_{8}$" (10mm) sieve
- have a liquid limit not exceeding 25%
- have a plasticity index not exceeding 6%

913. General backfill may comprise the excavated soil or imported soil or sand provided that any material in the soil will pass through a 2" (50mm) screen.

914. Backfill is required to refill the full width of trench above the level specified for sand surround, back to natural surface level. Cable slabs and marker tape shall be incorporated, during backfilling.

915. The compaction of the backfilling shall be to a density not less than the density of the existing adjacent material and to the entire satisfaction of the Principal. Backfilling shall be carefully placed in layers not exceeding 6” (150mm), well-watered if necessary, then tamped and compacted with mechanical rammers.

916. All backfill within 12” (300mm) of the cables/conduits shall be treated with a termiticide (FMC Biflex or equal) to the manufacturer’s recommendations if deemed necessary by the Principal.

917. The surface shall be reinstated to the original level and finish (i.e. paving, landscaping, etc.) to the satisfaction of the Principal.

Cable Protection and Marking

918. Mechanical protection of underground cables shall be in accordance with NEC 2017.

919. Orange PVC marker tapes 3” (75) wide and $^{3}/_{64}$” (1mm) thick (Brady Identoline UT series or equivalent), shall be laid in the trench directly above the cables at a depth of at least 12” (300mm) above the cable. The tape shall be marked with the warning “CAUTION - BURIED ELECTRIC LINE VOLTS” in black letters which shall not fade.

920. Underground cable route markers shall be installed at every change of direction of cable and on straight runs at least every 100’ (30 metres).

921. Markers shall identify the cable and indicate its direction of lay as indicated on the drawings.

5.16.4.10. Cables and Wiring

922. All cabling and wiring shall be supplied and installed in accordance with the applicable standards noted elsewhere in this Specification, in particular NEC 2017 with due consideration of the elevated power house temperatures.

923. Segregation shall be provided between power and control cabling by the use of separate enclosures. Where it is not possible to use separate enclosures power and control cables shall be separated as much as possible (i.e. on opposite side of the ladder) with a minimum spacing of 4” (100mm). For power cables to and from variable speed drives this minimum separation shall be 12” (300mm) from control cables and 4” (100mm) from other power cables. Minimum separation between different control cables (discrete and analogue) to be 2” (50mm).

924. Wiring shall be of the size required by the NEC 2017 for the actual circuit loading, or as specified. Minimum size shall be:

- Lighting 15 AWG (1.5 mm^2)
- Control 15 AWG (1.5 mm^2)

- Power 13 AWG (2.5 mm^2)

925. Where motors are subject to vibration, care shall be taken to prevent vibration damage to cables.

926. All cables are to be terminated in pre-insulated crimped lugs or pin terminations. Final connections to instruments and similar equipment which is withdrawable from its mounting shall be made with flex entries in PVC double insulated flex not less than 32/24 AWG (32/0.2 mm^2). Sufficient flex, neatly strapped, shall be provided to permit easy withdrawal of equipment.

927. All conductors shall be stranded copper unless noted otherwise on the drawings. All cabling to be circular and double insulated with black sheath where exposed to sunlight.

928. All controls cables shall be screened as indicated in the drawings or schedules. All power cables shall be double insulated and rated 0.6/1kV.

929. Colour coding for phase identification shall be in accordance with local practices.

5.17. Testing and Commissioning

5.17.1. General

930. The Contractor shall be responsible for all testing and commissioning. Testing and commissioning during the Contract is intended to achieve the following specific objectives:

a. Verify that equipment is manufactured correctly and meets the Specification and manufacturer's designs.

b. Verify that equipment and systems are installed according to the Specification, manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checks.

c. Verify that performance of equipment and systems is in accordance with the Specification and Detailed Design.

5.17.2. Commissioning Plan

931. The Contractor shall develop and fully document a comprehensive commissioning plan. This plan shall include all test procedures, test equipment lists, Inspection and Test Plans (ITP's), commissioning schedules and any other documentation required to ensure the effective testing and commissioning of all equipment and systems. This shall include the recommissioning of any existing plant within PS1.

932. All ITP's shall be based on original equipment manufacturers' recommendations and developed in accordance with prudent industry standards

933. The commissioning plan shall include all phases of the testing and commissioning process as detailed below.

934. The commissioning plan shall be submitted to the Principal for approval prior to any testing being undertaken. The Principal shall have the right to make commercially reasonable comments to the Commissioning Plan by written notice to the Contractor.

935. The Principal shall have the right to observe, and, to the extent reasonable, participate in testing and commissioning activities. Unless specified elsewhere in the Specification, the Contractor shall provide the Principal 14 days' notice prior to testing being undertaken.

5.17.3. Testing / Commissioning Phases

5.17.3.1. Factory Acceptance Testing (FAT)

936. This testing shall be done in manufacturers works or an approved test facility prior to being shipped to site.

937. As a minimum, the FAT shall be as detailed in the relevant clauses of the Specification. Any other tests required to ensure equipment meets the design requirements shall also be undertaken.

5.17.3.2. Site Acceptance Testing (SAT)

938. The SAT shall include testing of individual components/equipment after it has been installed on site. This testing shall include functional tests to ensure the equipment is operating as designed.

939. As a minimum, the SAT shall be as detailed in the Specification. Any other tests required to ensure equipment is as designed shall also be undertaken.

5.17.3.3. System Integration Testing (SIT)

940. The SIT shall include all testing required to ensure all equipment and systems installed are integrated together and operate as per the design.

941. Each system shall be operated through all modes of operation (e.g. seasonal, warm-up, cool- down, part- and full-load) to ensure the specified system response is achieved.

5.17.4. Non-conformances

942. Any equipment and systems that fail any testing shall be repaired or replaced at the Contractors expense.

943. Any costs for subsequent retesting of equipment and systems will be met by the Contractor.

5.17.5. Test procedures

944. The Contractor is responsible for all test procedures. The procedures shall be developed to ensure safety of people, plant and maintaining supply to the community during the commissioning process.

5.17.6. Test Equipment

945. All test equipment required to perform the required testing and commissioning shall be provided by the Contractor.

946. All test equipment shall be of sufficient quality and accuracy to test and/or measure system performance. All test equipment shall be calibrated. Calibration certificates shall be made available to the Principal prior to testing being undertaken.

5.18. Packaging and Transport

947. The primary freight mechanism to Majuro for large items is sea freight with airfreight also available. All equipment shall be shipped below decks or if shipped above decks shall be in fully sealed containers.

948. Any equipment shall be carefully packed and secured for transport to protect it from dust, water and salt laden air during loading, transport, unloading and subsequent storage in the open. All equipment shall be suitably packed and protected against vibration, movement and shock which may occur during loading and transport. Particular care in packing shall be taken when the equipment is transported by sea freight and during unloading.

949. Heavy and bulky equipment shall be provided with adequate lifting fixtures to facilitate ready handling during transit and on arrival at site.

950. Instruments, relays and fragile items shall be packed separately. All items which include delicate equipment shall be sealed in polythene sheeting and silica gel desiccant or vapour corrosion preventive shall be inserted within the polythene packing.

951. All crates containing timber shall be certified as free from insect infestation.

952. Precautions shall be taken in the packaging of all machines that have ball and/or roller bearings so as to minimise the risk of damage to the bearings. Any bearing found with "brinelling" marks shall be replaced by Contractor at their cost.

953. Special precautions shall be taken to protect journals where they rest on supports during transport. At such points, anti-corrosion fluid impregnated wrappings shall be used to protect the journals during transport.

954. The Contractor shall be responsible for any damages and malfunctions to any equipment that may arise from handling or transport.

Appendix 1 – MEC Diesel fuel Standard

Fuel Supplier is required to meet this specification

MARSHALLS ENERGY COMPANY INC.

SPECIFICATION FOR AUTOMOTIVE DIESEL OIL (Max.0.5% ADO)

Property	Test Method	Units	Min.	Max.
Ash	ASTM D482	Wt%		0.01
Carbon Residue on 10% btm	ASTM D4530/D189	Wt%		0.16
Cetane Index	ASTM D976	-	48	
Cloud Point	ASTM D2500/D5771/D5773	deg C.		15
Color	ASTM D1500	-		3.0
Copper Corrosion (3hrs@100°C)	AS1M D130	-		2
Density @ 15°C kg/l	ASTM D4052/D1298	Kg/l	0.810	0.860
API Gravity @ 15.6°C	ASTM D4052/D1298	API	32	42
Dist. 50% Recovered	ASTM D86	°C		
Dist. 90% Recovered	ASTM D86	°C		370
Flash Point	ASTM D93	°C	66	
Pour Point	ASTM D97mod/D5950/D5949	°C		10
Strong Acid No.	ASTM D974	mgKOH/g	NIL	
Total Acid No.	ASTM D974/D665	mgKOH/g		0.25
Sulfur	ASTM D4294/D2622	Wt%		0.5
Viscosity @ 40°C	ASTM D445	cst	1.9	5.5
Water and Sediment in Distillate	ASTM D2709	Vol%		0.05

NOTES.

1. Tests conducted according to ASTM/IP/UOP etc. Standard test methods are routinely verified to be in compliance with latest published versions. Minor changes may be made where they have no material impact on Test results and are necessitated by reasons such as safety, environmental standards, and method effectiveness. Method with changes will be reflected as XXXXXmod in the certificate.
2. For purposes of reporting (except density) and determining conformance with this specification, an observed value or a calculated value shall be rounded "to the nearest unit" in the last right hand significant digit used in expressing the limiting value, in accordance with the rounding off method or practice AS1M E29, using Significant digits in Test Data to determine conformance with Specifications.
3. The latest test methods are to be used unless specified.

Effective September 2005.

Appendix 2 - Example Power and Fuel Rating Factor ISO Calculations

Ref: ISO 3046.1, Section 10.3 Power Adjustment for Ambient Conditions.

EXAMPLE Turbocharged, Intercooled Engines

Reference Conditions		Site Conditions	
$.T_r$	= 298 ^{0}K (25 ^{0}C)	$.T_x$	= 318 K (45^0)
$.T_{cr}$	= 298 ^{0}K (25 ^{0}C)	$.T_{cx}$	= 318 K (45^0)
$.p_r$	= 100 kPa	$.p_x$	= 100.8 kPa
$.\phi_r$	= 0.3	$.\phi_x$	= 0.80

Assume: η_m = 0.80 (ISO 3046)

From Table ISO 3046.1 Table 2, for Formula Reference D: a = 0, m = 0.7, n = 1.2, s = 1

From Formula (3):

$$k = \left(\frac{p_x - a\Phi_x p_{sx}}{p_r - a\Phi_r p_{sr}} \right)^m \left(\frac{T_r}{T_x} \right)^n \left(\frac{T_{cr}}{T_{cx}} \right)^s$$

$$k = \left(\frac{100.8 - 0\Phi_x p_{sx}}{100 - 0\Phi_r p_{sr}} \right)^{0.7} \left(\frac{298}{318} \right)^{1.2} \left(\frac{298}{318} \right)^{1}$$

k = 0.872

From ANNEX B4, for k = 0.872 and η_m = 0.80:

B = 1.027

From ANNEX B5, for k = 0.872 and η_m = 0.80:

A = 0.849

i.e. SITE POWER = REFERENCE POWER x 0.85

SITE FUEL CONSUMPTION = REFERENCE FUEL CONSUMPTION x 1.03

Appendix 3 - Engine BMEP De-Rate Calculation

Engine and genset mechanical power output shall be de-rated based on cylinder BMEP to bring back to a maximum of 2,000kPa.
Ref: ISO 8528-2:2005 Sect 5.2 Main Characteristics for RIC engine

Calculation is given below:

$$P_{2,000kPa} = P_{MAX} \times \frac{2{,}000\ kPa}{BMEP_{MAX}}$$

Where:

$\boldsymbol{P_{2{,}000kPa}}$	Maximum power output for engine / genset at BMEP limited to 2,000 kPa
$\boldsymbol{P_{MAX}}$	Maximum power output for engine / genset at a given BMEP
$\boldsymbol{BMEP_{MAX}}$	BMEP given for maximum power output of engine

Appendix 4 - Sample Genset Test Sheet

Engine Make		**Serial No.**						
Engine Model		**Guaranteed Site Power Rating (kWe)**						
1	Time							
2	Ambient temperature (°F/°C)							
3	Ambient humidity (%RH)							
4	Combustion air temperature (°F/°C)							
5	Elevation (ft/m)							
6	Test site power rating (kW)							
7	Power output (kW)							
8	Percentage of adjusted test power rating (%)							
9	Speed (RPM)							
10	Oil pressure (psf/kPa)							
11	Oil temperature (°F/°C)							
12	Engine coolant temperature (°F/°C)							
13	To radiator coolant temperature (°F/°C)							
14	From radiator coolant temperature (°F/°C)							
15	Coolant flow (cu. ft/s / m^3/s)							
16	Engine charge air boost pressure (psf/kPa)							
17	Pressure drop across charge air system (psf/kPa)							
18	Charge air to charge air cooler temperature (°F/°C)							
19	Charge air from charge air cooler temperature (°F/°C)							
20	Exhaust gas temperature (°F/°C)							
21	Exhaust gas flow (cu. ft/s / m^3/s)							
22	Exhaust system backpressure (inches H2O)							
23	Fuel temperature at inlet to engine							
24	Fuel temperature from engine							
25	Test specific fuel consumption (lbs/kWh / g/kWh)							
26	Test site fuel consumption (lbs/kWh / g/kWh)							

Republic of the Marshall Islands – Sustainable Energy Development Project

Lot 2 – PV System Technical Specifications

Contents

1. PRELIMINARY

1.1. About this project

The Government of the Marshall Islands (GRMI) has been provided with grant funding by the World Bank for a Sustainable Energy Development Project (SEDeP) including renewable energy and power system upgrades aimed at increasing the share of renewable energy in the Republic of the Marshall Islands (RMI).

The objective of this component of the project (Lot 2) is to supply new PV systems sufficiently sized to supply at least 7% of the RMI's total energy consumption from renewable energy.

These specifications relate to the design of the new solar PV systems on buildings, new structures and the water reservoirs. It should be read in conjunction with the associated drawings and the Power Station & Bess Specifications (Lot 1).

1.2. Majuro Electricity Sector

Electricity on Majuro is generated, distributed and retailed by the Marshalls Energy Company (MEC). MEC operates two diesel power station at one site in Delap and several grid-connected PV systems on buildings around Majuro. Majuro's typical peak loads are approximately 8.5 MW. A sample load profile is provided in Figure 1.

Figure 1: Majuro load profiles from 2010, 2017 and 2018

Electricity is distributed via a medium voltage network made up of both overhead and underground cables. Two distribution voltages are used – 13.8kV across most sections of the network, and 4.16kV at the far eastern and western ends. Low voltage distribution is at 208/120V. 480V three-phase is also used in some facilities.

1.3. Environmental conditions

The Majuro Power Station is located in the Northern Pacific region in a tropical environment with ambient air temperatures ranging from 25°C to 35°C, average humidity of 80% and annual rainfall in excess of 3 metres. The average monthly windspeed ranges between 3-5 m/s. Corrosion is severe in all locations on Majuro and must be a consideration in all designs.

2. SCOPE OF WORKS

1. These specifications cover the design, supply, installation and commissioning of PV systems with a total capacity of 4.0MW at multiple sites on Majuro. The individual systems and components include:
    a. Approximately 2.6 MW floating PV systems on the Majuro Water Reservoirs, including supply of new transformers and control system. The systems are to be installed on five reservoirs as indicated on the drawings. Tenderers may propose a layout and total capacity for the system, provided the total guaranteed output in year 1 is achieved.
    b. New liners for three reservoirs
    c. Rooftop PV systems on existing school buildings at 6 schools and one college, including all new cabling and poletop or padmount transformers to connect to the distribution network, and a new kWh meter for each site. All systems are to be connected in a gross-metering configuration to the network, not to customer facilities. Refer to Table 1 for the full site list.
    d. Shed mounted PV systems on three existing basketball court structures
    e. Shed mounted PV systems over five basketball courts, including shed construction
    f. Canopy-mounted PV system over small water reservoir near the hospital, including canopy construction
    g. Provision of monitoring and control systems for all PV systems including communication cables for connection to the existing fibre-optic network
2. The contractor shall be responsible for connecting the PV systems to the local distribution network at either 13.8kV or 4.1kV as required for the location. Refer to the network single line diagram for site specific information.
3. The contractor shall be responsible for all civil works associated with the PV systems including any vegetation clearing required for access around the reservoirs, arrangement of crane access, trenching, and any temporary fencing required.

4. The contractor shall accommodate two MEC trainees during construction of the system for capacity-building purposes, if and when required by MEC. The trainees' costs will be borne by MEC.
5. The contractor shall provide full system manuals and as-built drawings to MEC.
6. The contractor is responsible for all testing & commissioning of the PV systems and delivery of testing and commissioning documentation.
7. A defects liability period of twelve months shall apply to the system from the date of practical completion.
8. The system will be subject to performance guarantees for a period of 24 months from the date of practical completion.
9. The Employer or their authorised representative shall conduct reviews, inspections and independent testing. The contractor is required to comply with all instructions from the Employer.
10. The contractor is to coordinate with the Lot A (power station and BESS) contractor throughout the construction phase.

2.1. Site List

11. The sites and proposed PV capacities identified for this project are shown in Table 1. Further details on each individual site are provided in the relevant sections and in Appendix A.

Table 1: PV site list and energy supply

System Type & Location	Qty	PV Capacity (kWp)	Annual Generation (MWh)
Floating	**5**	**2660**	**3,653**
Reservoirs	5	2660	3,653
Rooftop	**20**	**759**	**991**
College of the Marshall Islands	4	277	362
Delap Elementary School	1	25	31
Rita Elementary school	5	83	109
Delap North (new) Elementary School	3	43	55
Long Island Elementary School	1	14	19
MIHS	6	318	415
New Structure	**6**	**513**	**677**
Delap Elementary School	1	96	126
Hospital reservoir	1	91	120
Rita Elementary school	1	62	81
Delap North (new) Elementary School	1	72	95
Laura Sports Complex	2	193	255
Grand Total	**31**	**3932**	**5,320**

3. STANDARDS

12. All equipment installed in the system must be new and meet the relevant US or international standards. All system, components and equipment must comply with – and be designed and installed in accordance with the following standards.
    a. National Electrical Code (NEC) 2017 edition, specifically Article 690
    b. National Electrical Safety Code (NESC) 2017 edition
    c. IEC 61215 – Crystalline silicon modules
    d. IEC 62804 – PID testing
    e. IEC 61701 – Salt mist corrosion testing
    f. UL 6703/IEC 62852 – locking connectors
    g. IEC/UL 61730 – Photovoltaic module safety
    h. ASCE & SEI 7-16
    i. International Association of Geosynthetic Installers, HDPE Geomembrane Installation Specification, 2015
    j. GRI GM 13, Test Properties, Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes

4. TECHNICAL REQUIREMENTS

4.1. General

4.1.1. Site conditions

13. The following site conditions are to be used for design purposes and equipment selection.

Table 2: Environmental conditions

CHARACTERISTIC	VALUE
Ambient Temperatures	35°C summer day time (Max) 25°C winter night time (Min)
Mean Daily Solar Exposure	5 kWh/m^2/day
Precipitation	Mean annual rainfall in excess of 3000mm
Humidity	Average relative humidity 80%
Mean Barometric pressure	1009 hPa
Atmospheric Classifications	Environments as defined in AS/NZS 2312-2014. Category C5-M: Very High Marine
Design Wind Speed	48 m/s

14. No geotechnical reporting or any other sources indicating the ground condition of the site were available. The soil conditions are expected to be consist of coral limestone underlying unknown thickness of calcareous sand.
15. For the preliminary design bearing pressures 250kPa (5221.4 lb/ft_2) has been opted for based on previous experience of projects on Pacific atolls. The contractor will be

responsible for carrying out and determining suitable foundation parameters for the project.

4.2. Reservoirs Floating PV System

4.2.1. General

16. Solar panels are to be installed on five reservoirs; reservoirs 1, 2, 3, 6 & 7. The Contractor is responsible for the design and construction of all the elements required for the solar installations. Refer to drawing E311 for reservoir dimensions and layouts.
17. The reservoirs are managed by the Majuro Water and Sewer Company (MWSC). Access to the reservoirs is to be arranged through MWSC, and any power shutdowns must be coordinated with MWSC around their pumping schedule. Two reservoirs (4 and 5) are covered and contain treated water, and are not proposed to be used for this project.
18. The reservoirs are the main source of water for Majuro. Since construction of the project will involve draining the reservoirs, the works must be carefully staged in consultation with MWSC to ensure that sufficient water supply can be maintained.
19. As part of this project, new liners are to be provided for some of the reservoirs. Where new liners are not required, MWSC staff will be responsible for cleaning the existing liners prior to installation of floating PV systems.

4.2.2. Site information

20. The reservoirs are partially surrounded by an existing PV system. This PV system is to be left in its existing location so the construction plan will need to allow for installation around the existing system. There are also existing underground services associated with the PV system. MEC can provide documentation on the existing system but the contractor is responsible for locating all underground services prior to construction.
21. Access to the reservoirs is from the adjacent lagoon road, or alternatively from a track on the ocean side. Some sections of fencing will need to be removed to facilitate access. Possible cranage points are marked on drawings S115. The construction plan for the reservoirs will need to take into account the existing solar PV system installed around the edges of the reservoirs (refer to Appendix A for site photos). The track on the ocean side is overgrown with vegetation and would need to be cleared to facilitate vehicle access.
22. There is a 13.8kV underground cable running along the road side of the reservoir site, with three cable pits that can be used for connection to the network. Refer to drawing E-311 for locations of the cable pits.
23. There is a National Telecom Authority (NTA) facility across the road from the reservoir site. Connection to an existing fibre-optic cable is available at this facility. There is an existing conduit under the road that can be used to run fibre to the telecom facility from the reservoir site.

4.2.3. Reservoir liners

24. The following standards apply to this section:
    a. International Association of Geosynthetic Installers, HDPE Geomembrane Installation Specification, 2015
    b. GRI GM 13, Test Properties, Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
25. Liners on Reservoirs 1, 6 and 7 are required to be replaced before installation of the new solar PV systems.
26. The contractor is to design and supply new liners for these reservoirs, over the flat areas of the pond, up the batters and onto the walls of the reservoir. Refer to drawing S102 for typical liner details.
27. The liners can be installed over the existing liners if required.
28. The contractor is required to coordinate the liner replacements with the Majuro Water & Sewer Company (MWSC) to accommodate their requirements for maintaining water supply to the island including:
    a. Seasonal supply of water is not compromised
    b. Staged to maximise water storage across the seven reservoirs
    c. The works can be coincided with other planned maintenance
    d. Mooring works or any other works on the bed of the pond is completed at the same time.
29. HDPE geomembrane (smooth) is required for the pond liner. The supplied geomembrane should meet test property requirements prescribed in Table 1 of GRI GM13.
30. The geomembrane is to have the following properties at a minimum:
    a. Minimum thickness 2mm and density 0.94 g/cc or greater
    b. Durable, UV stable material with UV lifetime 20 years
    c. Good chemical and PH resistance
    d. Suitable for tropical conditions
    e. Warranty – 25 years
31. Handling, storage and care of the geomembrane prior to and following installation at the site, is the responsibility of the Contractor. The Contractor shall be liable for all damages to the materials incurred prior to final acceptance of the lining system by the Employer.
32. The geomembrane shall be protected from sunlight, chemicals, moisture, excessive heat or cold, sharp objects, or other damaging conditions. The geomembrane shall be protected from mud, dirt and dust. Any additional storage procedures required by the Manufacturer shall be the Contractor’s responsibility.

33. The ponds have been previously lined with a membrane and it may be that the existing membrane can be kept in place and used as a surfacing for the new liner. This is to be decided by MWSC upon inspection of the existing liners. If the existing liner is removed the following preparation is required:
    a. Pond sloped surfaces shall be trimmed to a smooth and even surface and profile ready for placement of the pond liner.
    b. Surfaces to receive geomembrane shall be proof-rolled where possible so as to ensure a firm surface. The Contractor shall inspect the surfaces of the subgrades involved at regular intervals to ensure that there are no conditions or sharp materials that could result in damage the geo-membrane.
    c. Any unsuitable material shall be excavated and replaced with suitable fill material.
34. Installation shall be carried out as detailed in the IAGI HDPE Geomembrane Installation Specification 2015 and any specific Manufactures Specification. In addition, the following conditions apply:
    a. Prior to the installation of the Geomembrane, the existing pond surface shall be cleaned of any debris for inspection by the Contractor, the Engineer and the Employer.
    b. Prior to any Geomembrane placement, the Contractor shall inform the Employer.
    c. Geomembrane shall not be installed over unsuitable surface areas until approval of these surfaces from the Employer. Failure to comply with this condition may result in the Employer directing the removal of Geomembrane or any other works necessary to enable an inspection to be undertaken. Time lost or costs incurred shall be borne by the Contractor. The Contractor shall certify in writing that the pond surface on which the Geomembrane is to be installed is acceptable before commencing placement.
    d. Panels installed on batters shall be installed in the one continuous length from the top of the batter down to 1.5m (minimum) past the toe.
    e. Each roll thickness shall be verified by the contractor on site after placement. A frequency of five tests per 100m of panel, 20m apart shall be adopted and measurements shall be taken at the edge of the sheet. The contractor can measure the thickness of the geomembrane by using measuring callipers or other method as approved by the Employer.
    f. The entire surface area of each and every roll shall be inspected by the Employer during unrolling and placement to ensure that there are no tears, abrasions, indentations, cracks, thin spots or other faults in the material. The Employer shall inform the Contractor of any such occurrence. It shall be the responsibility of the Contractor to ensure that all damage within the liner during the works is repaired or replaced in accordance with this specification.
    g. The Geomembrane shall be placed in a relaxed state to respond to thermal changes without causing excessive bridging, buckling, wrinkling or tensioning. No signs of stress

will be permitted within welds made during installation of the liner. Any such occurrences being identified will be repaired or remedied by the Contractor at no cost to the Employer.

h. Installation of geomembrane on slopes shall be undertaken from the top of the slope with the geomembrane being pulled down by hand from an excavator and spreader bar.

35. The Geomembrane shall be anchored at the anchor wall, as shown on the Drawings S102 and to the satisfaction of the Employer. The panels are to be cut to size, as required, anchored in the anchor wall.
36. Direct trafficking over the geomembrane is to be restricted to only necessary foot movements. No plant or equipment shall traffic over the geomembrane. In the event of moisture settling on the geomembrane, the contractor shall recognise the potential for employee slipping and take the necessary actions to prevent slipping and injury to employees.
37. All welding shall be double wedge welded with non-destructive pressure testing being undertaken on all seams and welds. All off-site destructive testing shall be by an independent laboratory to the satisfaction of the Employer. Overlap or secondary welding shall only be undertaken for repair works.
38. The Contractor shall provide the Employer with a complete description of the field welding process or processes to be employed. The proposed welding procedures of the Contractor are to be approved by the Employer.
39. The Contractor shall be responsible for the entire welding operation and shall maintain welding standards and practices capable of meeting the total requirements of this Specification and functions of the facility.
40. All field welds shall be to the satisfaction of the Employer and completed by a qualified welder.
41. The Contractor shall ensure that the surface upon which the welding is to take place is free of surface water which could adversely affect the weld quality. The surface of the sheet material within the weld zone shall also be free from any foreign materials such as clay, sand, dust etc.
42. All welding surfaces shall be adequately abraded (where necessary) using approved mechanical equipment, at a time no more than 5 minutes prior to the commencement of the welding operation. The Contractor shall take all necessary care to give attention to maintaining the abrasion in the immediate region of the weld and shall not cover grind the areas thus reducing the effective thickness of the Geomembrane adjacent to the weld zone. Where over grinding is observed, the Contractor shall rectify this by removing the offending area as directed by the Employer.
43. The liner shall be constructed and fixed to top perimeter of the pond wall, as shown in S102. The contractor is responsible for the anchorage detail to the wall.

44. Sand bags shall be placed at the base of the pond over the geomembrane liner to prevent the liner from blowing out. The sand bags shall be left in the pond following construction.
45. The Contractor is responsible for any additional measures to ensure the geomembrane is not damaged for the duration of the construction. At the completion of construction only the sand bags shall remain in the pond.
46. Sand bag material shall be sufficiently close- knit to prevent soil fines from coming out of the bags and discharging on the geomembrane.

4.2.4. Mooring and Access

47. The solar panels are to be moored in place and be limited to the flat area of each of the ponds to make allowance for the tidal levels of the ponds
48. The mooring is to be a mechanical tether system that allows for the fluctuation levels of the ponds, but needs to be robust in design and low maintenance. Example of a design for the mooring system is shown in drawing S113.
49. Each reservoir is to have a permanent access system, such as a jetty bridge as shown on drawing S113. The access is to be a minimum of 1200m wide and also provide support for cables from the solar system.

4.2.5. PV System

50. The total DC capacity of the floating mounted PV system is to be approximately 2.6 MW_p DC at STC.
51. PV modules shall comply with the technical requirements of Section 4.5.
52. Floating mounted PV systems on reservoir sites are proposed to be oriented north and south tilted at 5°. Tenderers may propose alternative layouts provided the performance requirements of Table 1are met.
53. The solar installation is limited to the flat central areas of the ponds, as there will be periods when the reservoir will be completely empty due to water demand on the atoll or for maintenance.
54. The PV array is to be mounted on a purpose-built floating structure on the reservoir sites. The structure is to be pre-fabricated for quick assembly on site. The structure must be an existing product with a proven track record of field installations at other sites. Details of the floating structure proposed are to be provided in the tender schedules.
55. Floating mounting structures are to be manufactured of HDPE material or other suitable marine-grade material.
56. The mounting solution is to include a method of accessing the panels for cleaning and maintenance, such as a walkway.

57. Inverters are to be mounted on the array or on a frame or structure on the ground within the reservoir site. Mounting on the array itself is preferred, but tenderers may propose a mounting solution.
58. Inverters are to comply with the requirements of Section 4.6.
59. String inverters are preferred for this project, as they can be more easily maintained or replaced by MEC.
60. Array supports, brackets, screws and other metal parts are to be of materials suitably corrosion resistant for the lifetime of the system. Where necessary, separation of dissimilar metals or anti-corrosive coatings should be used.
61. The mounting structure, with panels installed, must be able to resist winds gusts relevant for the island in accordance with SEI/ASCE 7-16. The contractor shall supply an engineering certificate stating that the array design is certified to this standard, as well as the mounting method required to achieve the rating.
62. Modules and mounting frames must be installed as per manufacturer's instructions (e.g. module clamping zone, rail fixing spacing, fixing screw type, etc.)
63. Fasteners are to be made of marine grade 316 stainless steel or 304 stainless steel and coated in a water-resistant rust inhibitor (e.g. lanolin). Bolts are to be made of 316 stainless steel and nuts of 304 stainless steel, to prevent binding.
64. A suitable method of grounding the array frame is to be provided.

4.2.6. Cabling

65. DC cabling is to be run in heavy duty conduit or channel fixed to the floating structure. Cabling shall not be unprotected or in contact with water.
66. AC cabling is to be run in heavy duty conduit or above-ground channel to the transformers. Cabling may not be buried on the embankment, but may be buried on the flat ground around the perimeter of the site.
67. Cabling is to meet the specifications described in Section 4.7.

4.2.7. Network Connection

68. There are four connection points available at the reservoir site (refer to drawing E-311). Three are to an underground cable via pull pits, and one is to an overhead pole. The

underground cable will need to be cut and terminated to new transformers via RMUs at each cable pit.

69. Padmount transformers with RMUs are to be provided at each underground connection point (refer to section 4.10)
70. A padmount transformer and overhead fuse links (fuse cutouts) may be provided for the overhead connection (refer to section 4.10).

4.2.8. Control & monitoring

71. All PV arrays on the reservoirs are to be controlled via a master plant controller. The controller shall have the ability to instruct the inverters to perform the following functions as a minimum:
    a. Connect to the network
    b. Disconnect from the network
    c. Limit active power
    d. Ramp up real/reactive power
    e. Ramp down real/reactive power
72. The existing 600kW PV system at the reservoir is also to be connected to the controller. This system uses SMA inverters and an SMA cluster controller.
73. The controller shall be integrated with the power plant control system, located at Power Station 1, and shall be capable of receiving instructions via Modbus. The contractor shall coordinate with the power station contractor regarding integration and communication requirements.
74. The communications connection for control and monitoring shall be via existing underground fibre-optic cable, located at the NTA (National Telecom Authority) facility across the road from the reservoir site. The contractor is responsible for providing all equipment and cabling required to connect to this facility, up to the point of connection. Termination of the NTA fibre is to be coordinated with NTA.

4.3. Roof-mounted PV systems

4.3.1. General

75. School holidays are the best time to access the roofs of the various schools included in this project. However, timing of access to the school sites will be negotiated with an authorised person from each school.
76. Contractors are advised that the Marshall Islands High School (MIHS) is known to have a large number of undocumented underground services. While MEC can assist with locating some of these services, it is the contractor’s responsibility to locate underground services before any trenching commences.

4.3.2. PV Systems

77. PV arrays are proposed to be located on school and college roofs as per drawings and as described in **Table 1** in Section 2.
78. The total DC capacity of the rooftop mounted PV system on existing schools and sports courts is to be approximately 1 MW_p DC at STC.
79. Orientation and tilt angle of each roof is shown in Appendix A, part b.
80. Some roofs are close to trees that may require trimming or removal. Consideration of shading impacts is to be included in output calculations.

4.3.3. Mounting structure

81. Purlin spacing of the existing school roofs is 609 mm. A roof structure drawing for Laura High School is provided; although this school is no longer included in the site list, this is typical of all the schools included in this project. Structure drawings were not available for all schools, but the roof purlin spacing of Laura High School may be considered typical for all schools (though total roof dimensions vary between schools).
82. No complications with the school sites or roof access are anticipated. However, there are a number of double storey roofs and consideration of how the modules will be loaded on to the roof will be necessary and should be described in the work plan. Available machinery and local contractor information is provided in Appendix B.
83. The mounting system is to be roof penetrative, flush mounting system.
84. Modules are proposed to be installed in landscape orientation to optimise the PV capacity on the given area. Alternative installation methods are acceptable as long as total system output described in **Table 1** is achieved and the installation m ethod meets manufacturer's guidelines.
85. Roof penetrations are to be suitably sealed and waterproofed for the lifetime of the system. Dektites or similar are recommended to achieve this.
86. Modules are to be installed at least 1000 mm (3.2 feet) from all roof edges, to allow for walkways for service technicians to access them.
87. Array supports, brackets, screws and other metal parts are to be of materials suitably corrosion resistant for the lifetime of the system. Where necessary, separation of dissimilar metals or anti-corrosive coatings should be used. Timber mounting structures shall not be used.
88. The mounting structure, with panels installed, must be able to resist winds gusts relevant for the island in accordance with SEI/ASCE 7-16. The contractor shall supply an engineering certificate stating that the array frame is certified to this standard, as well as the mounting method required to achieve the rating.
89. Modules and mounting frames must be installed as per manufacturer's instructions (e.g. module clamping zone, rail fixing spacing, fixing screw type, etc.)

90. Fasteners are to be made of marine grade 316 stainless steel or 304 stainless steel and coated in a water-resistant rust inhibitor (e.g. lanolin). Bolts are to be made of 316 stainless steel and nuts of 304 stainless steel, to prevent binding.
91. A suitable method of grounding the array frame is to be provided.

4.3.4. Network connection

92. School PV systems are to be connected to the local distribution network via a dedicated transformer and dedicated meter. While the concept design assumes the use of padmount transformers, contractors may propose poletop transformers for some sites if deemed appropriate following the site inspection. Refer to drawings for site-specific information.
93. Systems connecting to underground cable are to be supplied with an RMU. Systems connecting to overhead lines may be supplied with fuse links/cut-outs.

4.4. New structure PV systems

4.4.1. General

94. PV arrays are proposed to be located on new structures over sports courts and a small water reservoir. Refer to drawings E311 to E320. The sports courts are used for basketball and volleyball.
95. The total DC capacity of the rooftop mounted PV system on new structures (sports courts and small reservoir) is to be approximately 610 kW_p DC at STC.
96. New structures are to be used to collect rainwater. Each new structure is to be provided with guttering on both edges, two 2000-gallon water tanks, all required piping and taps for each tank.
97. Each new sports court structure is to be provided with lighting sufficient to provide 100 lux illumination across the courts at night. Luminaires are to use LED battens and weatherproof, impact-resistant diffusers and housing. For each sports court, provide an outdoor-rated heavy duty light switch and a daylight sensor to automatically switch lights off during the day.

4.4.2. Structure

98. The structure 22.5m x 32.0m x 9.5m (73.8ft x 105.0ft x 31.2ft) high steel portal canopy over existing outdoor sports courts. The canopy will be used to install solar panels. The sports courts are used for both basketball and volleyball and are sized to meet the requirements of both sports.
99. 30.0m x 30.0m x 3.65m (98.4ft x 98.4ft x 12ft) high steel portal canopy over an existing water reservoir. The canopy will be used to install solar panels.

100. The foundations have been preliminarily designed as pad footings with either ties to the adjacent footings or ground anchors. The contractor may opt to install piled foundations following site visits and soil assessment.

101. For the preliminary design bearing pressures 250kPa has been opted for based on previous experience of projects on Pacific atolls. The contractor will be responsible for carrying out and determining suitable foundation parameters for the project.

102. Consideration of alternative reinforcing systems is encouraged. All sand and aggregate required for concrete is required to be imported to the Marshall Islands, as described in the ESMP.

103. The structure and cladding system is to be designed for the climatic conditions in Majuro, including both the local wind speeds and high levels of wind-blown sea salt. No cladding system is required for the Hospital Reservoir structure as rainwater is to be directed to the reservoir pond and the solar panels will provide suitable sun shading to the reservoir.

104. The ultimate wind speed for the design of the canopy is 48m/s.

105. The gravity design of the structures needs to account of appropriate combinations of dead load, live load, construction loads and imposed (wind) loads as defined by ISO 4354.

106. Wind load is the main lateral action load for the structural elements. Earthquakes are not considered significant loading in this region. The design for the structures should also account for the following in the design:

a. Appropriate lateral live loading.

b. 2% mass (0.02G) of structure in horizontal direction.

107. The roof material of the new structure is to be trapezoidal high durability coated steel sheet as described in drawing S210.

4.4.3. PV System

108. PV systems are to be mounted on the roofs of each new structure. The hospital reservoir system is to be mounted to the purlins directly, as no roof is required.

109. Orientation and tilt angle of each roof is as shown in Appendix A, part b.

110. Impact of trees and obstructions on module shading should be considered.

111. Purlin spacing of the new structure roof is 1200 mm (refer to drawing S210).

112. Array supports, brackets, screws and other metal parts are to be of materials suitably corrosion resistant for the lifetime of the system. Where necessary, separation of dissimilar metals or anti-corrosive coatings should be used. Timber mounting structures shall not be used.

113. The mounting structure, with panels installed, must be able to resist winds gusts relevant for the island in accordance with SEI/ASCE 7-16. The contractor shall supply an engineering certificate stating that the array frame is certified to this standard, as well as the mounting method required to achieve the rating.

114. Modules and mounting frames must be installed as per manufacturer's instructions (e.g. module clamping zone, rail fixing spacing, fixing screw type, etc.)

115. Fasteners are to be made of marine grade 316 stainless steel or 304 stainless steel, and coated in a water-resistant rust inhibitor (e.g. lanolin). Bolts are to be made of 316 stainless steel and nuts of 304 stainless steel, to prevent binding

116. A suitable method of grounding the array frame is to be provided.

4.4.4. Network connection

117. Each system is to be connected to the network via a new dedicated transformer and dedicated meter. Systems installed at schools may connect to the same transformer used for rooftop systems at the school. Refer to drawings for details of transformer locations.

118. Systems connecting to an underground cable are to be supplied with a transformers and RMU.

119. Systems connecting to an overhead network may use either an RMU or a fuse link/cutout.

4.5. PV modules

120. The W_p capacity (at STC) of individual module are left to tenders to decided, as long as the total DC capacity close to specified in Table 1 is provided and the performance requirements of **Table 1.** are met. The final design must be s ubmitted by the contractor and will be approved by the Employer/MEC.

121. PV technology of the PV system is to be 60 cell Monocrystalline silicon technology for rooftop mounted PV systems, and 72 cell Monocrystalline silicon for floating PV systems.

122. 60 or 72 cell modules provided for each PV system under this tender are to be of identical make and model, from a manufacturer with demonstrated experience in manufacturing high-quality PV modules, and with previous deployment in commercial or utility scale systems. Ideally with a track record in the Pacific or at least the tropics.

123. Panels must be warranted to produce at least 90% of their nominal output (at STC) after 10 years, 80% of their nominal output after 25 years, and have a defects warranty period of at least 10 years.

124. Panels must be certified to UL 1703 and ideally the international standard IEC 61215, and have been tested at a qualified testing institution (e.g. UL, ESTI, TÜV Rheinland, or a recognised equivalent).

125. Panels must be tested to IEC standard 62804-1 for PID resistance. Test certificates are to be supplied prior to construction.

126. As the panels will be installed in a tropical environment, certification to IEC 61701:2011-Salt mist corrosion testing is required. Tenderers are to provide copies of the testing certificates in their tenders.

127. Panel framing, if provided, must be of marine-grade stainless steel or marine-grade anodized aluminium.

128. Panels must have adequate seals to prevent water ingress into the active components.

129. A minimum of 3 bypass diodes are required on each panel.

130. UV-resistant, locking connectors (e.g. MC-4 or equivalent) certified to UL 6703 are to be fitted to panel leads. Non-locking connectors (e.g. MC-3 or equivalent) are not to be used.

131. Each panel must be fitted with a manufacturer's sticker on the back, providing the following information:

a. Manufacturer's name;
b. Panel model number;
c. Panel serial number;
d. V_{OC}, I_{SC}, V_MP, I_MP & P_{MP} at STC;
e. Date of manufacture;
f. Country of manufacture.

4.6. Inverters

132. Modular inverter capacity is required, and off-the-shelf string inverters are required for all rooftop sites. A string inverter or central inverter option may be proposed the Majuro water reservoir sites.

133. Inverters for rooftop sites are to be the same make and no more than four different models are to be used. This is to facilitate easy replacement and a simple spare parts inventory.

134. Inverters for the Reservoir site are to be of the same make and model.

135. String inverters are to be rated to IP65, whether they are mounted indoors or outdoors.

136. The inverters' peak efficiency must be greater than 97%, and greater than 95% at maximum output.

137. Inverters are to be tested and certified to UL 1741. Evidence of this is to be provided in the tender.

138. A warranty period of ten (10) years minimum is required. This warranty is to be with the manufacturer, not the contractor. If an extended warranty is required to meet this specification, this is to be purchased by the contractor.

139. Inverters at the reservoirs are to be integrated with the control system and be capable of receiving and executing the following commands:

a. Connect to the network
b. Disconnect from the network
c. Limit active power
d. Ramp up real/reactive power
e. Ramp down real/reactive power

140. If string inverters are proposed and mounted outdoors, they are to be installed out of direct sunlight for the majority of the day, and mounted in accordance with manufacturers' guidelines with respect to mounting and clearance.

141. Inverters are to be installed such that cables cannot be inadvertently unplugged.

142. Inverters installed at the schools and sports courts are to be located in a restricted area or if this is not possible, protected from access by students and the general public. If inverters are proposed to be installed non-restricted area, a protective cage or enclosure is to be installed around the inverters to restrict access.

143. If string inverters are proposed to house inside an enclosure, their enclosure is to:

a. Be painted white, or else located out of direct sunlight;
b. Be highly resistant to corrosion;
c. Protect inverters from direct sun and rain;
d. Be naturally ventilated in such a way as to avoid inverter derating at full output in ambient temperatures of 33°C.

144. The use of air-conditioners for inverter cooling is not desirable on Majuro, owing to the high failure rate of air-conditioners in the Pacific. If air-conditioners must be used to avoid inverter de-rating, or to meet the warranty requirements then condenser coils must be treated with an anti-corrosive coating.

145. Generally, it should be assumed that corrosion resistance is a high priority, and tenderers should describe any anti-corrosive properties of either the inverters themselves, or the inverter enclosures, in their tender.

4.7. DC and AC cabling

146. All wiring methods must comply with National Electrical Code 2017, especially Article 690 and chapter 3.

147. AC Cabling is to be sized to for a maximum voltage drop of 3% at the point of connection to the network.

148. All cabling is to be designed with temperature derating suitable for the tropical conditions described in Section 4.1.

149. Direct exposure of cabling to sunlight is not acceptable (except between adjacent panels), even if cable sheathing is marked as UV-stabilized. All cabling that would otherwise be exposed to direct sunlight must be routed through heavy duty, UV-stabilized conduit.

150. All cables installed on or inside buildings are to be contained in heavy duty conduits.

151. All cables on the floating array shall be routed through sealed trunking or conduit and protected from salt water. All DC cables used in and around the reservoirs must be rated for use in wet conditions, including any cables run underground in the reservoir area.

152. Extra cable length for strain relief is to be allowed for where required on the floating PV system, in particular for cables connecting the array to the shore.

153. Cabling between the array and the jetty is to be on top of floating structures. The cabling is to be designed for marine applications, compliant with IEC 60331 and provided with mechanical protection.

154. Any underground cabling between inverters and transformer shall be enclosed in heavy-duty conduit, sized to ensure adequate heat dissipation in accordance with NEC Article 310. Where conduit protrudes from the ground, it is to be heavy-duty and UV stabilised.

155. Before trenching of underground cabling the contractor is responsible for identifying existing underground services.

156. Cables buried in trenches must be installed as per NEC Article 300.

157. All cable terminations are to be crimped with the appropriate tool. DC solar cables are to terminate onto a solar connector or the terminal of a disconnection device.

158. Cable ties used as primary cable support are to be stainless steel. Plastic cable ties shall not be exposed to direct sunlight and can be used only for secondary support and cable marshalling.

159. PV cabling at the array must be installed such that inductive loops are minimized, to minimize inductive voltage surges.

4.8. Earthing

160. Lightning arrestors are required on the DC circuits, as inter-cloud lightning may cause voltage spikes on the array circuits. Lightning arrestors are to have a method of visually checking that they are still operational.

161. The PV system earthing design shall not interfere with the earthing system of the transformer, and is to be certified by a suitably qualified electrical engineer.

162. The PV system earthing scheme (including the PV array and the transformer) shall be provided in the tender.

4.9. Switchgear

163. Overcurrent protections and isolating / disconnecting devices are to be provided as per NEC Article 690 except where explicitly stated.

164. Any outdoor isolator enclosures or junction boxes are to be rated to at least IP65.

165. Any outdoor isolator enclosures must be highly resistant to corrosion. If metallic parts are used as fasteners, or on the body, they must be 316 stainless steel or anodized aluminium. Galvanized steel is not acceptable. Any mounting screws, nuts and bolts, are to be made of 316 stainless steel, including all enclosure screws.

166. Isolator enclosures are to be fitted with a clear window, so operators can easily verify the on/off state of the isolators inside.

167. All outdoor enclosure cable entries are to be done from the bottom, to prevent water ingress.

168. It is not a requirement to limit the number of circuit breakers in any enclosure. Switchboards and enclosures are to be sized for the required number of circuits with temperature derating and clearance requirements.

169. Arc-fault circuit protection device and rapid shutdown protection is not required.

170. Ambient temperature influence of circuit breaker rating shall be considered.

171. Tenderers are advised that the quality of switchgear and other balance of systems components will be considered in the tender response evaluations, as poor quality switchgear can jeopardise the long-term viability of a project. Details of switchgear are to be provided in the schedules.

4.10. Transformers

172. All transformers are to be UL listed.

173. Installation of transformers is to comply with the requirements of the NEC, NESC, ANSI/IEEE C57.12.00 and ANSI/IEEE C57.12.28.

174. For reservoir sites, four pad mount transformers are to be provided. Refer to site layout drawing E-311 to E320 for transformer locations.

175. For schools and new sports courts, outdoor pad-mounted transformers are proposed for most sites. Contractors may propose either padmount or poletop transformers as appropriate following site visits. Refer to site layout drawings E-311 to E320 for transformer locations.

176. All outdoor transformers are to be provided with 316 marine grade stainless steel housings in line with MEC transformer procurement policy. This is due to extreme corrosion problems with standard mild steel housings.

177. All pad mounted transformers next to roads or driveways are to be protected by concrete or steel bollards.

178. Transformer capacity is to be 480V/13.8 KVA or 480V/4.16KV three phase depending on the location on the existing network. Refer to Network Single Line Diagram E-210 for details.

179. Any insulating oil offered must be 'UL Classified' and be proven to be non-corrosive by Method B of ASTM D1275-15 or IEC 62535 Ed. 1.0. Any and each oil offered will be certified as polychlorinated biphenyl-free (PCB-free).

180. Experience in similar environments has found that the insulation rating of high voltage equipment needs to be de-rated to account for the high salt content of the air. Consequently, any poletop transformers with exposed bushings are to be fitted with 24 KV bushing for 13.8kV feeder and 7.2 KV bushing for 4.16KV feeder bushings.

181. Pad mounted transformers connecting to underground cables shall be supplied with an RMU (reservoirs, Laura Sports Complex).

182. Transformers connecting to overhead lines may be connected via either an RMU or a fuse cutout/ link.

4.11. Ring Main Unit

183. A 3-way Ring Main Unit (RMU) is to be supplied with each padmount transformer connecting to the underground network.

184. The RMU is to be a 2-switch, 1 fuse arrangement with the fuse connected to the transformer.

185. The RMU is to comply with the requirements of the NEC, NESC and MEC, the local utility.

4.12. MV cabling

186. MV cabling installation is to comply with the requirements of the NEC, NESC, and MEC.

187. The contractor is responsible for terminating MV cables to the existing network. The contractor is required to coordinate with MEC and obtain permission before completing terminations.

4.13. Signage & Labelling

188. Permanent labelling shall identify all major components including circuit breakers, isolators, fuses, lightning arrestors, and inverters, in accordance with NEC Article 690.

189. A laminated, colour-coded drawing that identifies each PV string is to be mounted at the PV site to facilitate troubleshooting.

190. All warning and danger labels shall be provided in both English and Marshallese.

4.14. Instrumentation and monitoring

191. A data logger with web interface capability is required for each system. A product designed for PV system monitoring should be used. Data loggers must be TCP/IP enabled, connected to the existing data network, and publish data online for local utility (MEC) to see.

192. Three weather stations in total are to be provided across Majuro. They are to be located at Laura, at the Reservoirs, and at one site at the eastern end of the island. The weather station is to include an irradiance sensor, temperature sensor and wind sensor, and shall be suitable for integration with the data logging system for the purposes of performance monitoring.

193. The recorded data is to include, at a minimum:

a. Daily energy output of each inverter;
b. AC and DC power at the output/input of each inverter at 15 minute intervals;
c. AC and DC voltage at the output/input of each inverter at 15 minute intervals;
d. AC and DC current at the output/input of each inverter at 15 minute intervals;
e. Time of day.
f. kWh (AC) produced by each inverter;
g. Peak power (AC) from the inverters (date and time);

194. 4G LTE service is provided by NTA (National Telecommunication Authority). The signal strength and reliability is suitable for web-based monitoring, but it may not be used for control. Rooftop and sports court systems may be connected via the 4G network or via

a wired network if available at the site. The reservoirs are to be connected to a wired network only.

195. In addition to the above monitoring requirements, the large reservoir sites will interface with the MEC SCADA system and must have the ability to be controlled by that system. Refer to Section 4.2.8 for more information.

4.15. Spare Parts & Tools

196. The following spares shall be provided for the PV systems at commissioning:

1. 1% of the total installed PV module quantity, for each module type
2. 10% of the total installed string inverter/inverter module quantity;
3. 5% of spare inverter fan modules;
4. 1% of total installed stainless steel earthing shims;
5. 1% of the total installed PV module clamps;
6. 1% DC isolators;
7. 1% DC isolator enclosures;
8. 5% of the total installed lightning arrestors;
9. 5% of the total installed string fuses;
10. 10% of solar connectors;
11. 500m of solar cable;
12. 1% AC isolator;
13. 1% AC isolator enclosure;
14. 5% of the total communications cable length and terminations;
15. 1% spare float modules for reservoirs

197. The following tools will be provided to MEC at commissioning (the tools may be used during construction, but the Employer will assess whether or not they are in sufficient condition to satisfy the requirement):

1. A tool to open solar connectors;
2. A solar connector crimping tool;
3. An RJ-45 (or otherwise) crimping tool (for communications cable);
4. Arc-flash protection equipment suitable for BESS servicing;
5. An infra-red camera with minimum specifications of:
    1. 3-inch LCD display;
    2. Accuracy of ±2%;
    3. Resolution of 120x90;

4. Thermal sensitivity of 0.1°C;

4.16. Documentation and manuals

The following documentation is to be provided at completion:

198. Test results for any concrete used

199. Producer statements in accordance with Conditions of Contract (ie. including civil works, electrical works, etc.)

200. FAT certificates for the following components shall be provided to the Employer prior to, or alongside, the Notice of Practical Completion:
    1. PV modules, including flash test results;
    2. Inverter functional testing;
    3. Controller functional testing.

201. Commissioning test sheets shall be provided to the Employer prior to, or alongside, the Notice of Practical Completion.

202. As-built drawings for all system components shall be provided to the Employer prior to, or alongside, the Notice of Practical Completion.

203. A soft-copy of a comprehensive system O&M manual shall be provided to the Employer prior to, or alongside, the Notice of Practical Completion, including:
    1. A description of system monitoring, operation, and maintenance procedures;
    2. System troubleshooting and restart procedures;
    3. Details of technical support and procedures;
    4. Warranty statements;
    5. Instructions on how to lodge warranty claims;
    6. Manufacturers' datasheets and manuals;
    7. Serial numbers for all major components;
    8. Batch numbers for any HV cabling supplied;

204. The O&M manual will be reviewed by the Employer according to the criteria above. The Practical Completion Certificate will not be issued until the Employer is satisfied that the criteria are met.

205. Within 21 days of approval, 5 x hard copies of the O&M manual shall be provided to MEC.

206. Alongside the Notice of Practical Completion, the contractor is to provide asset information on the plant and equipment designed/supplied under this contract. The information will be used by the Employer and/or MEC to enable the management, maintenance and replacement of assets over their life cycle. Information relating to

opening value of the assets will only be used for asset management purposes, and not for interrogation or assessment of the financial information in relation to the contracted works.

207. The minimum information required includes the following:

1. List of assets
2. Asset identification information including but not limited to manufacturers part number and serial number for each asset item
3. Expected economic life by asset class (including scheduled maintenance activities and the anticipated life benefit from undertaking such maintenance)
4. Opening book value of the assets.
5. Operation and Maintenance plan.
6. Asset useful life (in calendar, days or other such unit of measurement appropriate to the particular asset and its operation/use)
7. Forecast/estimated asset replacement cost at the end of its economic life
8. Suggested depreciation rate applicable for each asset type.

208. The format of the asset information will be determined following contract award.

209. The asset information will be reviewed by the Employer according to the criteria above. The Practical Completion Certificate will not be issued until the Employer is satisfied that the criteria are met.

APPENDIX A. ADDITIONAL SITE INFORMATION

Map of PV sites on Majuro Atoll

Figure 2: Map of PV sites

a. Site general information

Table 3: Site information

Site	Location Coordinates	Buildings / Areas	Lease Holder	Drawing reference
Reservoirs	7.0693, 171.2906	5 x Raw water reserviors	MWSC	E-311
Marshall Islands High School	7.1183, 171.3657	7 buildings	PSS / MALGOV	E-312
Rita Elementary school	7.1215, 171.3634	5 buildings, 1 sports structure	PSS / MALGOV	E-313
Delap Elementary School	7.0848, 171.3711	1 building, 1 sports structure	PSS / MALGOV	E-314
Long Island Elementary School	7.0717, 171.3128	1 building	PSS / MALGOV	E-316
Delap North (new) Elementary School	7.0907, 171.3823	3 buildings, 1 sports structure	PSS / MALGOV	E-317
College of the Marshall Islands	7.1031,171.3781	3 buildings, 1 existing covered sports structure	College of the Marshall Islands	E-318
Hospital Reservoir	7.0934, 171.382	1 new canopy structure	MWSC	E-329
Laura Sports Complex	7.127, 171.0476	1 basketball court, 1 tennis court	Malgov	E-330

b. Full site list with PV capacity

Table 4: Full site list with individual roof details

System Type & Location		Qty	PV Capacity (kWp)	Orientation	Tilt angle
Floating		**5**	**2641**		
	Reservoir #7		568	0/180	5
	Reservoir #6		568	0/180	5
	Reservoir #3		568	0/180	5
	Reservoir #2		568	0/180	5
	Reservoir #1		368	0/180	5
Rooftop		**27**	**1082**		
College of the Marshall Islands	Basketball Court		88	-63/117	10
	CMI 3		53	-75/105	15
	CMI 2		50	-166 / 14	15
	CMI 1		85	-75/105	15
Delap Elementary School			25	-156	18
Rita Elementary school	Buildings S		57	-24	18
	Buildings L		28	-136	18
Delap North elementary School	Buildings C		14	-158	18
	Buildings B		14	22	18
	Buildings A		14	-68	18
Long Island Elementary School			14	-76	18
MIHS	Building F + Other		63	-65 / 115	18
	Building E		45	-36	18
	Building D		37	-36	18
	Building C		45	-36	18
	Building B		37	-36	18

New Structure		**7**	**610**		
Delap Elementary School			96	25/-155	10
Hospital reservoir			91	-77 / 103	10
Rita Elementary school			62	44/-136	10
Delap North (new) Elementary School			72	22/-158	10
Long Island Basketball			96	25/-155	10
Laura Sports Complex	Court A		96	130/-50	10
	Court **B**		96	39/-141	10
Grand Total		**39**	**4333**		

c. Reservoirs

Figure 3: Drone footage of reservoirs showing locations of existing PV arrays

Figure 4: Reservoirs

Figure 5: Access track on ocean side of reservoirs and existing solar cable pit. Note, this photo was taken 2 years ago and the track is now overgrown.

d. MIHS

Figure 6: Aerial image of MIHS campus

e. Rita Elementary School

Figure 7: School building at Rita Elementary School

f. Delap Elementary School

Figure 8: Delap Elementary School buildings and area proposed for covered sports court

g. Long Island Elementary School

Figure 9: Aerial image of Long Island school

h. North Delap Elementary School

Figure 10: North Delap Elementary School

i. College of the Marshall Islands

The CMI has an indoor switchroom and 13.8kV/480V transformer. Unlike most other facilities around Majuro, CMI runs a 480V distribution network around the campus. The existing transformer had an oil leak at the time of inspection and may be replaced before this project begins.

Figure 11: Existing switchboard at CMI

Figure 12: CMI transformer

j. Laura Sports Complex

Figure 13: Aerial image of Laura Sports Complex. Basketball court and tennis court are to be used. Nearest 13.8kV connection point is approximately 500ft along the road.

APPENDIX B. LOCAL LOGISTICS

Majuro is accessible by plane from Hawaii (4 flights/week), Guam (4 flights/week) and Nauru (1 flight/week).

Majuro is on shipping routes serving both the North and South Pacific region. The port of Majuro can handle 40ft shipping containers.

The following major equipment is available for hire in Majuro:

Cranes:

Hydraulic Crane Truck 150 ton, Grove GMK5130

Note: This crane has been derated due to cable issues. It could be brought back to full capacity if the cable is replaced.

Hydraulic Crane Truck 90 ton, Grove TM890

Contact Pacific International Inc (PII) for further information on these cranes.

Local contractors

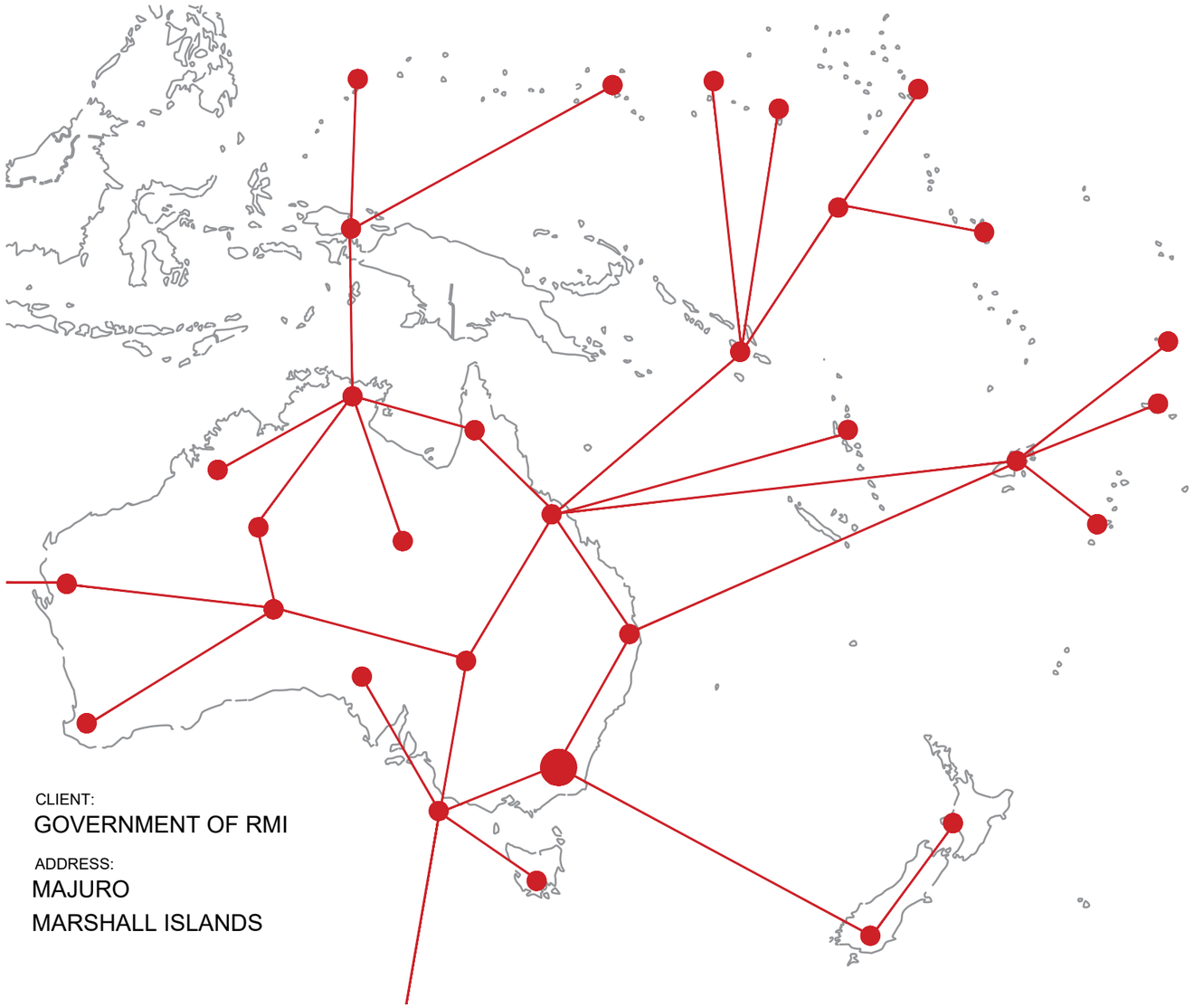
There are three local construction contractors active in Majuro. Tenders may be introduced to these companies during the pre-bid site visit.

SEDEP RMI OWNERS ENGINEER

LOT 1: POWER STATION & BESS DESIGN & BUILD

A0285

FOR TENDER



CLIENT:
GOVERNMENT OF RMI

ADDRESS:
MAJURO
MARSHALL ISLANDS

ITP Renewables
Consulting | Engineering | Implementation

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IT Power (Australia)

SHEET LIST

Sheet Number	Sheet Title
POWER STATION: GENERAL	
G-010	MAIN TITLE SHEET - POWER STATION
G-011	SHEET LIST AND LEGEND
G-040	POWER PLANT LOCATION PLAN
G-140	SITE PLAN
POWER STATION: ELECTRICAL	
E-211	POWER STATION 1 SLD
E-212	SWITCHING STATION SLD
E-213	POWER STATION AUXILLARY SLD
E-214	POWER STATION DC AUXILLARY SCHEMATIC
E-261	GENSET FUEL PID
E-262	GENNSET OIL PID
E-263	GENSET WASTEWATER PID
E-310	POWER STATION EQUIPMENT LAYOUT
POWER STATION: STRUCTURAL	
S-411	POWER STATION DEMOLITION PLAN
S-412	POWER STATIOON DEMOLITION ELEVATIONS
S-413	POWER STATION DEMOLITION ELEVATIONS & SECTION
S-422	POWER STATION GROUND FLOOR ALTERATIONS
S-423	POWER STATION FOUNDATION SECTIONS
S-424	POWER STATION FIRST FLOOR ALTERATIONS
S-425	POWER STATION ELEVATIONS
S-210	BASKETBALL CANOPY TYPICAL DESIGN
S-220	HOSPITAL RESERVOIR TYP DESIGN

LEGEND	
	TRANSFORMER
	INVERTER
G	GENERATOR
	NEUTRAL EARTHING TRANSFORMER
	CT
	VT
	TRANSFER SWITCH
	CIRCUIT BREAKER
	CONTACTOR
	FUSE SWITCH
	BATTERY
	NON-RETURN VALVE
	FILTER / STRAINER
	BALL VALVE
F	FLOW METER
	UNION COUPLING
	BUTTERFLY VALVE
M	ELECTRONIC MOTOR

	TWO-WAY VALVE
	PUMP
F	FUEL GAUGE
	SPRING RETURN VALVE
	PRESSURE GAUGE
	FLOAT SWITCH (ELECTRICAL)
	MANUAL ACTUATOR
	SOLENOID VALVE
	BREATH / VENT
	WATER SENSOR (ELECTRICAL)
	FLEXIBLE PIPING
	FLOAT VALVE
	PRESSURE RELIEF
	BLANKED END
	REDUCER
	DRY BREAK CONNECTION (F)
	DRAY BREAK CONNECTION (MF)
	DRY BREAK CONNECTION (M)

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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DRAWN WJ / MO
CHECKED LF
APPROVED JM

DRAWING **SHEET LIST AND LEGEND**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

DRAWING NO. **A0285-G-011**

SCALE AS NOTED
SHEET SIZE A3
ORIG. DATE 4/12/18
REV. DATE 7/12/18
REV NO. ----

1 - MAJURO MAP

SCALE: 1:200,000

2 - LOCATION PLAN

SCALE: 1:1000

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

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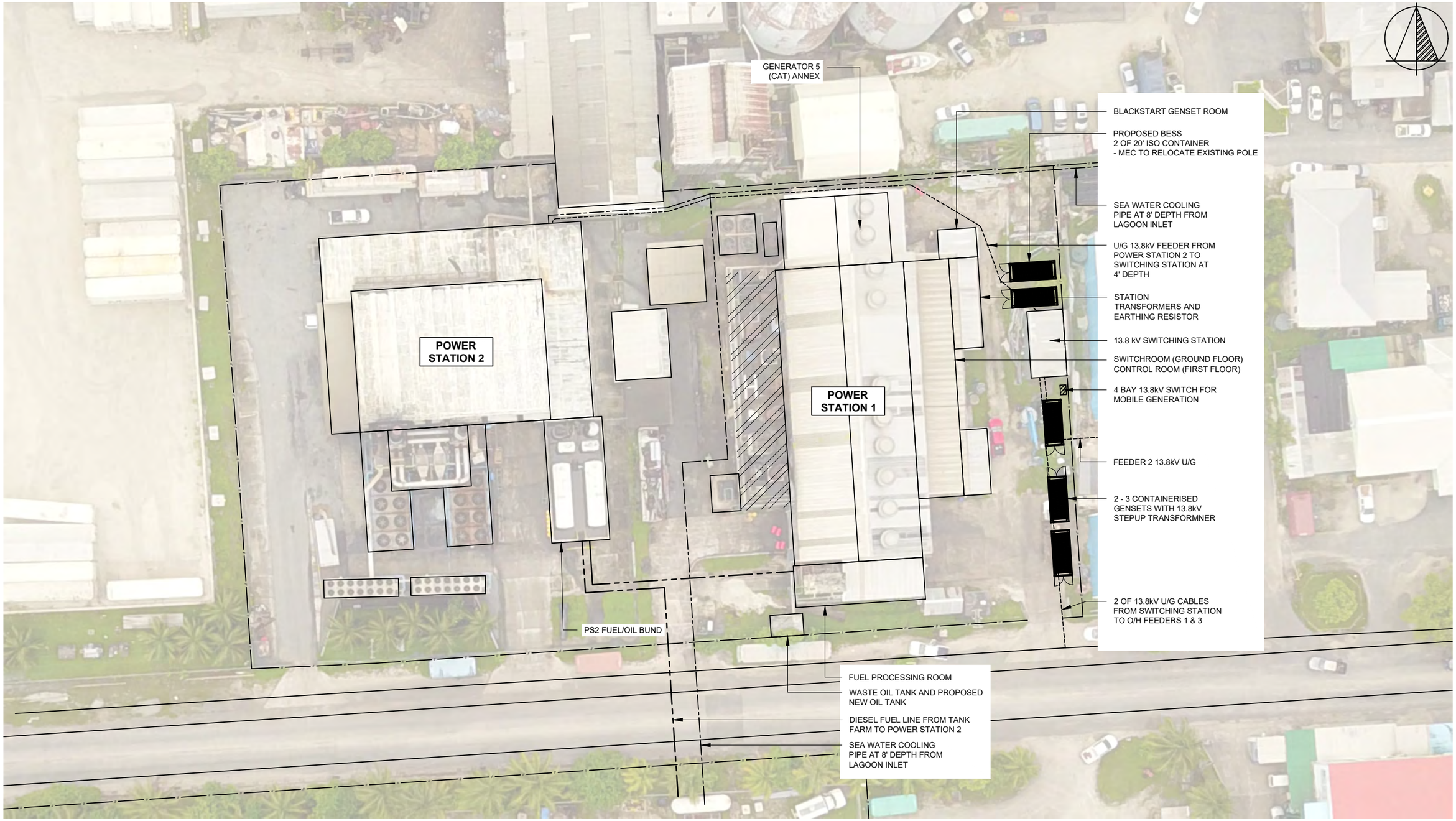
DRAWN WJ / MO
CHECKED LF
APPROVED JM

DRAWING **POWER PLANT LOCATION PLAN**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

DRAWING NO. **A0285-G-040**

SCALE AS NOTED
SHEET SIZE A3
ORIG. DATE 29/11/18
REV. DATE 6/12/18
REV NO. -----



1
G-040

POWER STATION SITE PLAN

SCALE: 1:500

FOR TENDER

NO.	STAGE	DATE
1	RELOCATED BESS, ADDED BUND (MPOR)	20/03/19
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

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AUSTRALIA

DRAWN	WJ / MPOR
CHECKED	LF
APPROVED	----

DO NOT SCALE.
ALL MEASUREMENTS IN MM UNLESS OTHERWISE STATED.

DRAWING	**SITE PLAN** ----
PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----
DRAWING NO.	**A0285-G-140**

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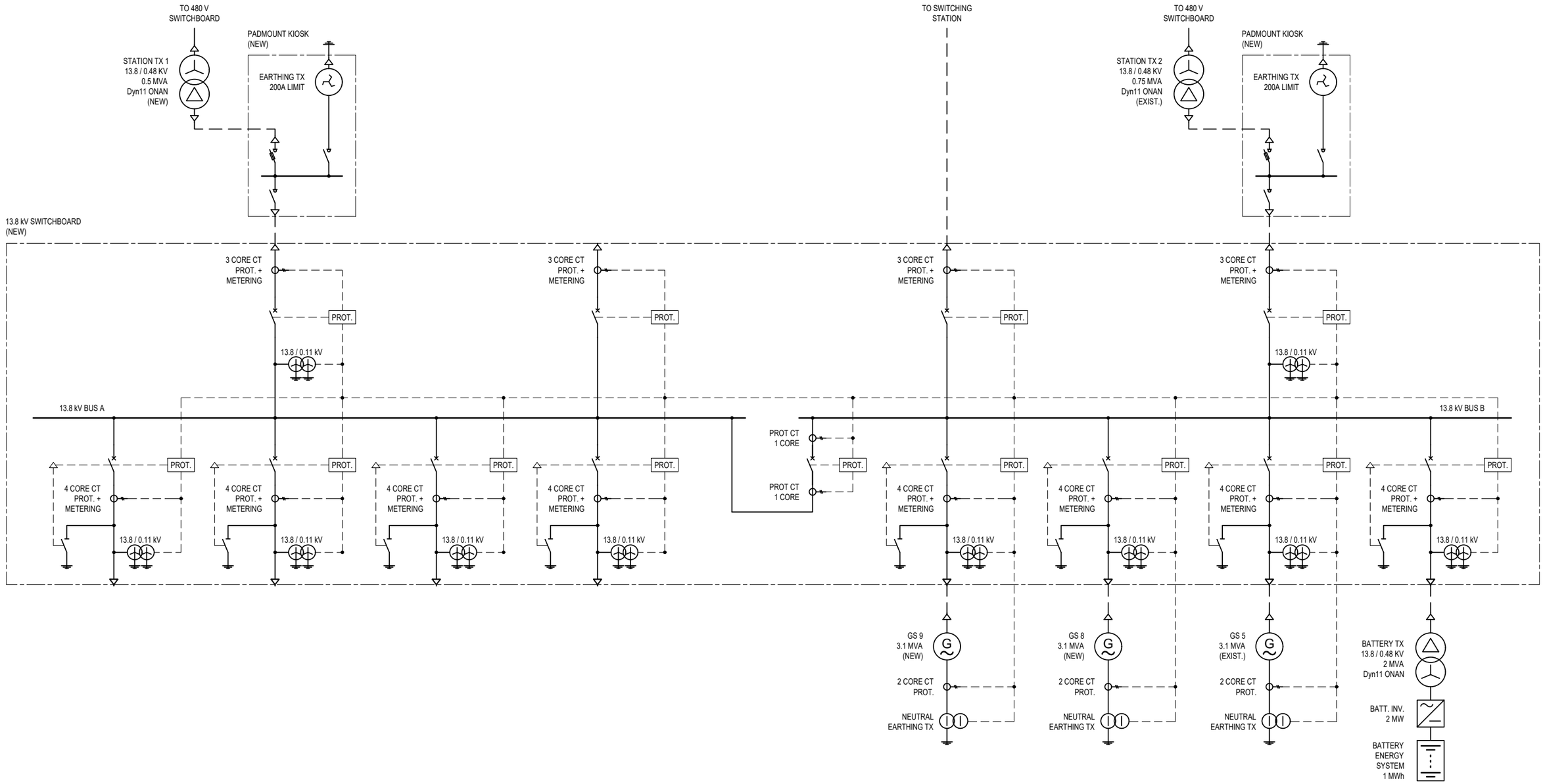
ORIG. DATE	29/11/18
REV. DATE	31/5/19
REV NO.	**1**



RATING OF EXISTING GENSETS BASED ON CURRENT KW DERATED VALUE @ 0.8PF
RATING OF NEW GENSETS BASED ON 2.5MW RATING @ 0.8PF

FOR TENDER

NO.	STAGE	DATE
1	REMOVED EXISTING GENERATORS (MPOR)	19/03/19
2	REMOVED GENERATOR 10 AND SPARE LABELS	31/05/19
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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ener-g

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DRAWN LF
CHECKED JM
APPROVED JM

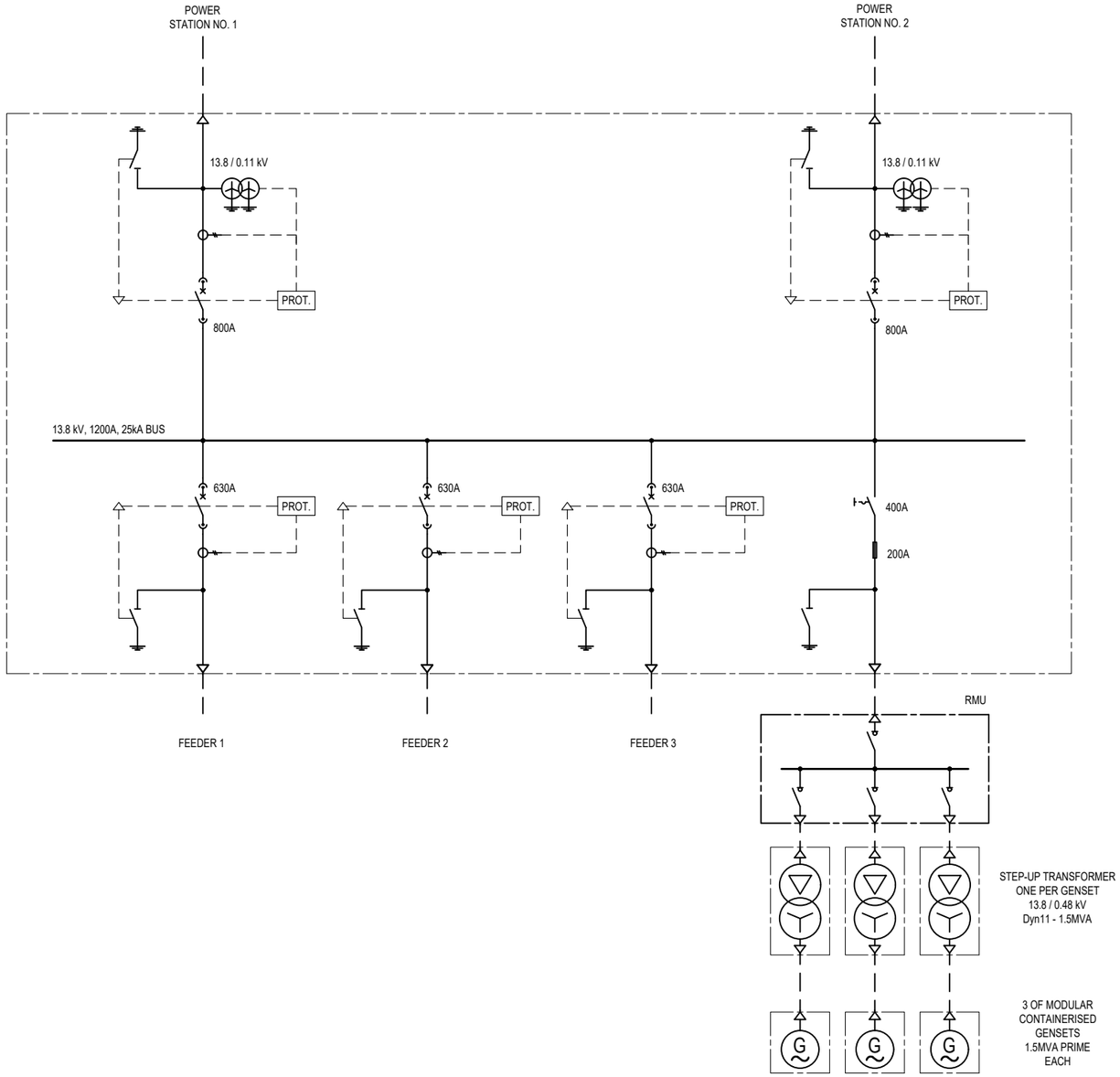
DO NOT SCALE.
ALL MEASUREMENTS IN MM UNLESS OTHERWISE STATED.

DRAWING **POWER STATION 1 SLD**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

DRAWING NO. **A0285-E-211**

SCALE AS NOTED
SHEET SIZE A3
ORIG. DATE 20/9/18
REV. DATE 31/5/19
REV NO. **1**



FOR TENDER

NO.	STAGE	DATE
1	ALTERATIONS TO SWITCHGEAR REPRESENTATION (MPOR)	19/03/19
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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APPROVED JM

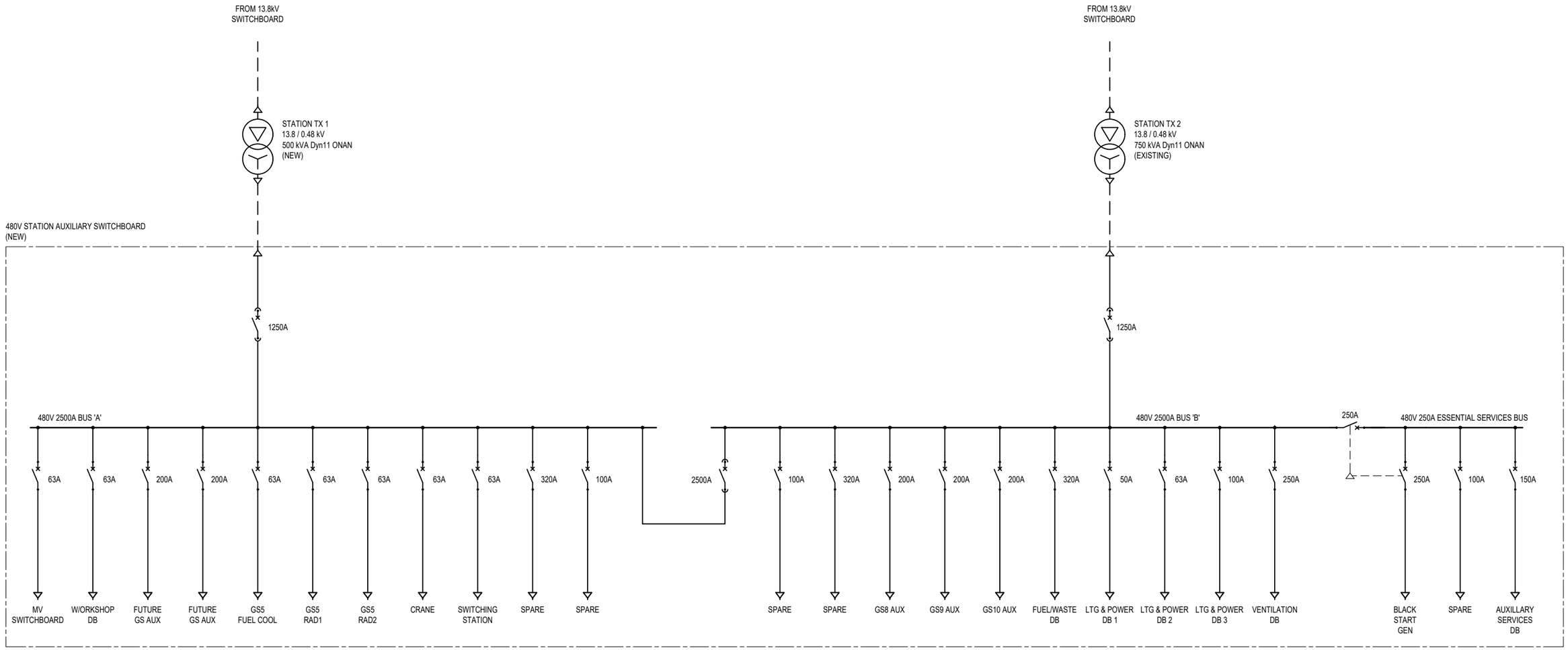
DO NOT SCALE.
ALL MEASUREMENTS IN MM UNLESS OTHERWISE STATED.

DRAWING **SWITCHING STATION SLD**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

DRAWING NO. **A0285-E-212**

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	29/11/18
REV. DATE	22/3/19
REV NO.	1



FOR TENDER

NO.	STAGE	DATE
1	ALTERATIONS TO BREAKER LAYOUT, RATINGS (MPOR)	19/03/19
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

PARTNERS

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www.itpau.com.au

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AUSTRALIA

DRAWN	WJ / MPOR
CHECKED	LF
APPROVED	JM

DRAWING **POWER STATION AUXILLARY SLD**

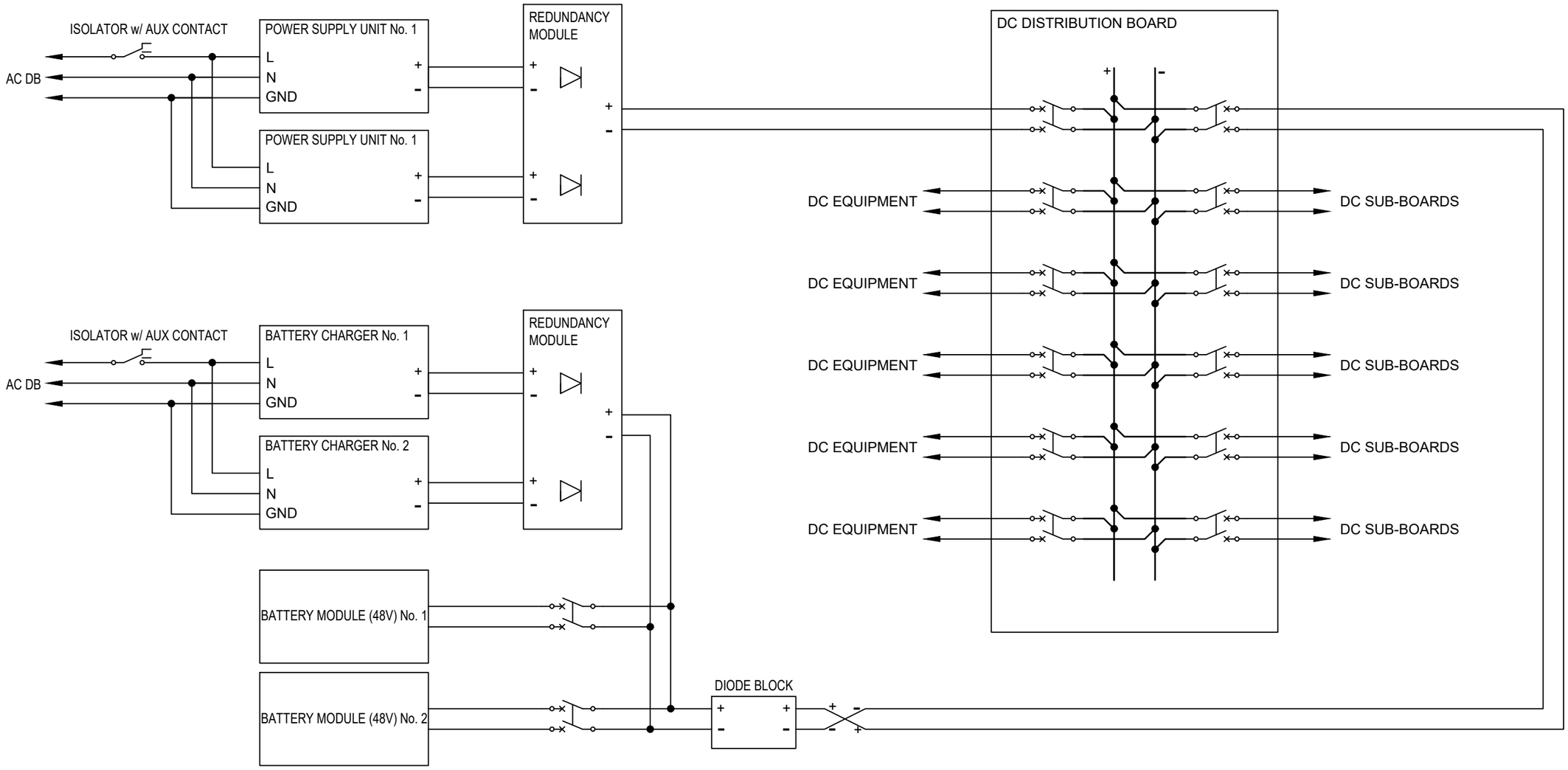
PROJECT SEDEP RMI OWNERS ENGINEER

CLIENT GOVERNMENT OF RMI

ADDRESS MAJURO
MARSHALL ISLANDS, ----

DRAWING NO. **A0285-E-213**

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	29/11/18
REV. DATE	20/3/19
REV NO.	1



1 / - PROPOSED STATION BATTERY & DC SUPPLY ROOM

NTS

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

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AUSTRALIA

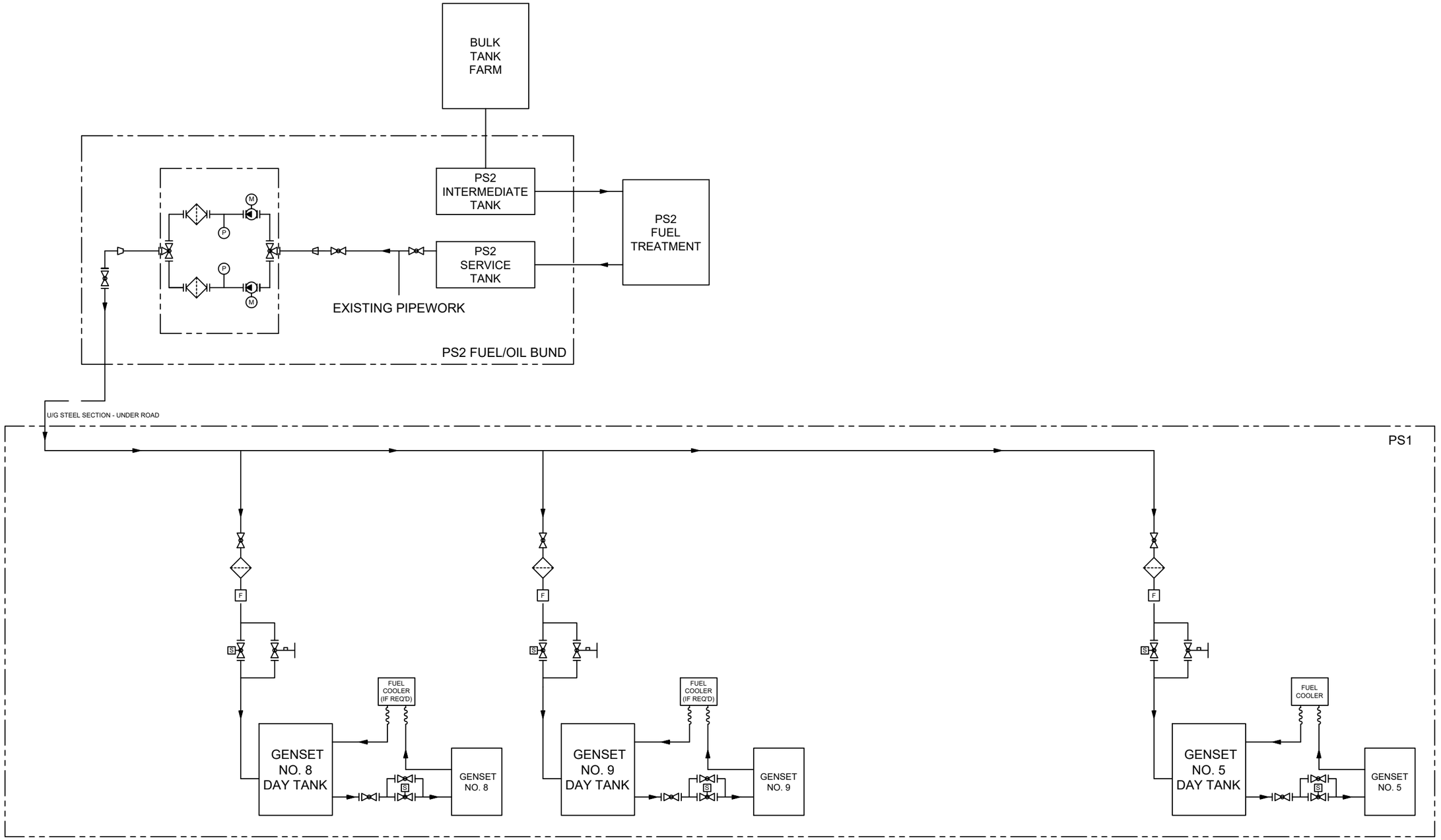
DRAWN WJ / MO
CHECKED LF
APPROVED ----

DRAWING **POWER STATION DC AUXILLARY SCHEMATIC**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

DRAWING NO. **A0285-E-214**

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	3/12/18
REV. DATE	5/12/18
REV NO.	----



FOR TENDER

NO.	STAGE	DATE
1	SOLENOID VALVE BYPASS VALVES FROM MAIN AND DAY TANKS	19/03/19
2	REMOVED GENSET 10	31/05/19
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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DRAWN WJ / MPOR
CHECKED LF
APPROVED JM

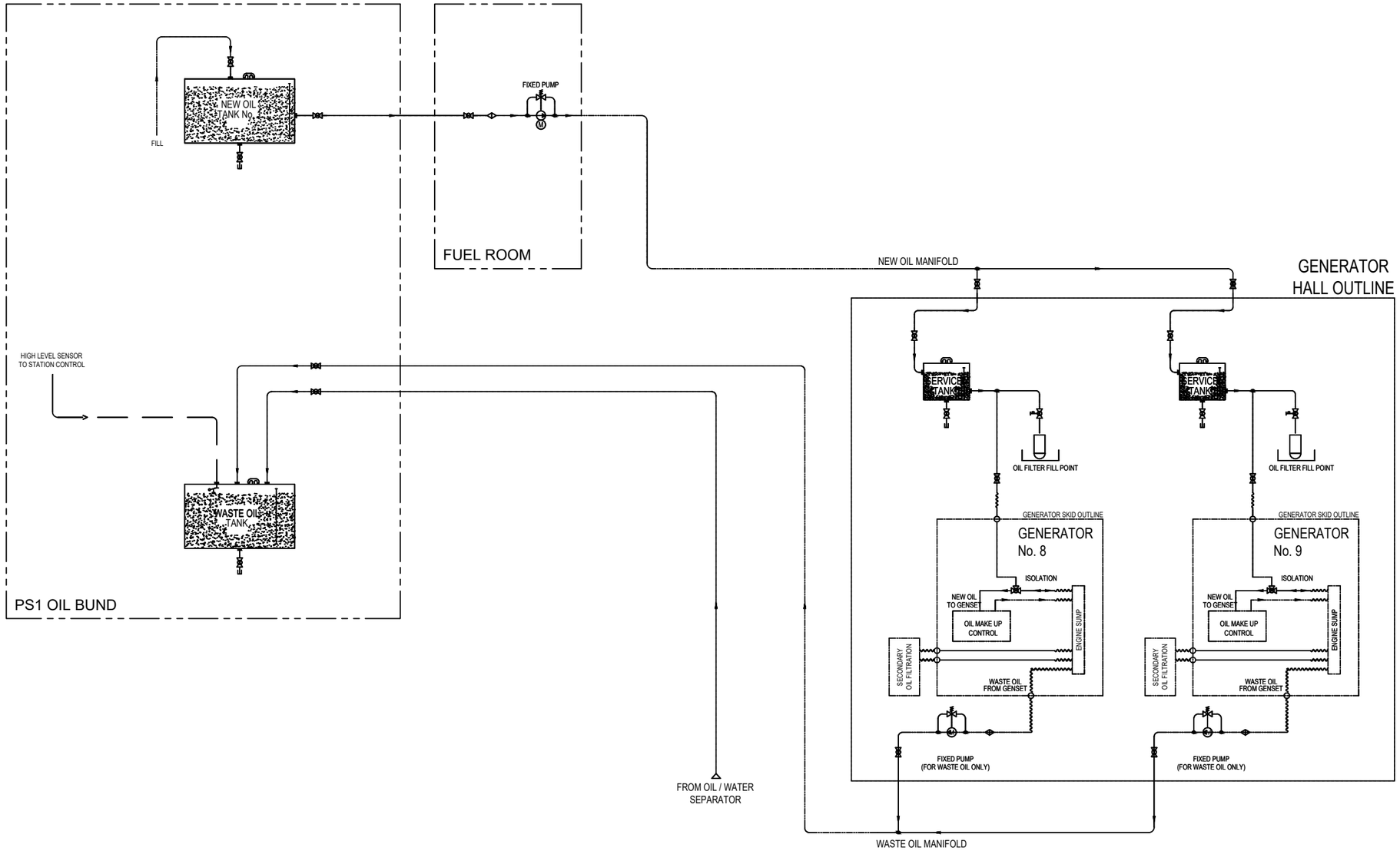
DO NOT SCALE.
ALL MEASUREMENTS IN MM UNLESS OTHERWISE STATED.

DRAWING **GENERATOR FUEL PID**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

SCALE AS NOTED
SHEET SIZE A3
ORIG. DATE 29/11/18
REV. DATE 31/5/19

DRAWING NO. **A0285-E-261**
REV NO. **1**



FOR TENDER

NO.	STAGE	DATE
1	ADDED SECONDARY OIL FILTRATION, FUEL ROOM (MPOR)	19/03/19
2	REMOVED GENERATOR 10	31/05/19
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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DRAWN	WJ / MPOR
CHECKED	LF
APPROVED	JM

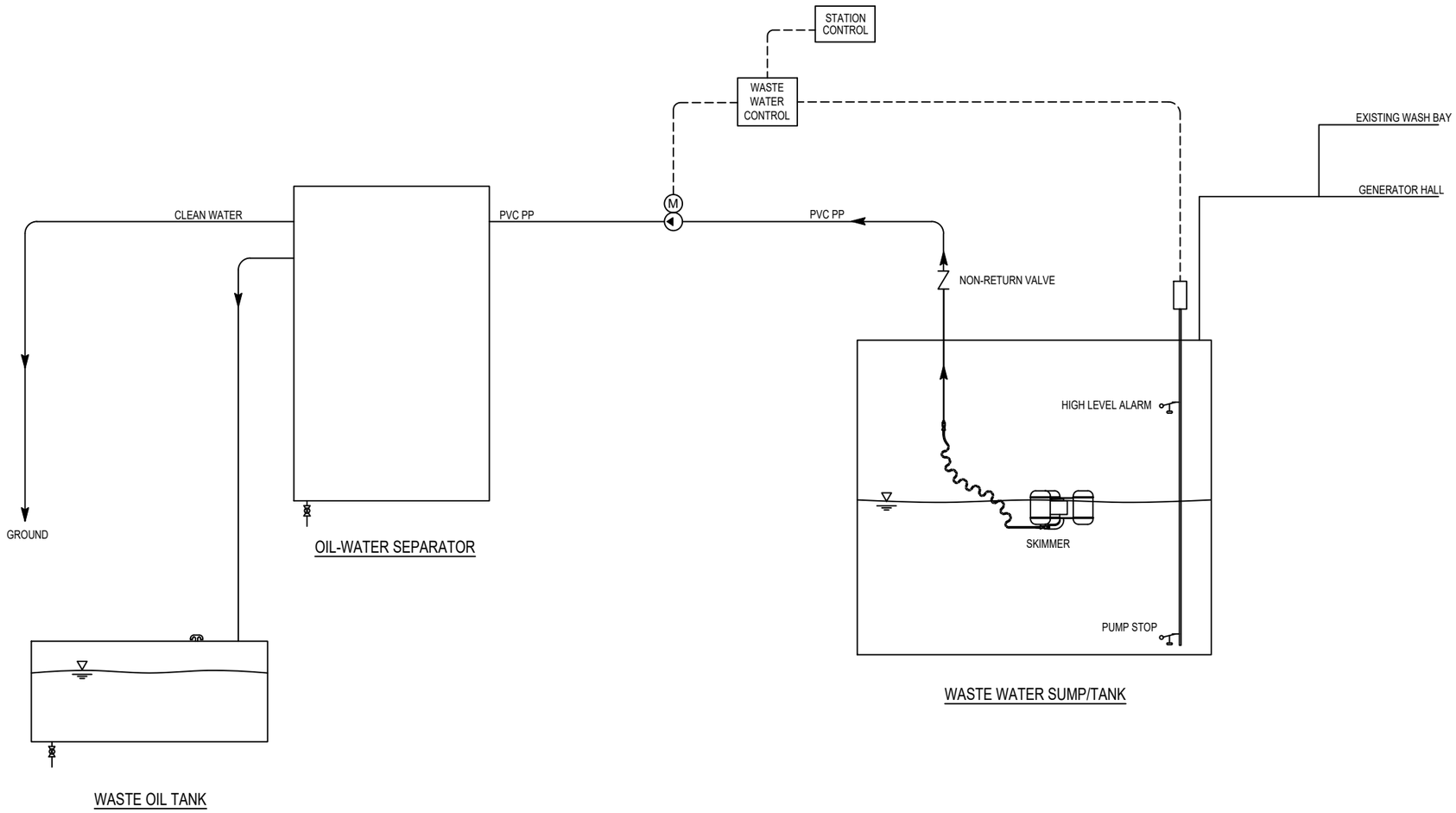
DRAWING **GENERATOR OIL PID**

PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	29/11/18
REV. DATE	31/5/19

DRAWING NO. **A0285-E-262**

REV NO. **1**



OIL-WATER SEPARATOR

WASTE WATER SUMP/TANK

WASTE OIL TANK

FOR TENDER

NO.	STAGE	DATE
1	ADDED SUMP INPUTS (MPOR)	19/03/19
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

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DRAWN	WJ / MPOR
CHECKED	LF
APPROVED	JM

DRAWING **GENERATOR WASTEWATER PID**

PROJECT SEDEP RMI OWNERS ENGINEER

CLIENT GOVERNMENT OF RMI

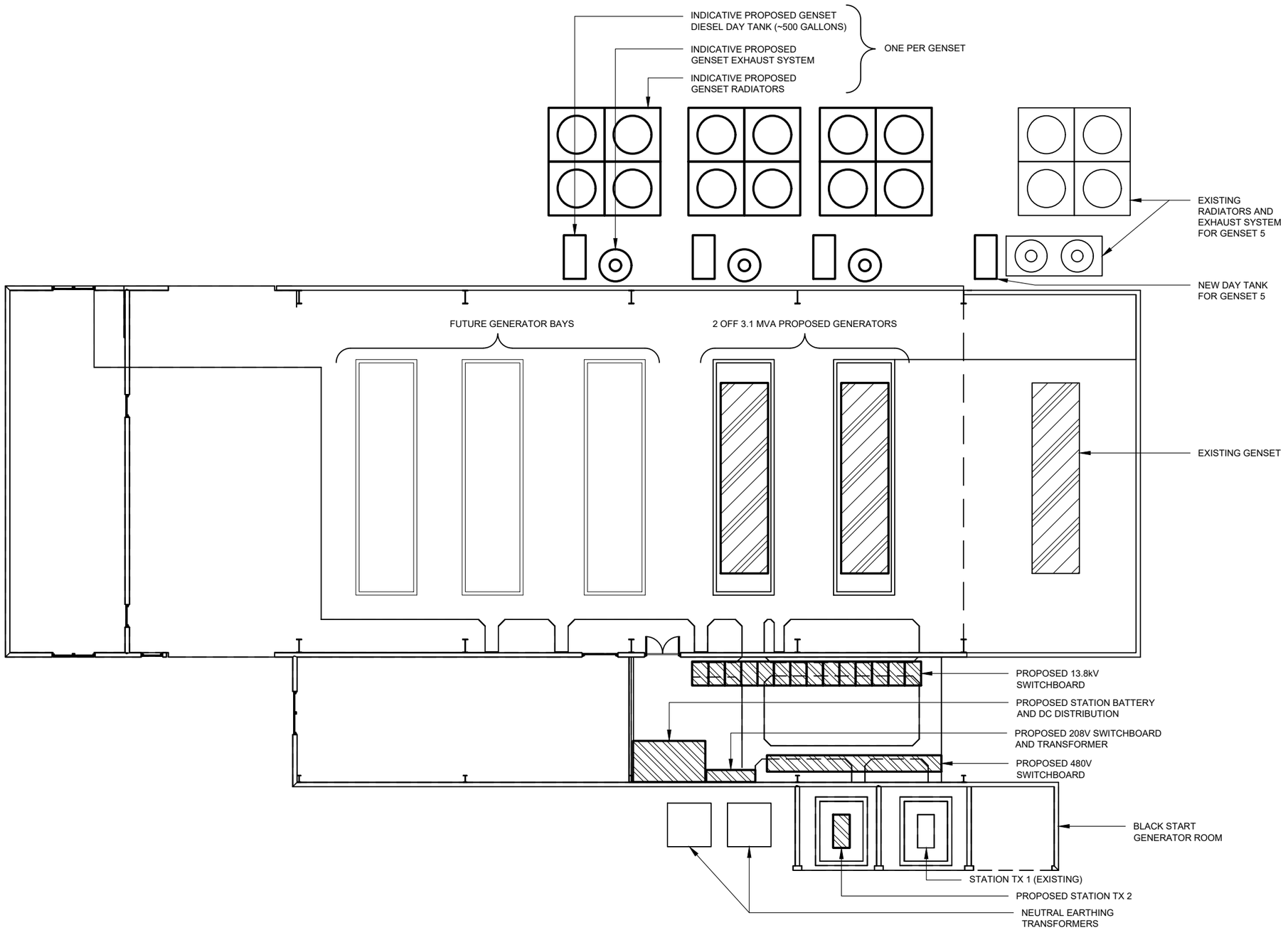
ADDRESS MAJURO
MARSHALL ISLANDS, ----

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	29/11/18
REV. DATE	19/3/19

DRAWING NO. **A0285-E-263**

REV NO. **1**

G:\Work\0Projects\A0285 WB RMI Owners Engineer PV&BESS May2018\3Work in Progress\3. PV system design\Design drawings\CAD\E-263 GENSET WASTEWATER PID.dwg, PLOTTED BY MATTHEW O'REGAN AT 3/6/2019 9:17 AM



1 / - POWER STATION EQUIPMENT LAYOUT

SCALE: 1:200

FOR TENDER

NO.	STAGE	DATE
1	RELOCATE GENERATORS, ADD EARTHING TRANSFORMERS	19/03/19
2	REMOVED GENERATOR 10	31/05/19
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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DRAWN	WJ / MPOR
CHECKED	LF
APPROVED	JM

DRAWING **POWER STATION EQUIPMENT LAYOUT**

PROJECT SEDEP RMI OWNERS ENGINEER

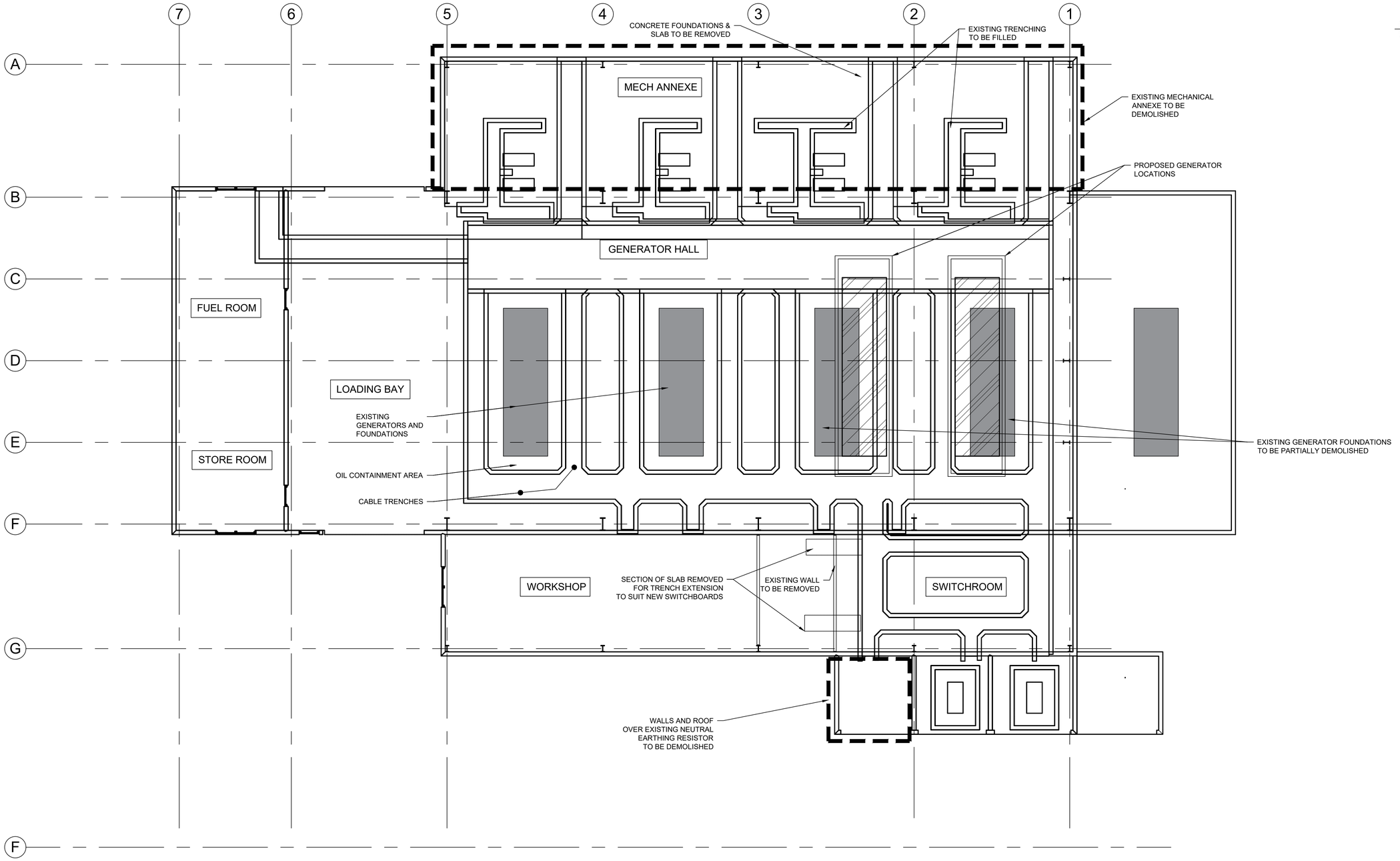
CLIENT GOVERNMENT OF RMI

ADDRESS MAJURO
MARSHALL ISLANDS, ----

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	29/11/18
REV. DATE	31/5/19

DRAWING NO. **A0285-E-310**

REV NO. **1**



1 - PLAN-GROUND FLOOR

SCALE: 1:100

FOR TENDER

NO.	STAGE	DATE
1	RELOCATED GENERATORS, DEMOLITION AREAS (MPOR)	20/03/19
2	REMOVED GENERATOR 10	03/06/19
3	####	####
4	####	####
5	####	####
6	####	####

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DRAWN	WJ
CHECKED	LF
APPROVED	JM

DO NOT SCALE.
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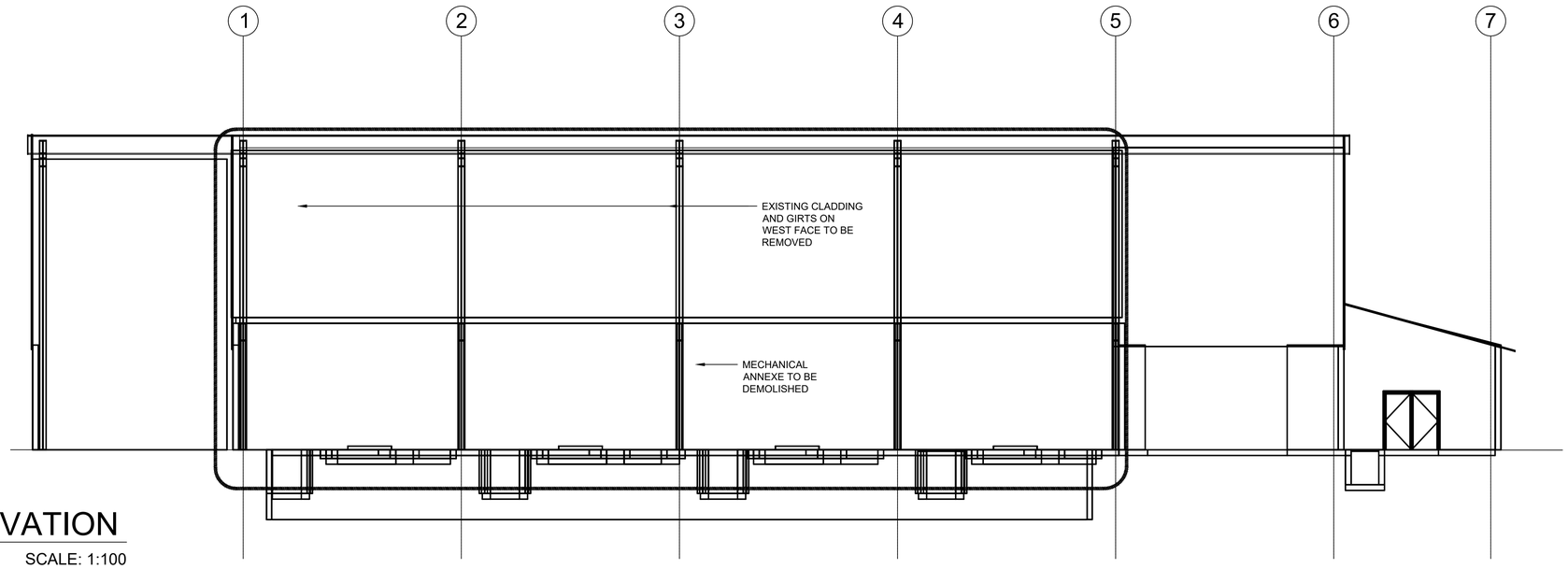
DRAWING **POWER STATION DEMOLITION PLAN**

PROJECT SEDEP RMI OWNERS ENGINEER

CLIENT GOVERNMENT OF RMI

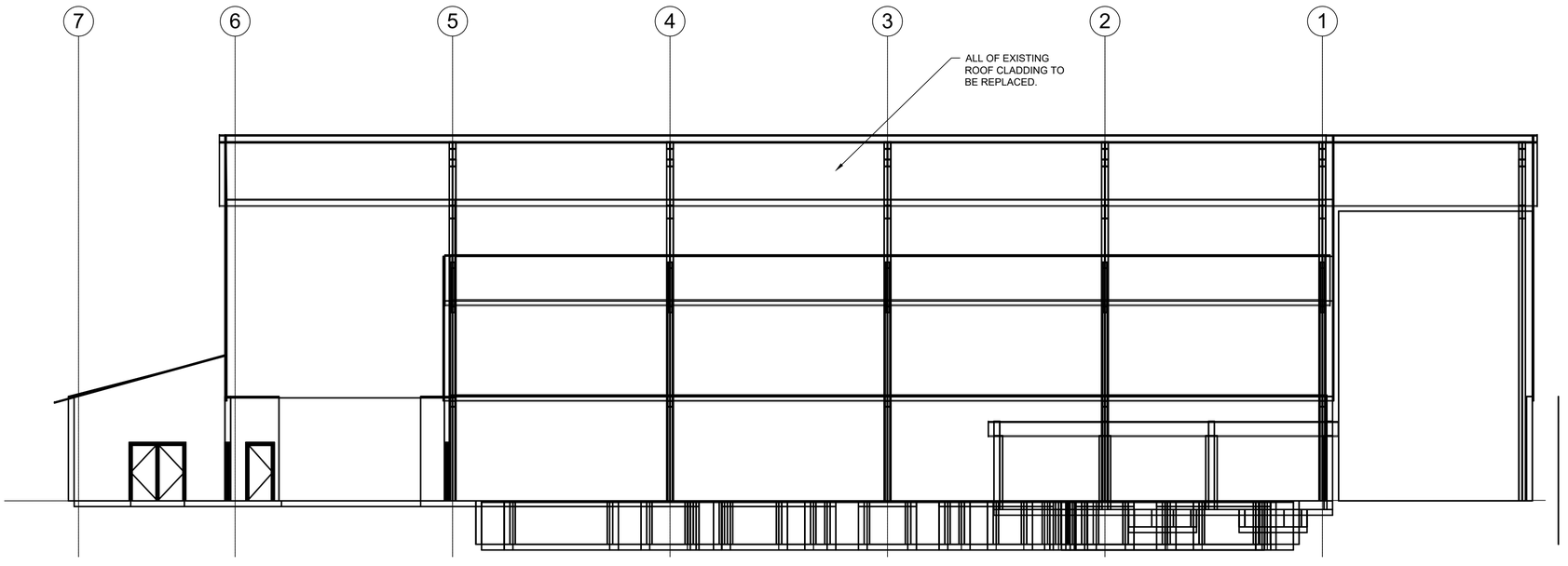
ADDRESS MAJURO
MARSHALL ISLANDS, ----

SCALE	AS NOTED
SHEET SIZE	A1
ORIG. DATE	28/11/18
REV. DATE	3/6/19
DRAWING NO.	**A0285-S-411**
REV NO.	**1**



1 / - WEST ELEVATION

SCALE: 1:100



2 / - EAST ELEVATION

SCALE: 1:100

FOR TENDER

NO.	STAGE	DATE
1	EXTENDED DEMOLITION AREA (MPOR)	20/03/19
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

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APPROVED	JM

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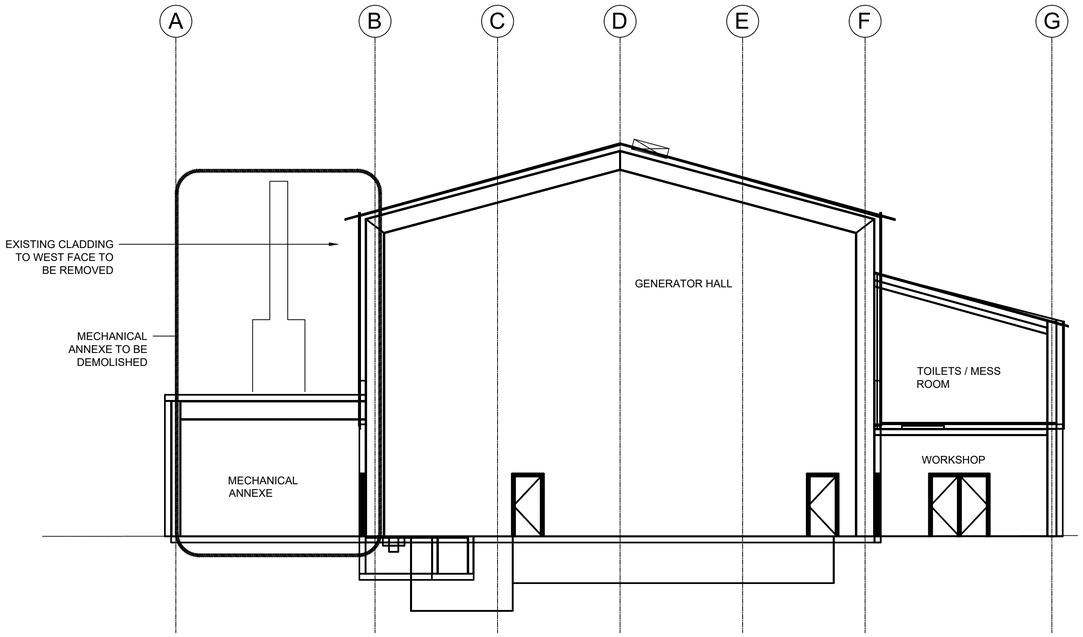
ALL MEASUREMENTS IN MM UNLESS OTHERWISE STATED.

DRAWING **POWER STATION DEMOLITION ELEVATIONS**

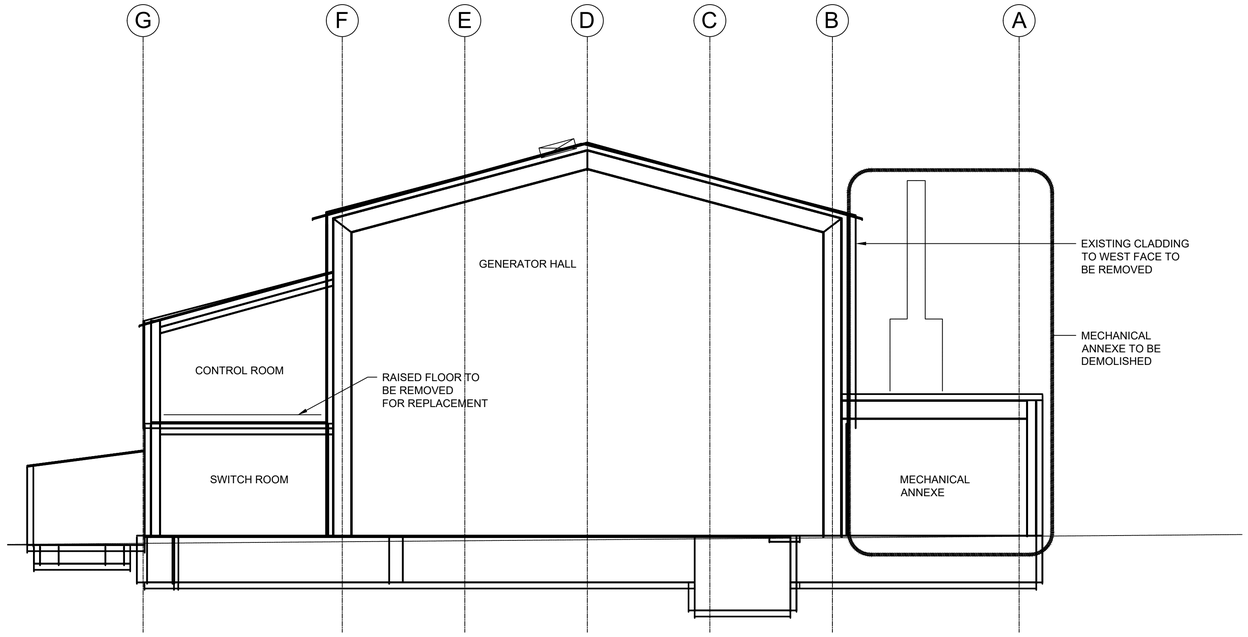
PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----
DRAWING NO.	**A0285-S-412**

SCALE	AS NOTED
SHEET SIZE	A1
ORIG. DATE	28/11/18
REV. DATE	22/3/19
REV NO.	**1**



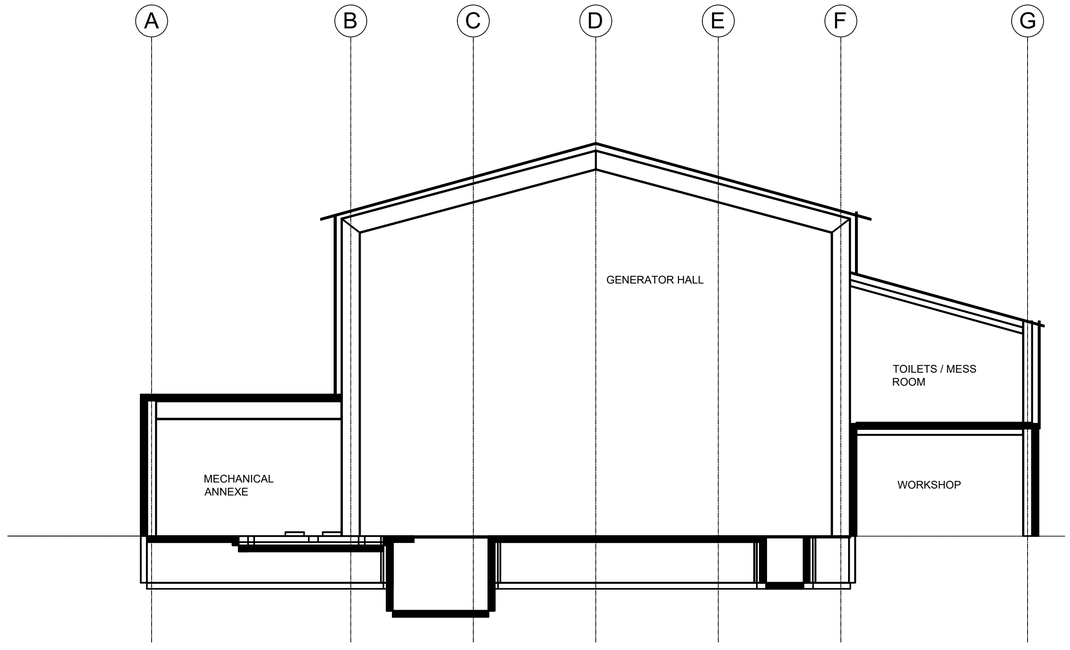
1 - SOUTH ELEVATION

SCALE: 1:100



2 - NORTH ELEVATION

SCALE: 1:100



3 - TYP. BUILDING ELEVATION

SCALE: 1:100

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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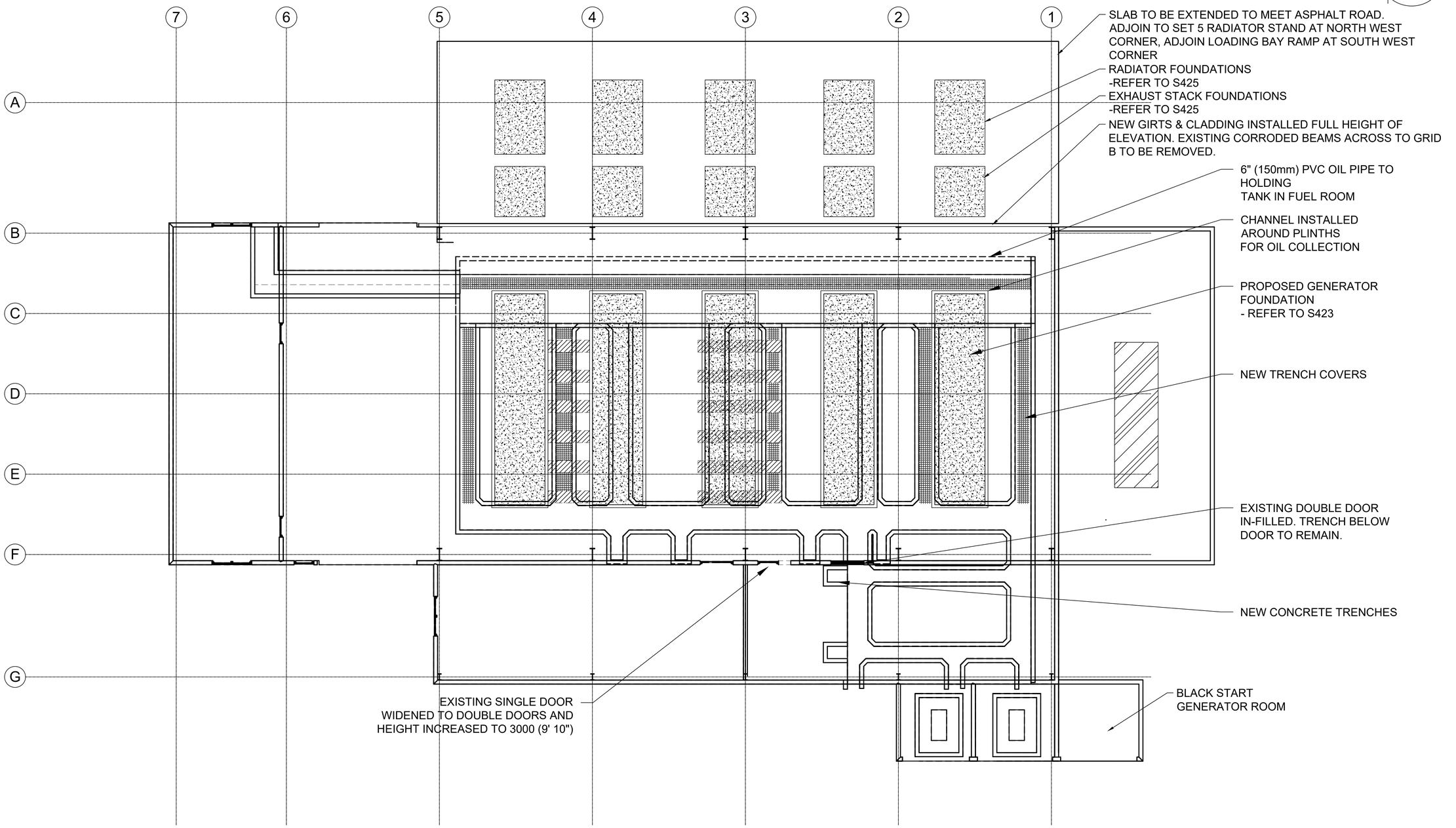
DRAWN	WJ
CHECKED	LF
APPROVED	JM

DO NOT SCALE.
ALL MEASUREMENTS IN MM UNLESS OTHERWISE STATED.

DRAWING **POWER STATION DEMOLITION ELEVATIONS & SECTION**

PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----
DRAWING NO.	**A0285-S-413**

SCALE	AS NOTED
SHEET SIZE	A1
ORIG. DATE	28/11/18
REV. DATE	22/3/19
REV NO.	----



1 - PROPOSED GROUND FLOOR ALTERATIONS

SCALE: 1:100

FOR TENDER

NO.	STAGE	DATE
1	RELOCATE GENERATORS, FOUNDATION DESIGN (SG)	20/03/19
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

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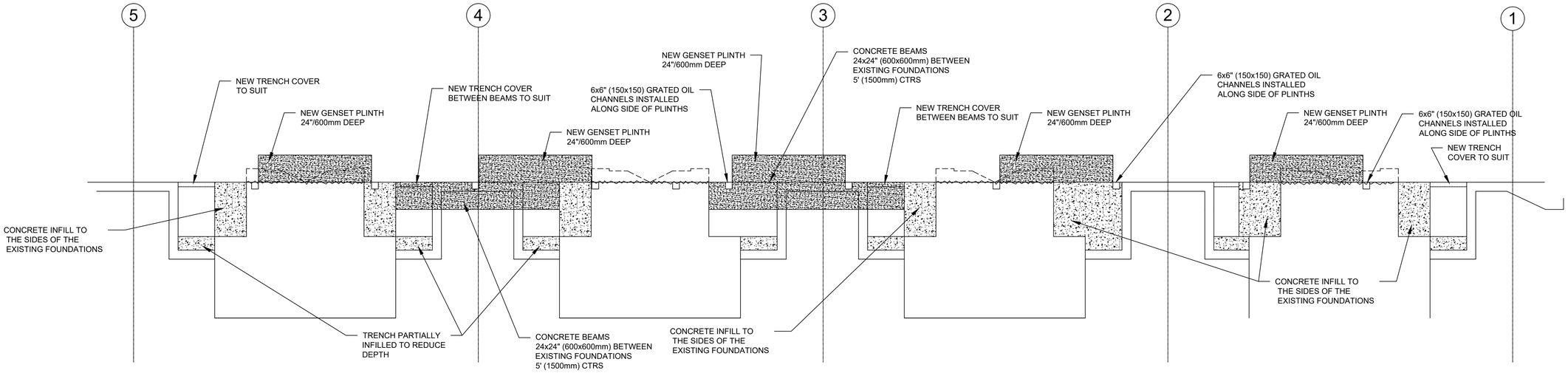
DRAWN	WJ/SG
CHECKED	LF
APPROVED	JM

DRAWING **POWER STATION GROUND FLOOR ALTERATIONS**

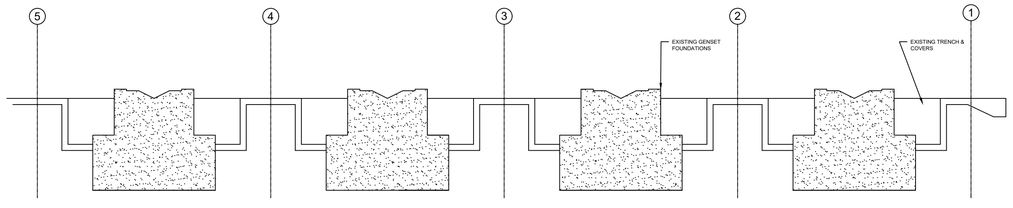
PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----
DRAWING NO.	**A0285-S-422**

SCALE	AS NOTED
SHEET SIZE	A1
ORIG. DATE	29/11/18
REV. DATE	22/3/19
REV NO.	**1**



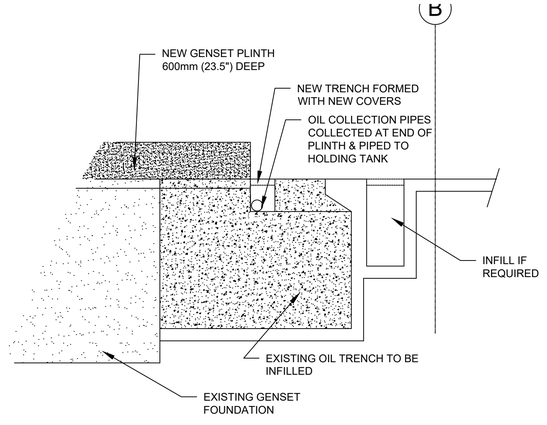
1 / S422 **SECTION GENERATOR FOUNDATION ALTERATIONS**

SCALE: 1:100



2 / S422 **SECTION EXISTING GENERATOR FOUNDATION**

SCALE: 1:200



3 / S422 **SECTION GENERATOR FOUNDATION ALTERATIONS**

SCALE: 1:50

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

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DRAWN	SG
CHECKED	LF
APPROVED	JM

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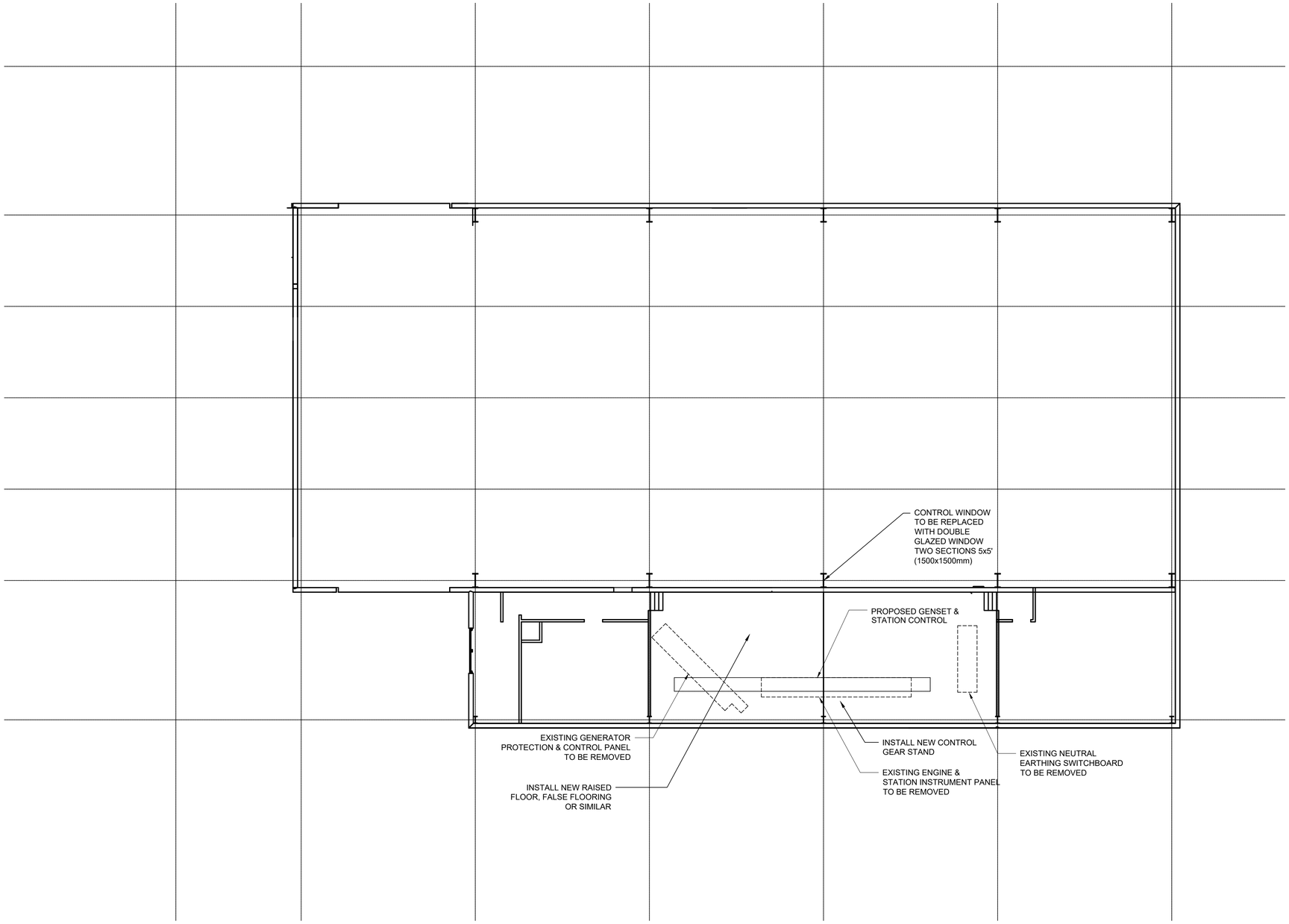
DRAWING	**POWER STATION FOUNDATION SECTIONS** ----
PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----
DRAWING NO.	**A0285-S-423**

SCALE	AS NOTED
SHEET SIZE	A1
ORIG. DATE	29/11/18
REV. DATE	21/3/19
REV NO.	----



1
-

PROPOSED FIRST FLOOR ALTERATIONS

SCALE: 1:100

FOR TENDER

NO.	STAGE	DATE
1	RELOCATED NEW SWITCHBOARD (MPOR)	20/03/19
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

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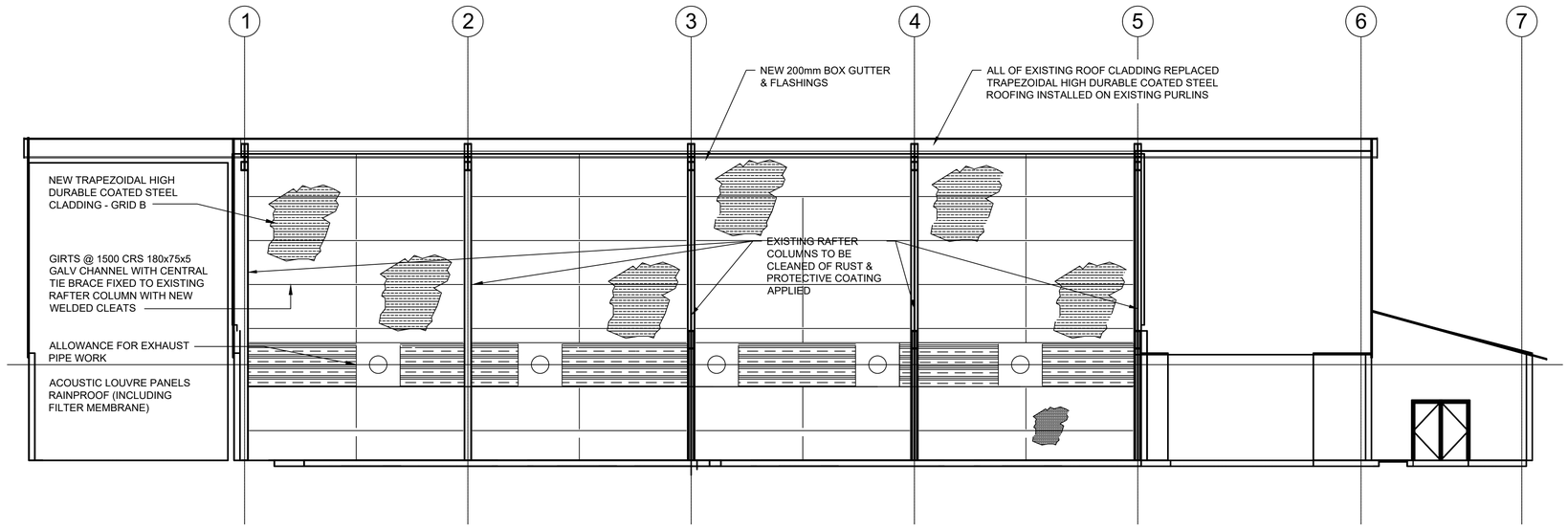
DRAWN	WJ
CHECKED	LF
APPROVED	JM

DO NOT SCALE.
ALL MEASUREMENTS IN MM UNLESS OTHERWISE STATED.

DRAWING **POWER STATION FIRST FLOOR ALTERATIONS**

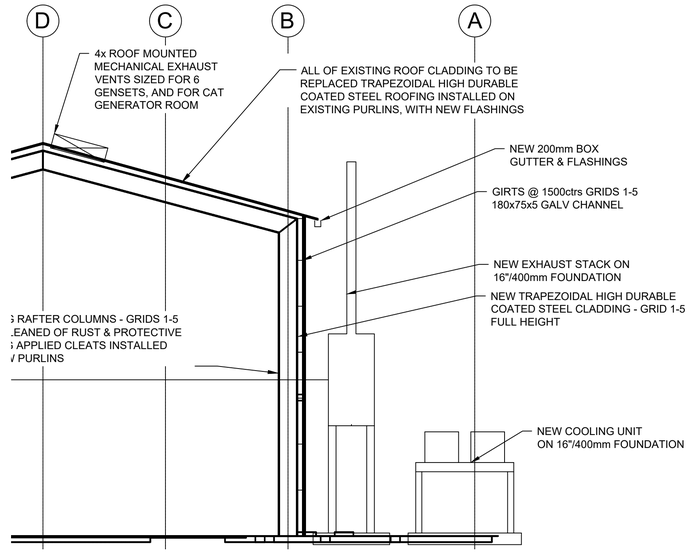
PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----

SCALE	AS NOTED
SHEET SIZE	A1
ORIG. DATE	29/11/18
REV. DATE	20/3/19
DRAWING NO.	**A0285-S-424**
REV NO.	**1**



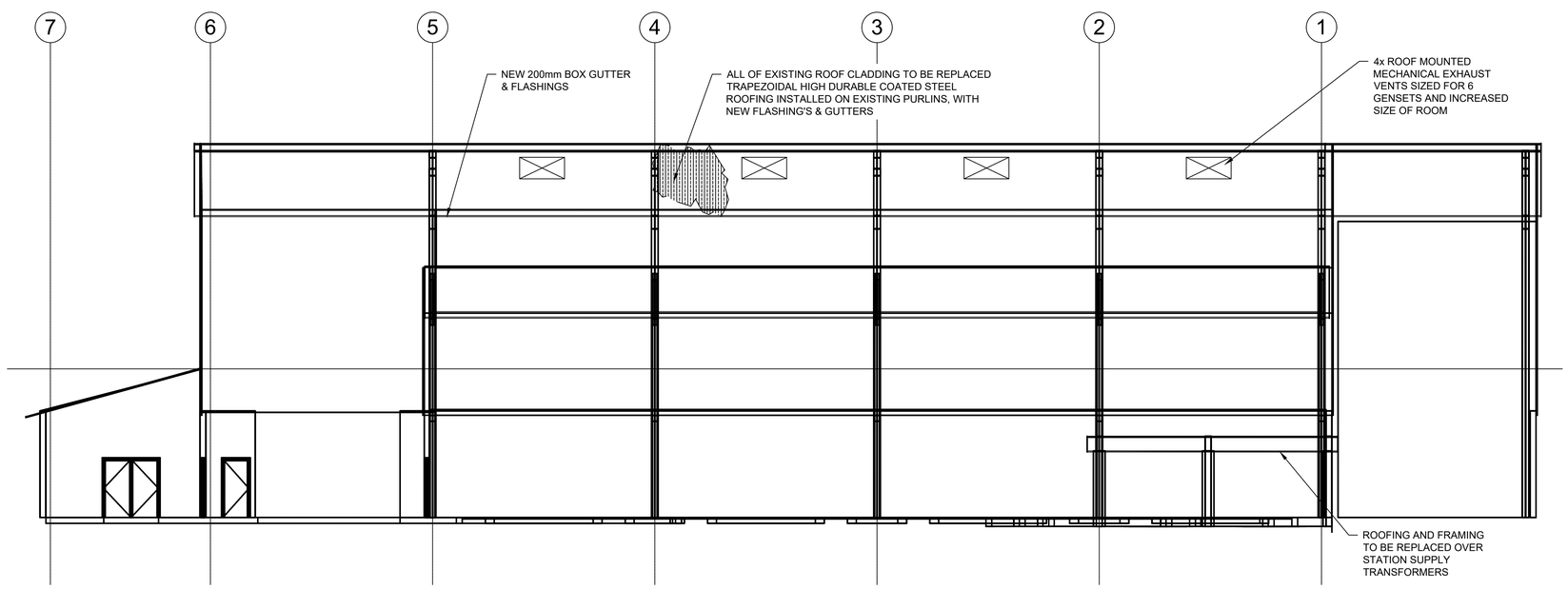
1 - WEST ELEVATION

SCALE: 1:100



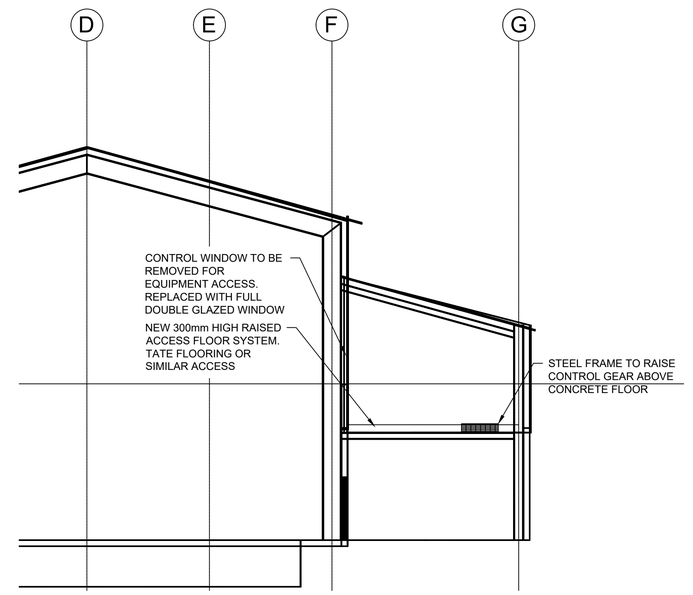
2 - PART NORTH ELEVATION

SCALE: 1:100



3 - EAST ELEVATION

SCALE: 1:100



4 - PART SECTION CONTROL ROOM

SCALE: 1:100

FOR TENDER

NO.	STAGE	DATE
1	RELOCATED EXHAUSTS (MPOR)	20/03/19
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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AUSTRALIA

DRAWN	WJ
CHECKED	LF
APPROVED	JM

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DRAWING **POWER STATION ELEVATIONS**

PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----
DRAWING NO.	**A0285-S-425**

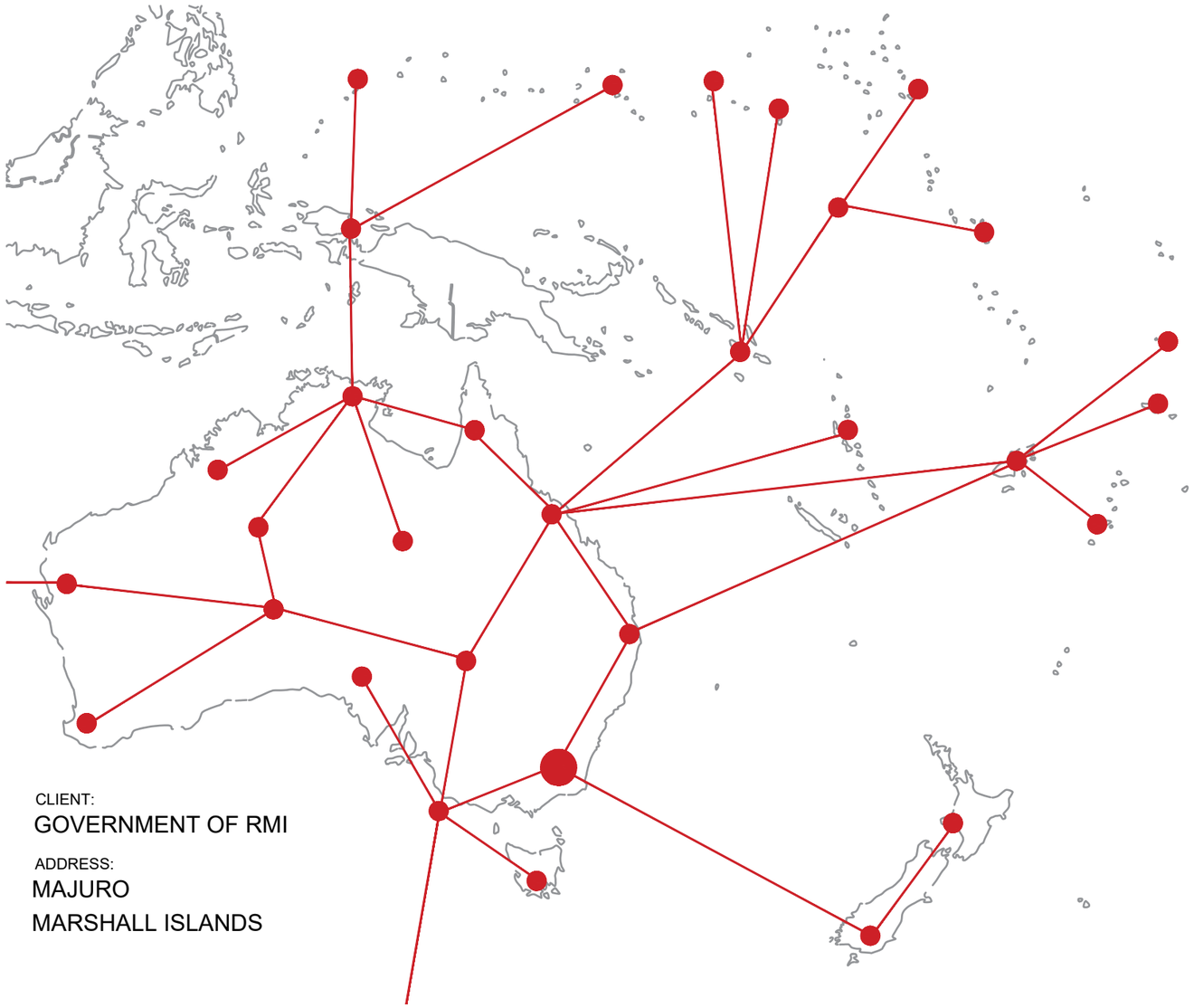
SCALE	AS NOTED
SHEET SIZE	A1
ORIG. DATE	29/11/18
REV. DATE	22/3/19
REV NO.	**1**

SEDEP RMI OWNERS ENGINEER

LOT 2: PV DESIGN AND BUILD CONTRACT

A0285

FOR TENDER



CLIENT:
GOVERNMENT OF RMI

ADDRESS:
MAJURO
MARSHALL ISLANDS

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Consulting | Engineering | Implementation

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f +61 (0) 2 6257 6511

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IT Power (Australia)

SHEET LIST

Sheet Number	Sheet Title
G-010	MAIN TITLE SHEET
G-020	SHEET LIST
G-040	LOCATION PLAN
C-110	RESERVOIR PREPARATORY WORKS
E-210	NETWORK SLD
E-311	RESERVOIRS
E-312	MIHS
E-313	RITA ELEMENTARY SCHOOL
E-314	DELAP ELEMENTARY SCHOOL
~~E-315~~	~~LAURA HIGH SCHOOL~~
E-316	LONG ISLAND ELEMENTARY SCHOOL
E-317	NORTH DELAP ELEMENTARY SCHOOL
E-318	COLLEGE OF THE MARSHALL ISLANDS
~~E-321~~	~~COOP BASKETBALL COURT~~
~~E-322~~	~~LAURA BASKETBALL~~
E-330	SPORTS COMPLEX NEAR LAURA
E-329	HOSPITAL RESERVOIR

LEGEND	
	TRANSFORMER
	INVERTER
	GENERATOR
	NEUTRAL EARTHING TRANSFORMER
	CT
	VT
	CHANGE-OVER SWITCH
	CIRCUIT BREAKER
	CONTACTOR
	FUSE SWITCH
	BATTERY
	PV SYSTEM

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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O'CONNOR, ACT 2602
AUSTRALIA

DRAWN WJ / MO
CHECKED LF
APPROVED JM

DRAWING **SHEET LIST**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

DRAWING NO. **A0285-G-020**

SCALE AS NOTED
SHEET SIZE A3
ORIG. DATE 7/12/18
REV. DATE 21/3/19
REV NO. -----

1 / - LOCATION PLAN

SCALE: 1:125,000

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

PARTNERS

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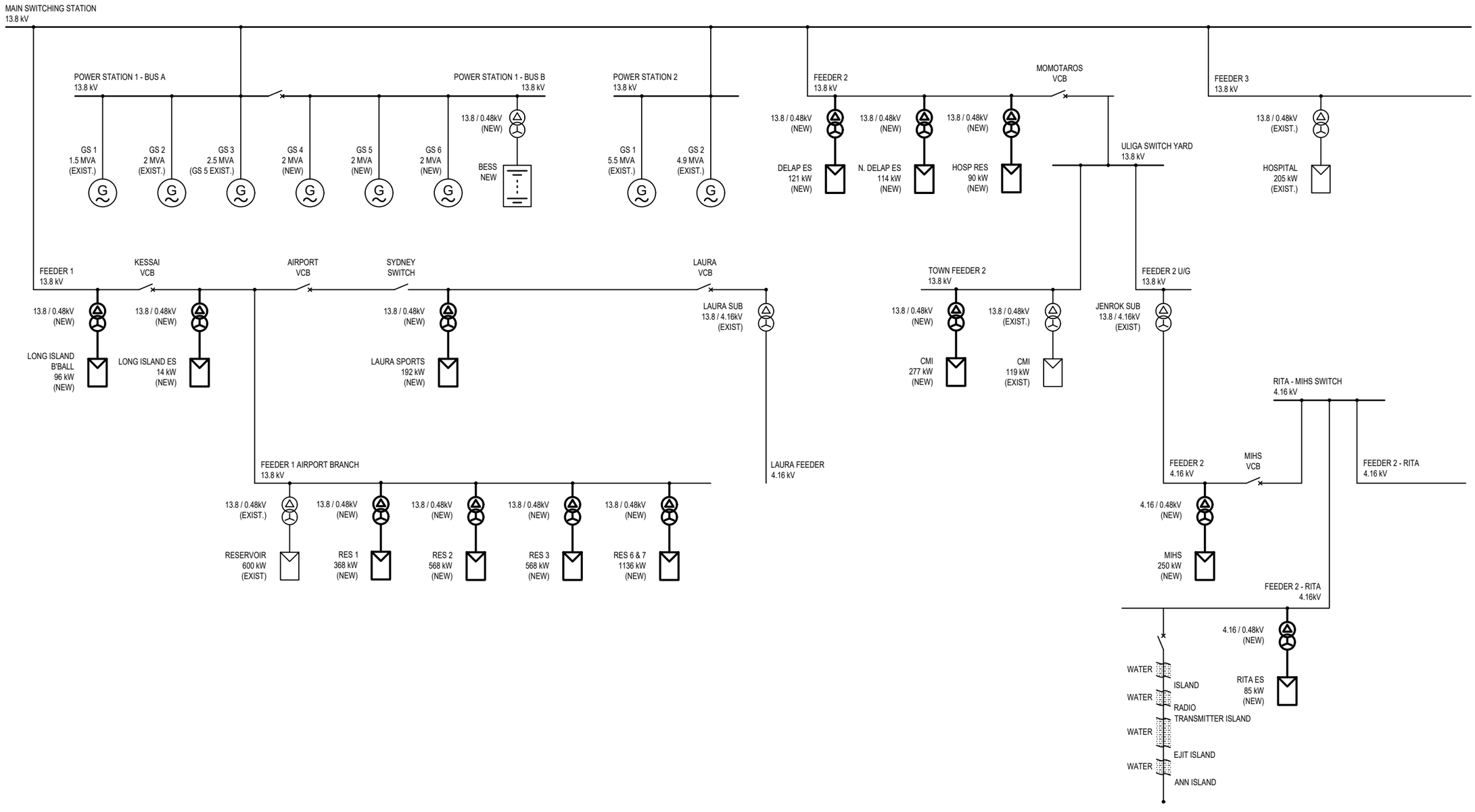
AUSTRALIA

DRAWN	LF
CHECKED	JM
APPROVED	JM

DO NOT SCALE.
ALL MEASUREMENTS IN MM UNLESS OTHERWISE STATED.

DRAWING	**LOCATION PLAN** ----
PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----
DRAWING NO.	**A0285-G-040**

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	19/7/18
REV. DATE	21/3/19
REV NO.	----



FOR TENDER

NO.	STAGE	DATE
1	REVISIONS FROM MEC (MPOR)	19/03/19
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

PARTNERS

ener-g

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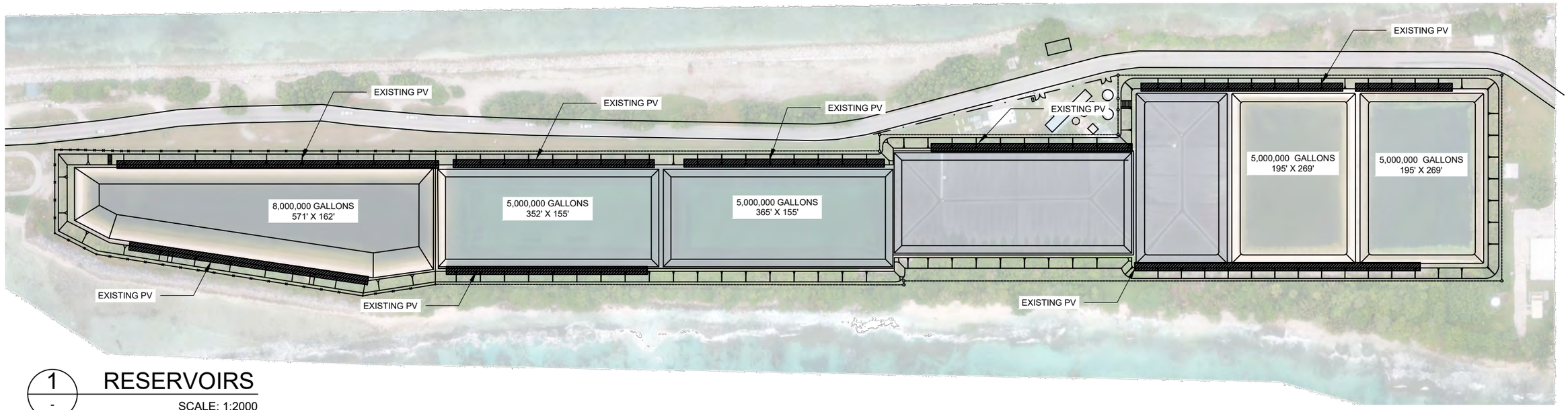
DRAWN	LF
CHECKED	JM
APPROVED	JM

DRAWING	**NETWORK SLD**

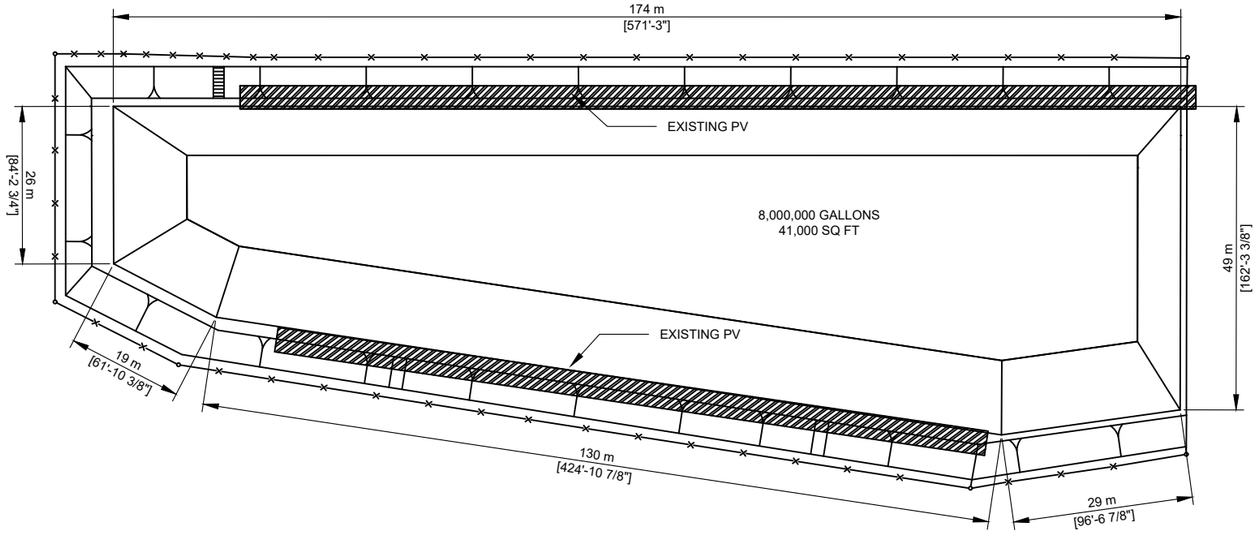
PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----
DRAWING NO.	**A0285-E-210**

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	20/9/18
REV. DATE	16/5/19
REV NO.	**2**

NOTE
1. LINES ARE TO BE REPLACED FOR RESERVOIRS 1, 6 & 7.
2. RESERVOIRS 2 & 3 ARE TO BE EMPTIED & CLEANED BY MWSC BEFORE COMMENCED OF WORKS.
3. RESERVOIRS 4 & 5 ARE COVERED FRESH WATER RESERVOIRS AND WILL NOT BE AFFECTED IN ANY WAY BY THIS PROJECT.



1 - RESERVOIRS
SCALE: 1:2000



2 - RESERVOIR 1 DIMENSIONS
SCALE: 1:1000

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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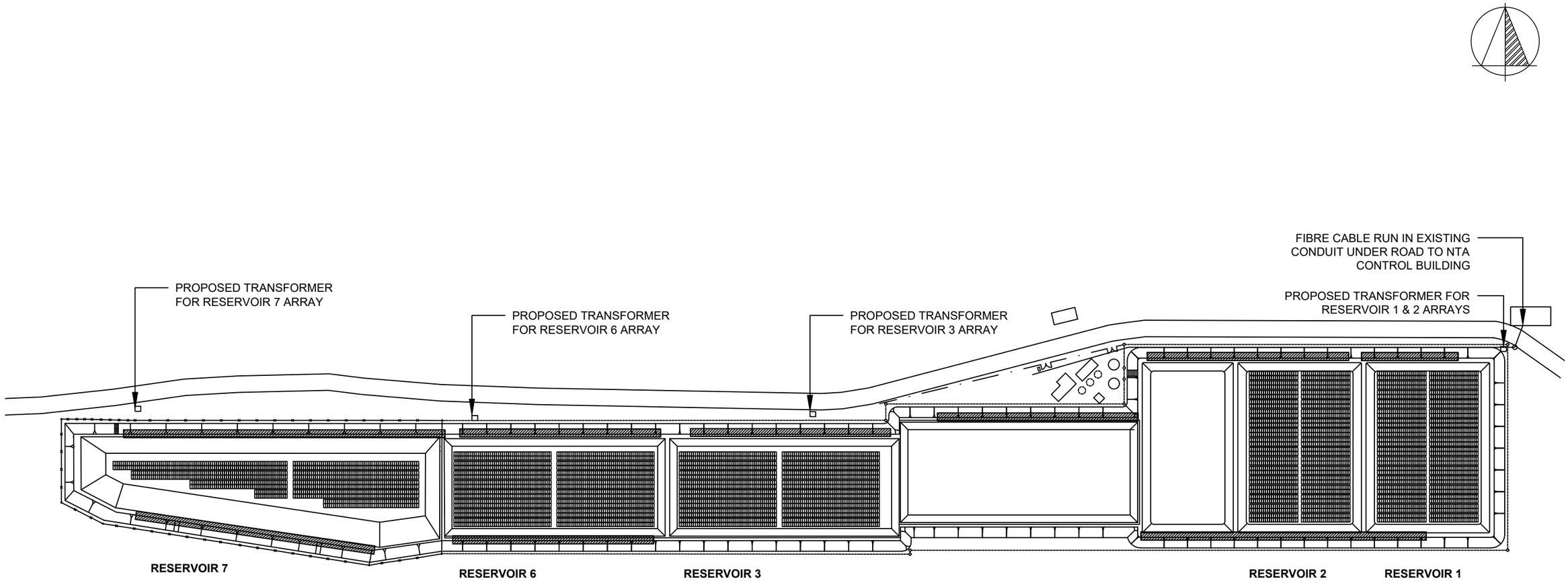
APPROVED JM

DRAWING **RESERVOIR PREPARATORY WORKS**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

DRAWING NO. **A0285-C-110**

SCALE AS NOTED
SHEET SIZE A3
ORIG. DATE 4/12/18
REV. DATE 21/3/19
REV NO. ----



1 - RESERVOIRS ARRAY LAYOUTS

SCALE: 1:2000

FOR TENDER

NO.	STAGE	DATE
1	REVERSED RESERVOIR NUMBERING (MPOR)	20/03/19
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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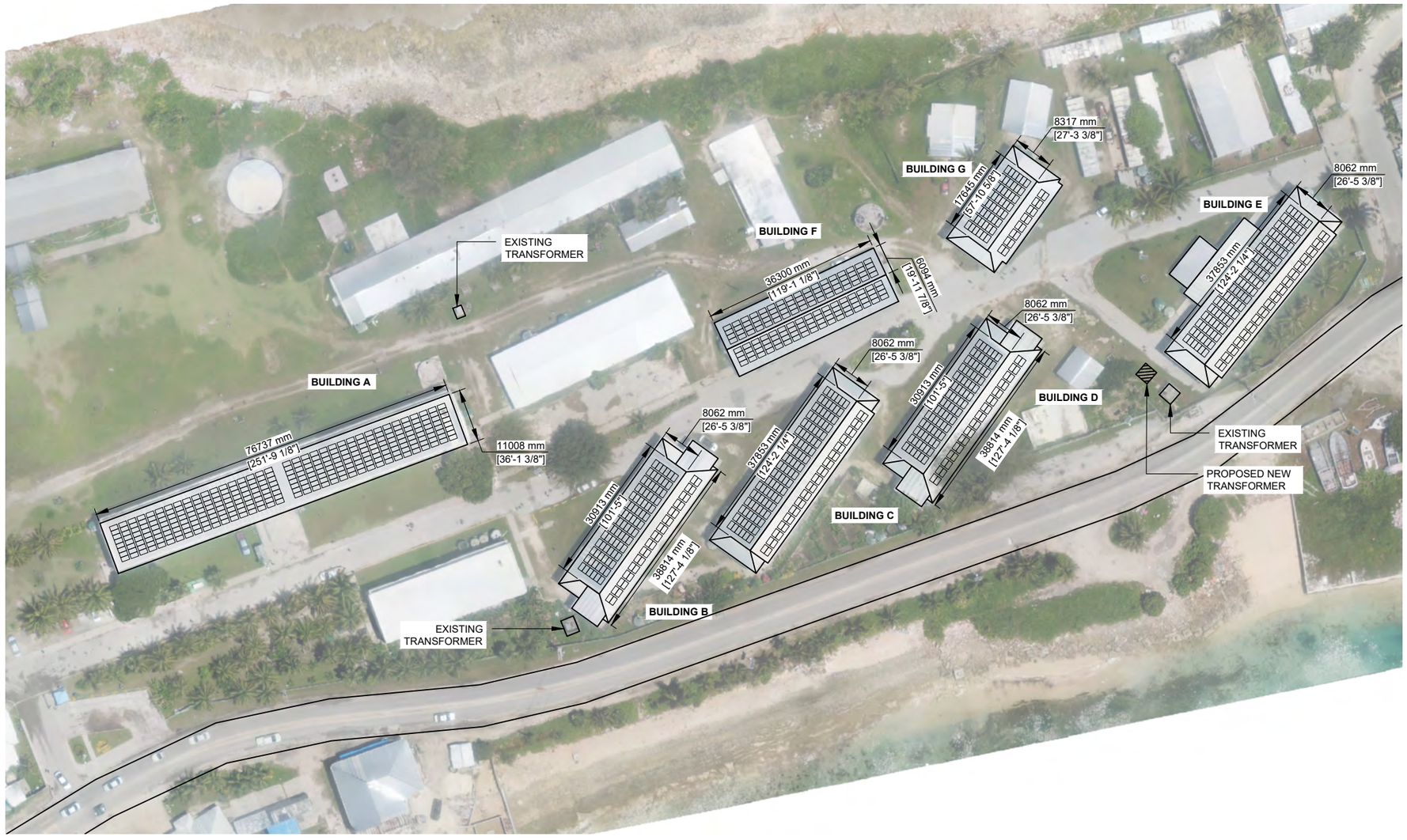
DRAWN	LF
CHECKED	JM
APPROVED	JM

DRAWING **RESERVOIRS**

PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----
DRAWING NO.	**A0285-E-311**

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	23/7/18
REV. DATE	21/3/19
REV NO.	**1**



1 - MIHS ARRAY LAYOUT

SCALE: 1:1000

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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DRAWN	LF
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APPROVED	JM

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ALL MEASUREMENTS IN MM UNLESS OTHERWISE STATED.

DRAWING	**MIHS** ----
PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----
DRAWING NO.	**A0285-E-312**

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	4/10/18
REV. DATE	21/3/19
REV NO.	----

1 RITA ELEMENTARY ARRAY LAYOUT

SCALE: 1:500

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

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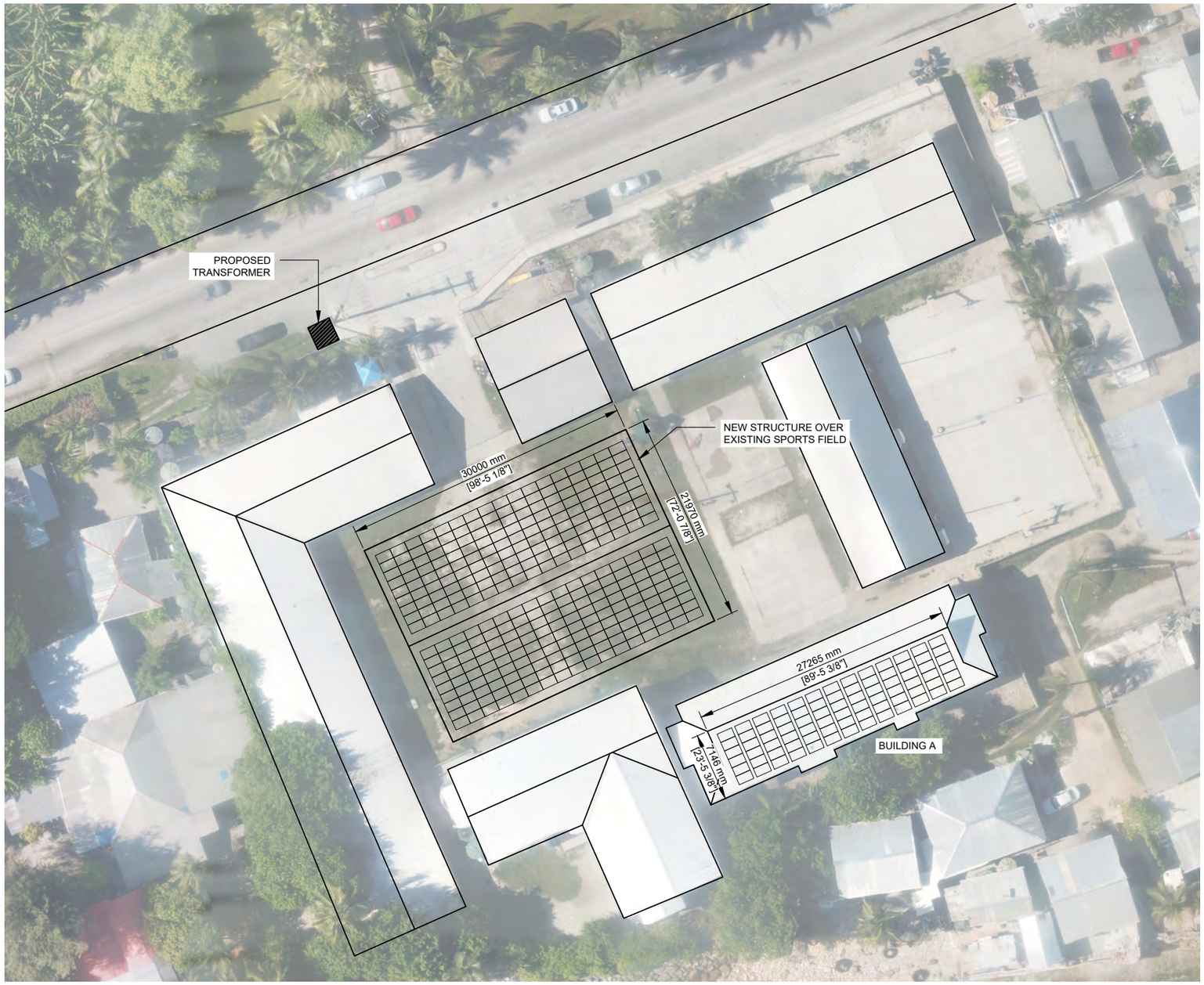
DRAWING	**RITA ELEMENTARY SCHOOL** ----
PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----
DRAWING NO.	**A0285-E-313**

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	4/10/18
REV. DATE	21/3/19
REV NO.	----



1
-

DELAP ELEMENTARY SCHOOL ARRAY LAYOUT

SCALE: 1:500

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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DRAWN LF
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APPROVED JM

DRAWING **DELAP ELEMENTARY SCHOOL**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

DRAWING NO. **A0285-E-314**

SCALE AS NOTED
SHEET SIZE A3
ORIG. DATE 24/10/18
REV. DATE 21/3/19
REV NO. ----

1
-

LONG ISLAND ELEMENTARY SCHOOL ARRAY LAYOUT

SCALE: 1:500

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

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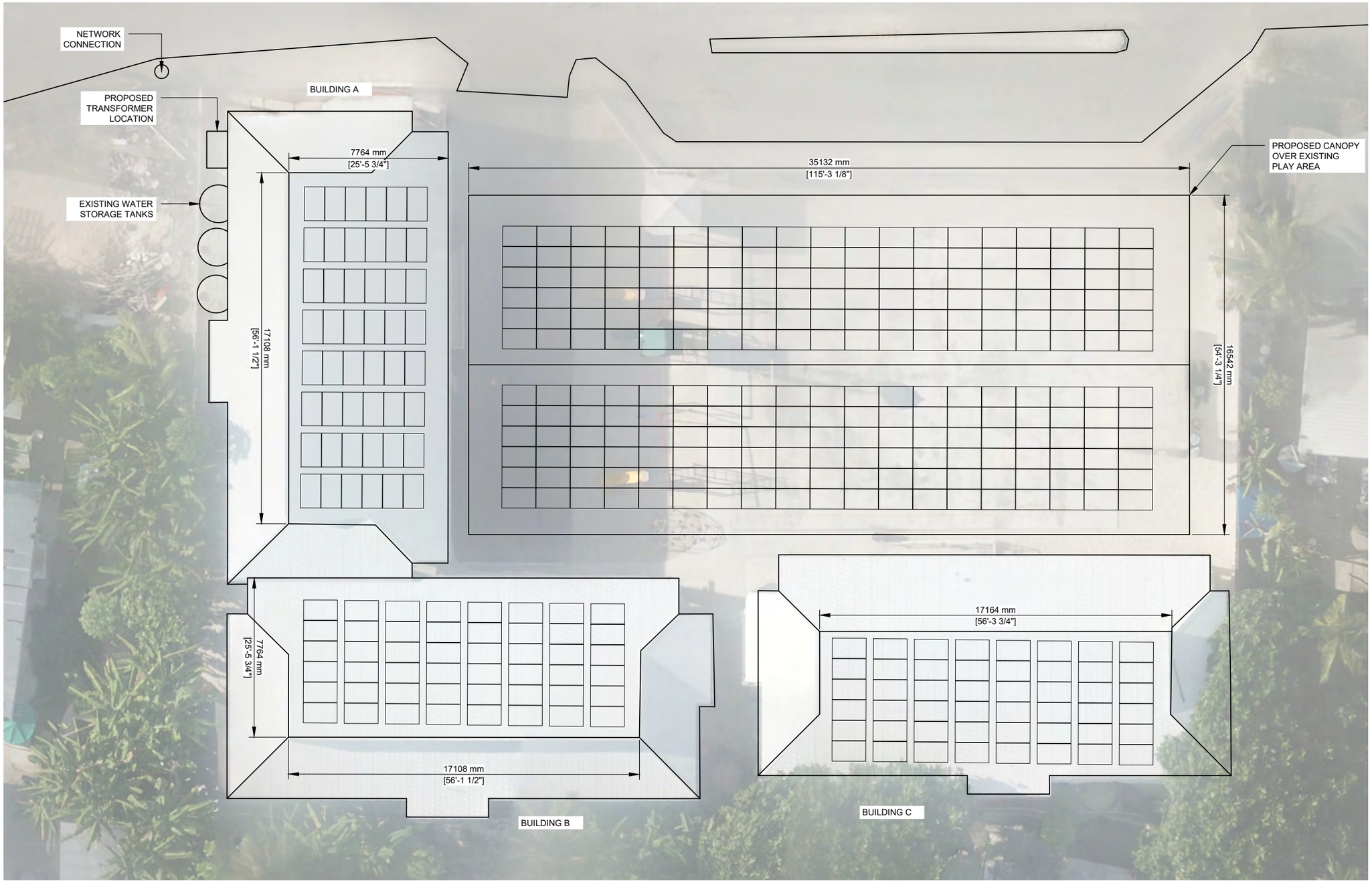
DRAWING **LONG ISLAND ELEMENTARY SCHOOL**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

DRAWING NO. **A0285-E-316**

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	24/10/18
REV. DATE	21/3/19
REV NO.	----



1 - NORTH DELAP ELEMENTARY SCHOOL ARRAY LAYOUT

SCALE: 1:200

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

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APPROVED JM

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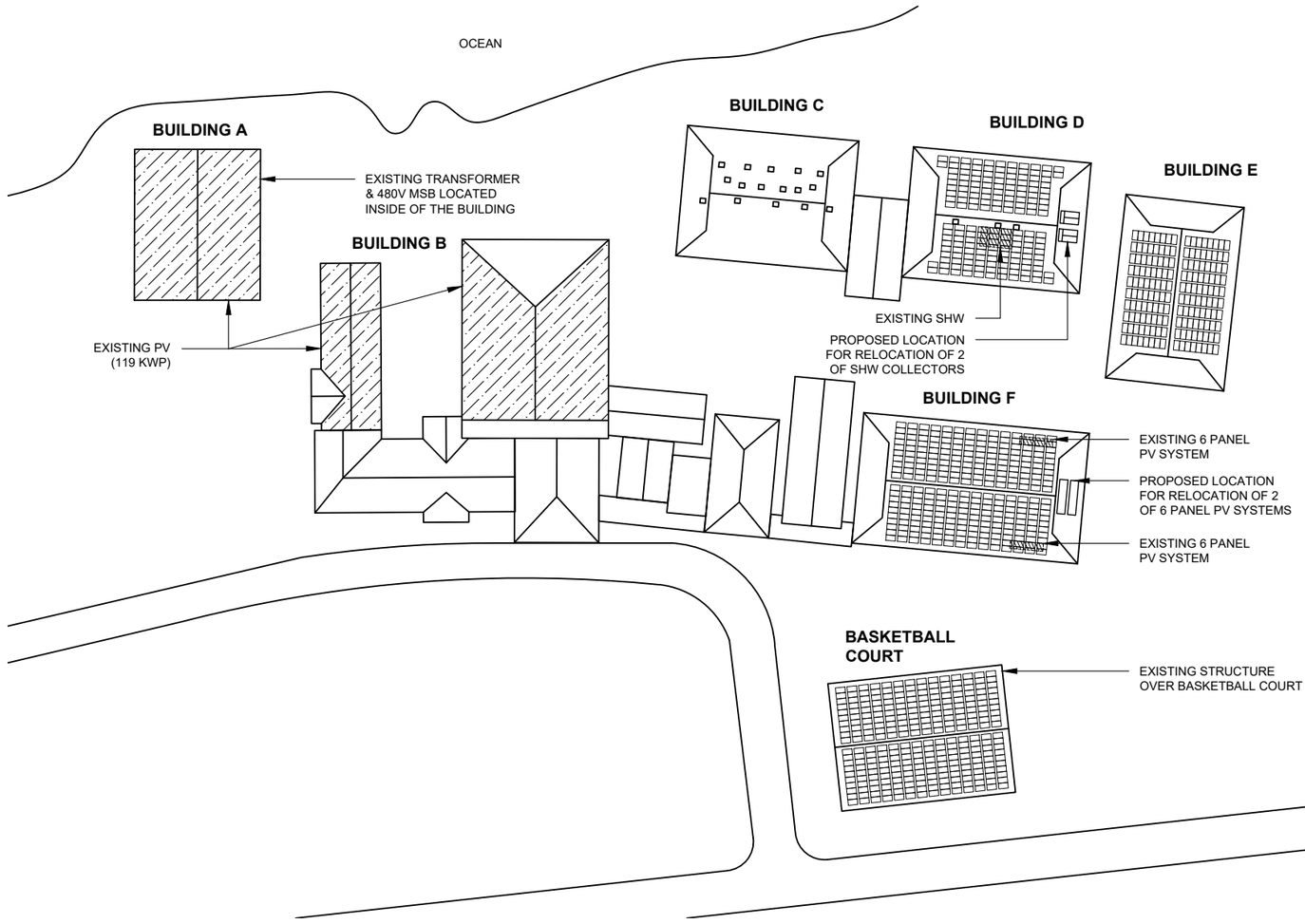
DRAWING **NORTH DELAP ELEMENTARY SCHOOL**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

DRAWING NO. **A0285-E-317**

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	24/10/18
REV. DATE	21/3/19
REV NO.	----



1 - CMI ARRAY LAYOUT

SCALE: 1:1000

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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AUSTRALIA

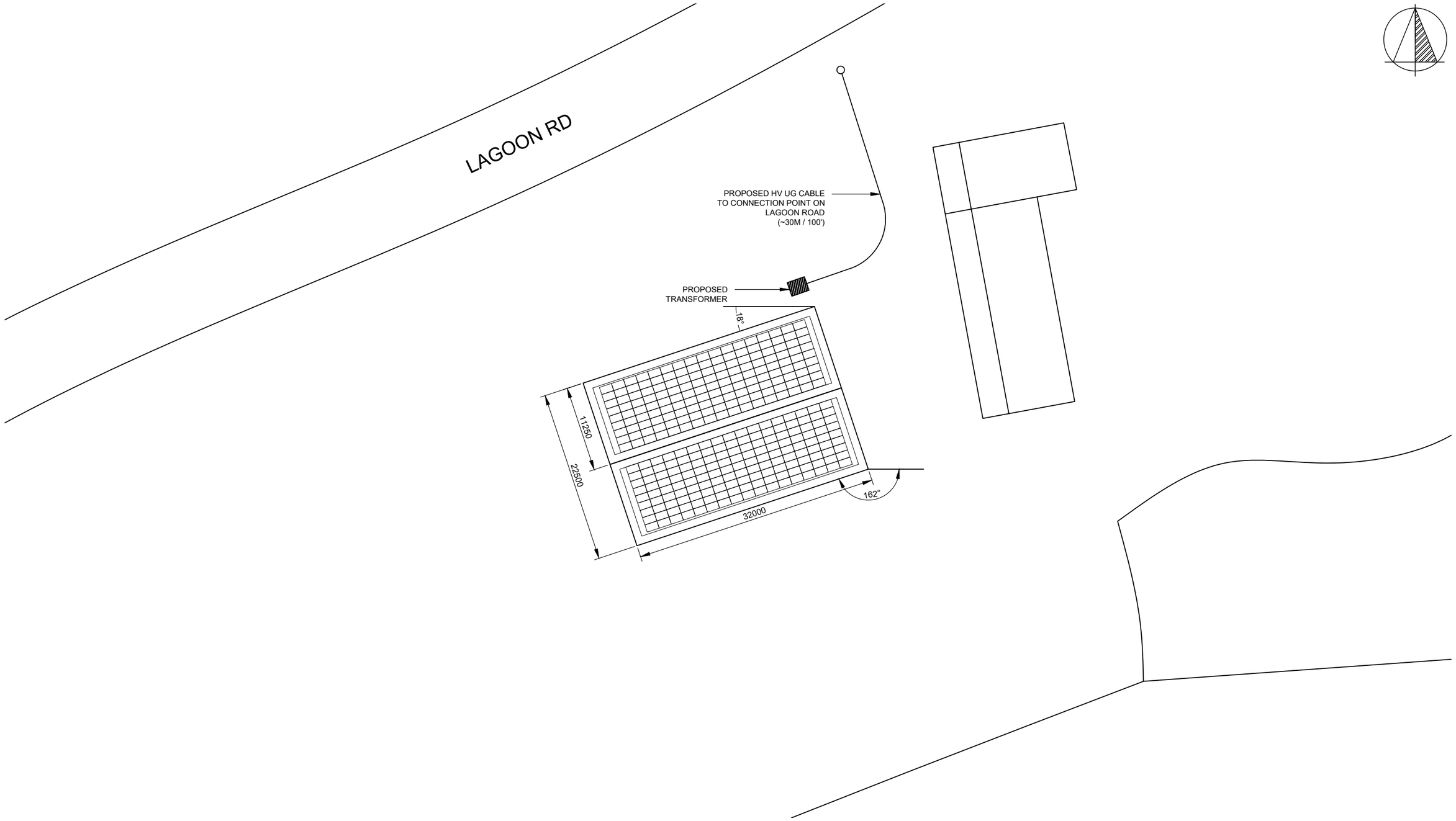
DRAWN WJ
CHECKED LF
APPROVED JM

DRAWING **COLLEGE OF THE MARSHALL ISLANDS**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

DRAWING NO. **A0285-E-318**

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	30/10/18
REV. DATE	21/3/19
REV NO.	----



1 - LONG ISLAND BASKETBALL COURT

SCALE: 1:500

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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DRAWN MPOR
CHECKED JM
APPROVED JM

DRAWING **LONG ISLAND BASKETBALL COURT**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

DRAWING NO. **A0285-E-319**

SCALE AS NOTED
SHEET SIZE A3
ORIG. DATE 24/10/18
REV. DATE 20/3/19
REV NO. -----

1
-

LAURA SPORTS COMPLEX ARRAY LAYOUT

SCALE: 1:500

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

NOTES

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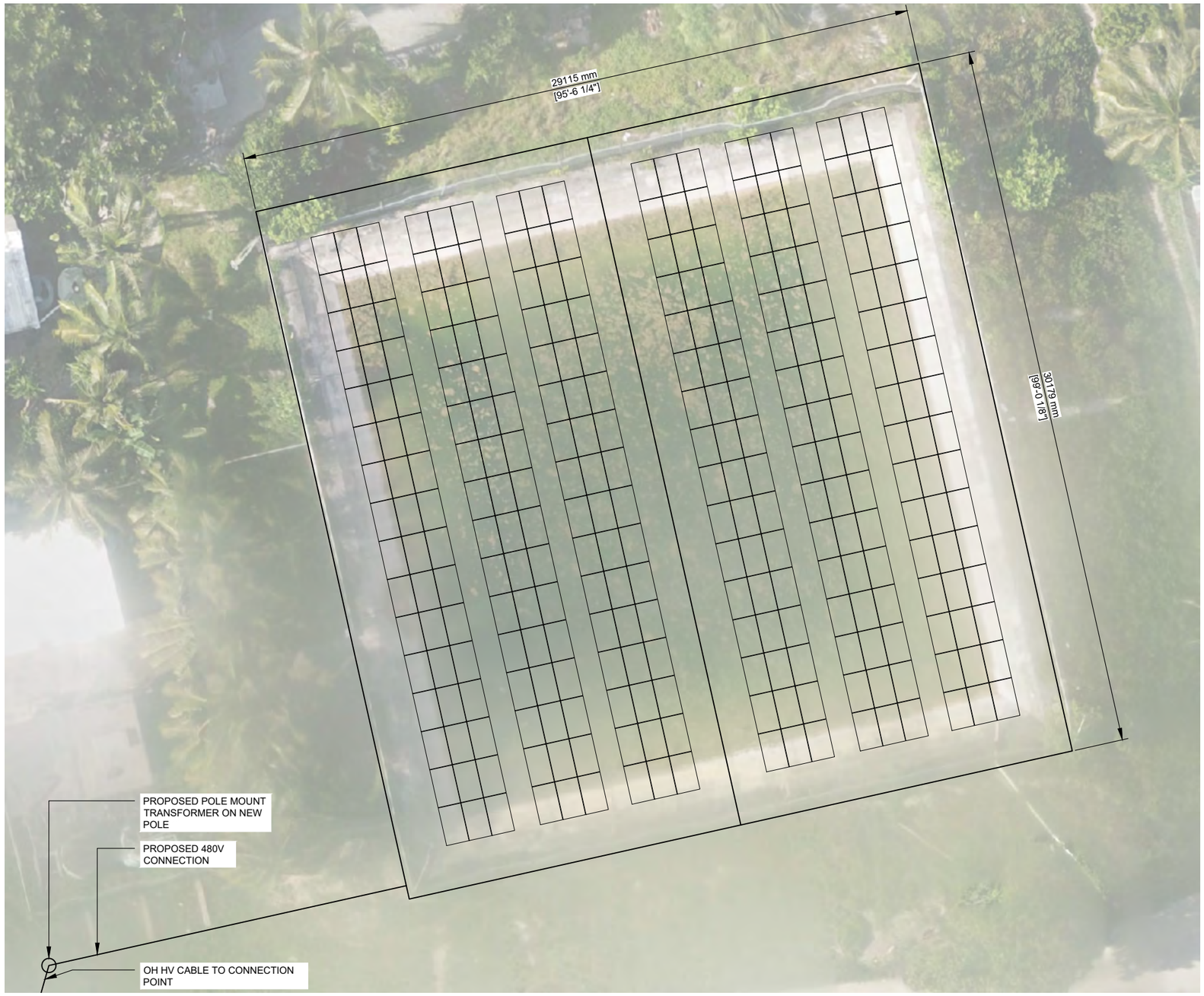
DRAWN	LF
CHECKED	JM
APPROVED	JM

DO NOT SCALE.
ALL MEASUREMENTS IN MM UNLESS OTHERWISE STATED.

DRAWING	**SPORTS COMPLEX NEAR LAURA**

PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----
DRAWING NO.	**A0285-E-330**

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	25/10/18
REV. DATE	21/3/19
REV NO.	----



1
-

HOSPITAL RESERVOIR ARRAY LAYOUT

SCALE: 1:200

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

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AUSTRALIA

DRAWN LF
CHECKED JM
APPROVED JM

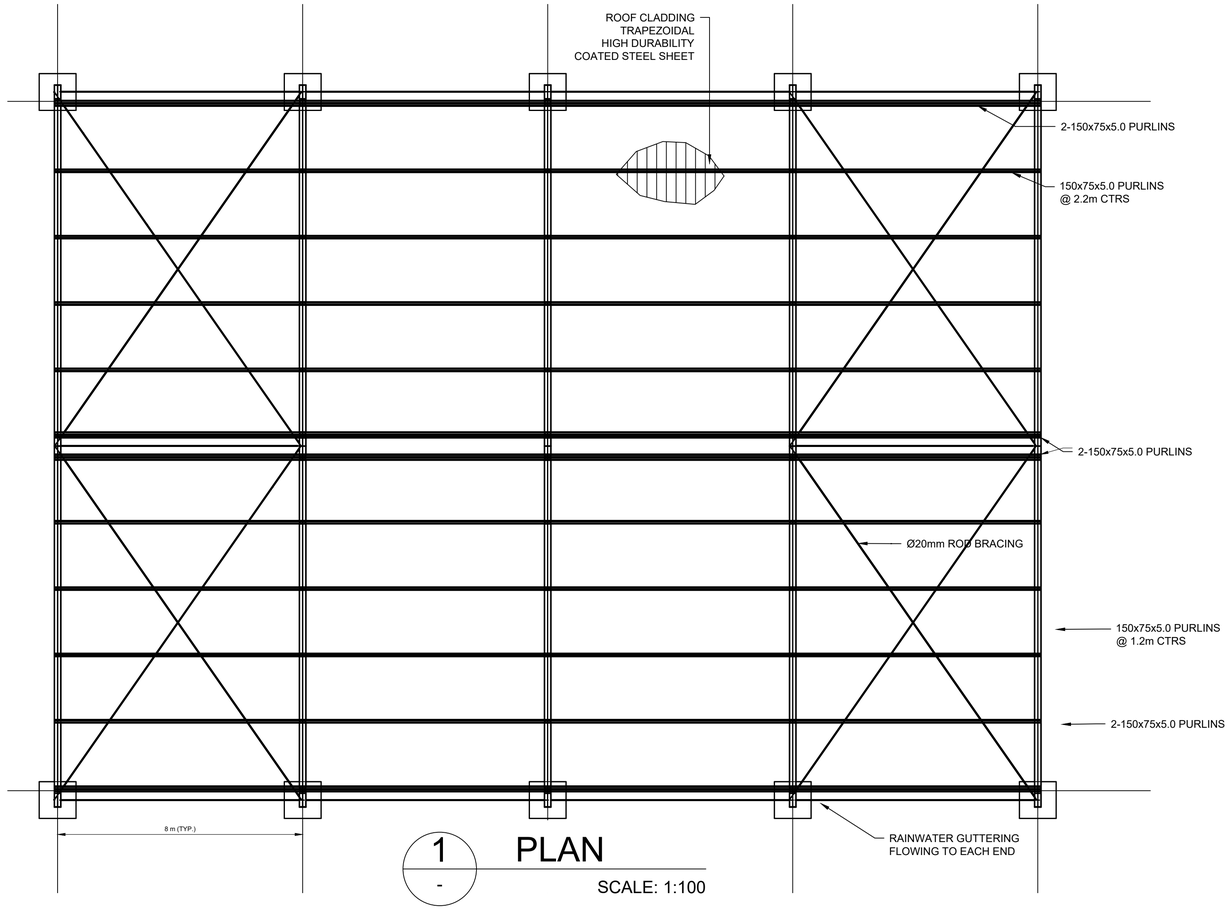
DO NOT SCALE.
ALL MEASUREMENTS IN MM UNLESS OTHERWISE STATED.

DRAWING **HOSPITAL RESERVOIR**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

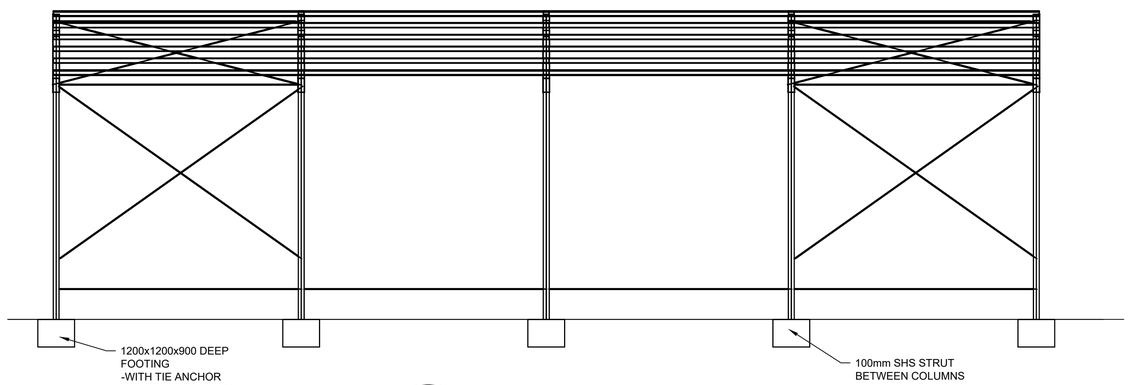
DRAWING NO. **A0285-E-329**

SCALE	AS NOTED
SHEET SIZE	A3
ORIG. DATE	26/10/18
REV. DATE	21/3/19
REV NO.	-----



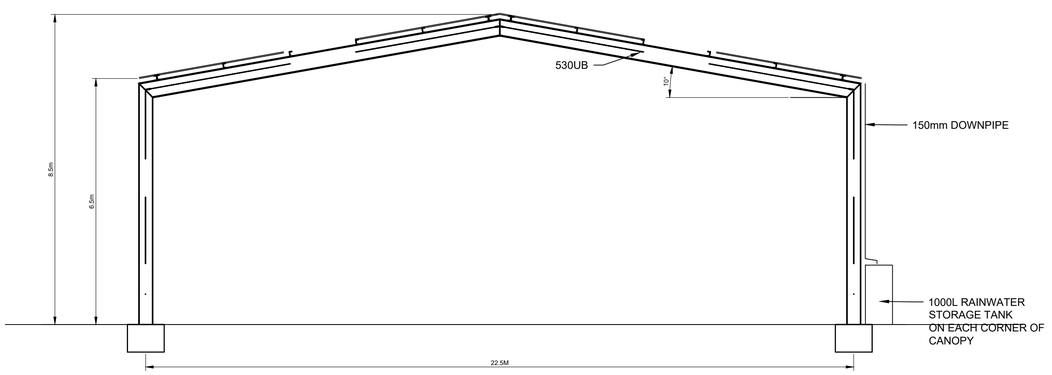
1 / - PLAN

SCALE: 1:100



2 / - ELEVATION

SCALE: 1:100



3 / - SECTION

1:100

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

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AUSTRALIA

DRAWN	WJ / MO
CHECKED	LF
APPROVED	JM

DO NOT SCALE.
ALL MEASUREMENTS IN MM UNLESS OTHERWISE STATED.

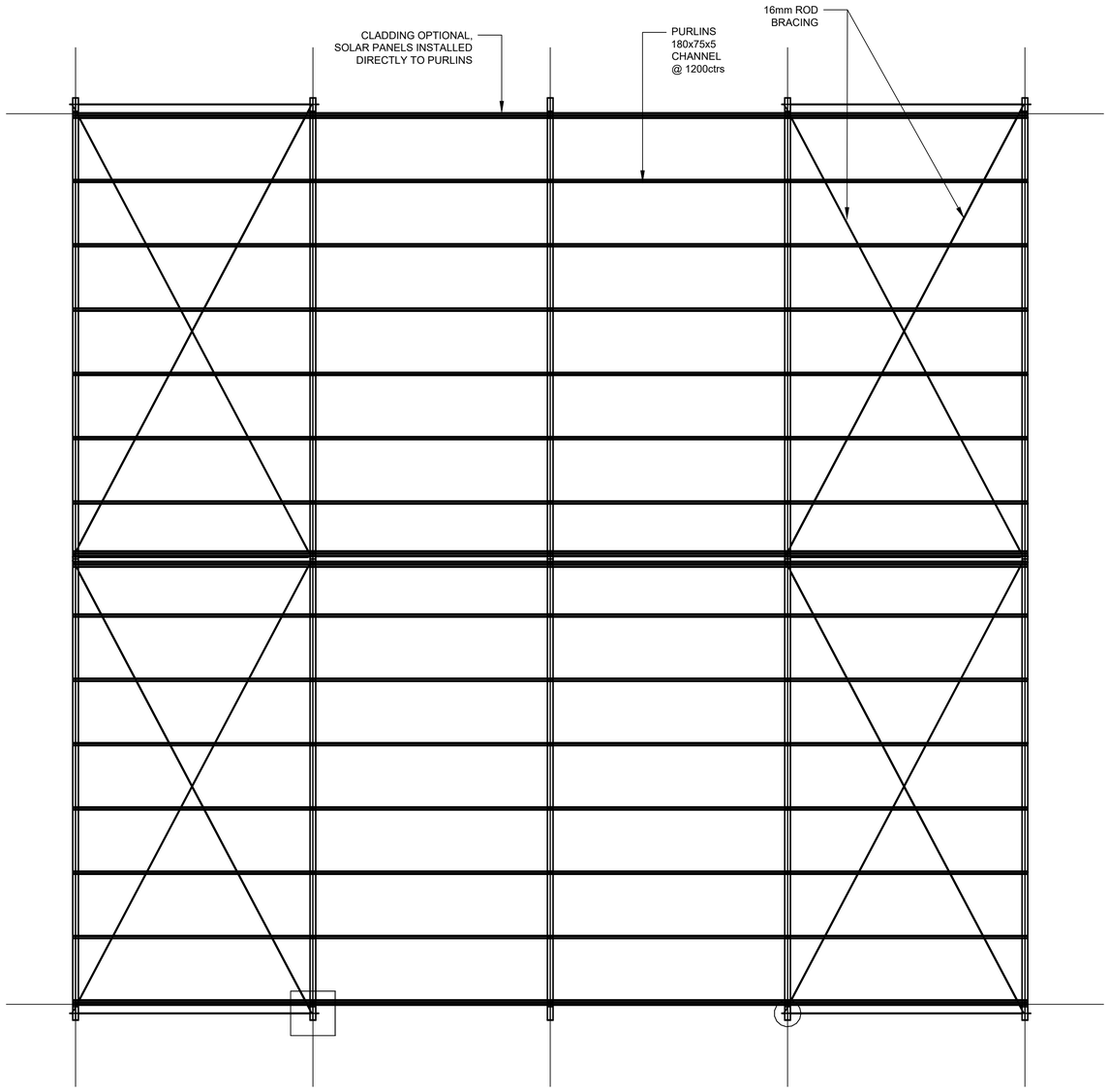
DRAWING **BASKETBALL CANOPY TYPICAL DESIGN**

PROJECT SEDEP RMI OWNERS ENGINEER
CLIENT GOVERNMENT OF RMI
ADDRESS MAJURO
MARSHALL ISLANDS, ----

SCALE	AS NOTED
SHEET SIZE	A1
ORIG. DATE	6/12/18
REV. DATE	7/12/18

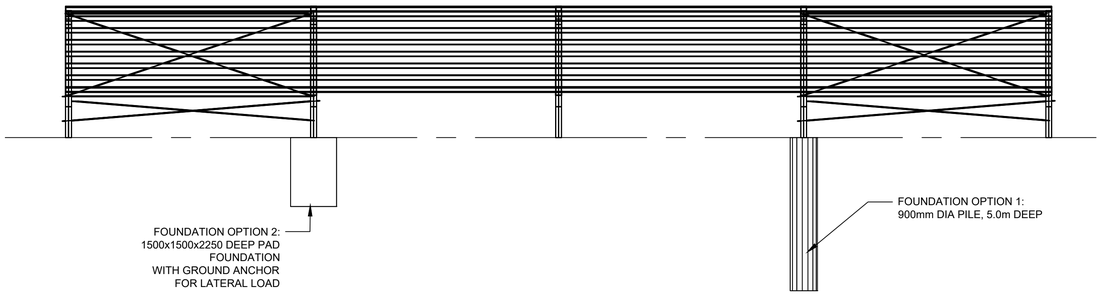
DRAWING NO. **A0285-S-210**

REV NO. **----**



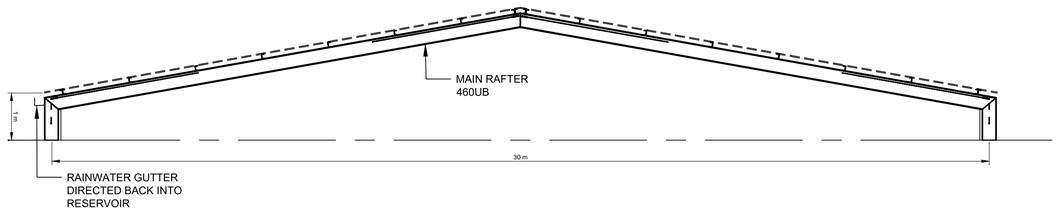
1 - PLAN

SCALE: 1:100



2 - ELEVATION

SCALE: 1:100



3 - SECTION

1:100

FOR TENDER

NO.	STAGE	DATE
1	####	####
2	####	####
3	####	####
4	####	####
5	####	####
6	####	####

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DRAWN	WJ / MO
CHECKED	LF
APPROVED	JM

DRAWING **HOSPITAL RESERVOIR TYP DESIGN**

PROJECT	SEDEP RMI OWNERS ENGINEER
CLIENT	GOVERNMENT OF RMI
ADDRESS	MAJURO MARSHALL ISLANDS, ----
DRAWING NO.	**A0285-S-220**

SCALE	AS NOTED
SHEET SIZE	A1
ORIG. DATE	7/12/18
REV. DATE	7/12/18
REV NO.	**----**

Republic of Marshall Islands

Sustainable Energy Development Project (SEDeP)

Environmental and Social Management Plan

Republic of Marshall Island Sustainable Energy Development Project (SEDeP)

Environmental and Social Management Plan

Quality Information

Document	Sustainable Energy Development Project (SEDeP) Environmental and Social Management Plan Revision D
Date	2 October 2017
Prepared by	Kate Walker, PEECS
Reviewed	DIDA Office , RMI

Revision History

Revision	Revision Date	Details
A	20 Sept 2017	Final Draft for Stakeholder Review
B	24 Sept 2017	Final Draft for Public Disclosure
C	2 Oct 2017	All feedback incorporated. Final SEDeP ESMP version. Update 29 October 2017 – no additional comments from public disclosure.
D	19 Feb 2019	Reviewed by DIDA against current project scope and circumstances.
E	9 May 2019	Updated by DIDA to reflect update design of reservoir solar panel support structures.

Acronyms and Abbreviations

AP	Affected Persons
BESS	Battery Energy Storage System
CdTe	Cadmium Telluride
CoP	Code of Practice
DIDA	Division of International Development Assistance
DSM	Demand Side Management
EE	Energy Efficiency
EPA	Environmental Protection Agency
EPC	Engineering, Procurement, Construction
EPD	Energy planning department
EEZ	Exclusive Economic Zone
ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
GBV	Gender Based Violence
GoRMI	Government of Republic of Marshall Island
GRM	Grievance Redress Mechanism
IDA	International Development Association
IEE	Initial Environmental Examinations
IOM	International Organisation for Migration
JICA	Japan International Cooperation Agency
KADA	Kwajalein Atoll Development Authority
KALGOV	Kwajalein Atoll Local Government
KAJUR	Kwajalein Atoll Joint Utility Resources Inc
LED	Light Emitting Diode
MEC	Majuro Energy Company
MICS	Marshall Island Conservation Society
MIMA	Marshall Islands Mayors Association
MIPA	Marshall Island Port Authority
MoF/DIDA	Ministry of Finance/Division for International Development Assistance
MOU	Memorandum of Understanding
MOWP	Method of Works Plan
MRD	Ministry of Resources and Development
MWSC	Majuro Water and Sewage Company
NEP	National Energy Policy
NEPA	National Environmental Protection Agency
NEPA	National Environmental Management Authority
NGO	Non-Governmental Organisation
O&M	Operation and Maintenance
OHS	Operational Health and Safety
PCR	Physical Cultural Resources
PIU	Project Implementation Unit

PMU	Project Management Unit
PREP	Pacific Resilience Project
PSC	Project Steering Committee
PV	Photovoltaic
RAP	Resettlement Action Plan
RE	Renewable Energy
RMI	Republic of the Marshall Islands
RPF	Resettlement Policy Framework
SECP	Stakeholder Engagement and Consultation Plan
SEDeP	Sustainable Energy Development Project
SOP	Standard Operating Procedures
SSM	Supply Side Management
SWMP	Solid Waste Management Plan
TA	Technical Assistance
TMP	Traffic Management Plan
TOR	Terms of Reference
TT	Task Team
WB	World Bank
WUTMI	Women United Together Marshall Islands

Contents

Executive Summary

Scope of ESMP

This Environmental and Social Management Plan (ESMP) for the Sustainable Energy Development Project (SEDeP) of the Republic of the Marshall Islands (RMI) has been prepared by an independent consultant on behalf of the Division of International Development Assistance (DIDA) of the Ministry of Finance, Go RMI.

The ESMP provides the set of mitigation, monitoring, and institutional measures to be taken during the implementation and operation of the SEDeP to avoid or eliminate adverse environmental and social impacts, offset them or reduce them to acceptable levels. The ESMP also includes the actions needed to implement these measures.

It is the responsibility of the Project Implementation Unit under the Marshalls Energy Company, Inc. (MEC), to ensure that the SEDeP ESMP is fully integrated into the Project. The ESMP shall form part of any bid documentation for physical works, and it shall be the PIU's responsibility to ensure that the technical requirements and data sheets of Project bid documentation is subject to review against this ESMP to ensure that all appropriate safeguard measures are captured at the bid stage.

Project Summary

Currently, more than 90 percent of energy provision in RMI is dependent on expensive imported fuels making it the costliest sector of nations economy.

In Majuro, MEC operates an ageing power station with four out of seven generators currently in operation. Since the introduction of prepaid electricity meters in 2010, and following the loss of one major customer, there has been a steady decrease in the demand for electricity. There are also several solar PV systems in Majuro feeding into the distribution network. The network itself is over 30 years old and in need of significant reinvestment and modernisation, additionally the distribution network was not designed to accommodate any power generation from renewable energy (RE) systems.

On Ebeye, KAJUR has a generation capacity sufficient to meet Ebeye's population demands. There are four high-speed generators however the engines are run down and would need to be replaced as part of any new generation project implemented on the island. There is currently no solar PV or any other RE on Ebeye.

The SEDeP, funded by the World Bank, has been developed to contribute to the long-term sustainability of the RMI energy supply and to support a shift away from diesel power generation to renewable energy (RE). The following table summarising all RE activities being financed by the project with more details provided below regarding specific investments.

Energy Investments	Supply and installation of several solar PV systems, a Battery Energy Storage System (BESS) and grid-management equipment. Install solar PV arrays on Majuro. Diesel genset(s) in Ebeye and Majuro.
Promotion of energy efficiency	A program for MEC and KAJUR will be designed and implemented to provide recommendations to achieve loss reduction. A program to enhance efficient use of energy including awareness campaigns and training. Supply and installation of selected EE investments. Development of policies and regulations for energy efficiency
Technical Assistance, Capacity Building and Project Management	A program of activities designed to enhance the capacity of MEC, KAJUR and EPD will be carried out. Support the preparation of studies for the subsequent phases of the Project, including preparation of safeguards instruments for RE projects for Ebeye and the Outer Islands (Wotje, Jaluit, Rongrong and Santo). Prepare mechanism for maintenance fund and support training of MEC and/or KAJUR on the O&M strategies. Support and strengthen MEC´s capacity for project management and implementation, coordination, monitoring and evaluation, and reporting through the establishment of a PIU in MEC.

Solar Array Systems in Majuro: A detailed assessment of potential sites able to host the solar panel arrays has identified 9 locations as being suitable, with total installed capacity of about 4.13MW. The final locations of the solar panel arrays have not yet been confirmed however, several primary candidate sites have been identified. These include:

Water Reservoir: The proposed design for the water reservoir entails solar arrays being mounted above the water. This option is attractive as it provides multiple benefits such as reducing evaporation of fresh water, reducing light dependent algae growth and not requiring large areas of land to host the array.

Building Roofs: Installation of panels on the roofs of government buildings is an efficient way to increase solar PV surface area while minimizing the need for land and minimising impacts on privately owned buildings.

Basketball Courts, Open Hospital Spaces and Car Parks: Installation of solar arrays above basketball courts, car parks and other green areas is included in the identified list.

Diesel Generators: The KAJUR power station on Ebeye is proposed to get one, possibly, two new generators installed on the existing footprints to improve fuel efficiency and help accommodate future planned solar installations. On Majuro one or more diesel generators may be replaced and network connections may be improved or upgraded.

Energy Efficient Investments: The SEDeP is proposing to finance the supply and installation of energy efficiency investments. This could include investments such as the replacement of old equipment with more efficient and/or higher capacity equipment, streetlight replacement with LED, light bulbs, replacement of incandescent lightbulbs or energy efficient equipment in selected public buildings.

Design of Future Renewable Energy Efficient Investments: The SEDeP is financing the studies for potential future Ebeye and Outer Island (Wotje, Jaluit, Rongrong and Santo) RE projects. These studies will include the design, the environmental and social impact assessment studies, land due diligence assessment and preparation of safeguards instruments.

Legal Framework and Safeguard Policies

SEDeP proposed activities potentially trigger the following World Bank safeguard policies: OP4.01 Environmental Assessment, OP4.04 Natural Habitats, OP4.37 Safety of Dams, OP4.11 Physical and Cultural Resources and OP4.12 Involuntary Resettlement. Corresponding laws, regulations and policies of the RMI, particularly the National Environmental Protection Act 1984, EIA Regulations 1994, Solid Waste Regulation 1989 and Public Water Supply Regulation 1994 also come in to play.

The Resettlement Policy Framework for SEDeP details the legal framework for the management of land in the RMI.

The management of social and environmental impacts of all SEDeP project activities will comply with the requirements of the above RMI laws and regulations, the triggered World Bank policies and the Resettlement Policy Framework.

Stakeholder Engagement and Consultation

The SEDeP has a plan for engaging and consulting with stakeholders for the duration of project implementation. As part of this plan, several consultation meetings have already been held during the development phase of this project and a series of recommendations and measures have been incorporated into the project to address concerns raised during the consultations. These measures include:

- Only government owned buildings (plus Coop School) are targeted for installation of solar PV arrays.
- To deal with the disposal of hazardous or bulky waste, a Solid Waste Management Plan will be developed by the Contractors. Additionally, the requirements of the Solid Waste Management Plan will be adapted into a Code of Practice for Solid Waste Management in the renewable energy sector and implemented for all future projects on Ebeye and the Outer Islands.
- A Resettlement Policy Framework has been developed for the SEDeP as part of the required safeguard instrumentations. The RPF governs due diligence of land ownership and also governs voluntary or involuntary acquisition of lands or assets to ensure that any affected persons are properly consulted and compensated before project works commence.
- The SEDeP provides for the preparation of an escrow account/sinking funds mechanism and support training of MEC and/or KAJUR on operational and maintenance strategies.
- Engineers are required to consider cyclonic events in the design of installations.
- Engineers are required to conduct a thorough assessment of solar PV technologies and select those most appropriate for installation over the water reservoir taking into account any

potential impacts on the water quality and the treatment and monitoring procedures of MWSC.

- All imported project staff will abide by RMI immigration policy and provide all required documentation, including health checks. Overseas workers will undergo cultural familiarisation induction upon arrival and sign a code of conduct applicable for the duration of their contract.
- All project staff will undergo training by local services providers identified by the MEC PIU on prevention of HIV/AID and GBV.
- The Contractor will develop a Code of Conduct (to be approved by PIU) for all workers (local and overseas) to sign detailing the expected behaviours of Project staff, ESHS requirements, Cultural respect, OHS requirements, Community Health and Safety considerations

Environmental and Social Impacts

The SEDeP has the potential to create a variety of impacts through the implementation of the various subprojects and components. These potential impacts can be either positive or negative depending on the receptors involved and the activity. The impact of this project on the physical, biological and social environment has been assessed to determine likelihood and identify effective mitigation measures. The potential impacts are summarised in the table below in relation to the related project activity:

Project Activity	Potential Impacts	
Solar PV Investments on Majuro	Environmental	• Coastal erosion and reef damage associated with sand dredging for concrete production • Water pollution from concrete production waste water • Biosecurity risks from imported aggregate • Loss of vegetation through regular tree trimming for rooftop installations • Reduced access to reservoir floor for maintenance • Biodiversity impacts from loss of open spac in vicinity of reservoir. • Risk to integrity of reservoir structure from fixed shore-based installations and/or in-reservoir floating structures. • Broken solar panels leading to possible contamination of water reservoir from chemical elements within solar panels
	Social	• Limited access to recreation and car park spaces during installation • Impact associated with overseas workers such as increased risk of HIV • Increased risk of GBV associated with increased incomes in households • Increased public shade areas following installation
Diesel GenSet Installation	Environmental	• Potential waste legacy from decommissioned equipment • Hazardous waste from old oil and fuel • Ongoing accumulation of used oil during the operation of the new GenSet
Energy Efficiency Activities	Environmental	• Solid waste generated from replacement of old equipment and appliances. Waste can cause increased pressure on landfills and cause contamination to the soil from leaching.
	Social	• LED lighting can impact human health and sleep patterns

Energy Policy		• Ongoing indirect impacts on waste stream from e-waste, appliances, light bulbs, etc
Design of future projects	Environmental	• Potential need for scarce land resources • Modification of reef flat environments and habitats • Increased solid waste generation
	Social	• Influx of labour into Ebeye relying on already limited resources and services • Influx of labour leading to increased risks of spread of communicable diseases and other adverse social impacts

Overall the environmental and social impacts are expected to be minimal, in most cases site specific, and with measures available to ensure their effective mitigation and/or reversal.

Environmental and Social Management Measures

To address the potential impacts associated with the SEDeP activities, a series of detailed Environmental and Social Management Plan tables have been developed. Within each of these plans measures are in place to manage all identified impacts. Many of these measures are applicable to all project impacts and these include meeting all national permitting obligations; the integration of all ESMP requirements into bid documents and contracts; the development of a Solid Waste Management Plan; cultural familiarisation training for overseas project staff; training for all project staff in awareness and prevention of HIV transmission and GBV; detailed requirements for management of laydown areas; biosecurity measures, and; OHS requirements for all project works. In addition to these general and project wide measures, there are some site specific and activity specific measures that are also required. These specific measures are briefly summarised below by project activity:

Project Activity	Environmental or Social Management Measures (Design, Construction and Operational Phases)
Solar PV Installations	• Conduct a bird survey of the reservoir to identify the species and habitat features of the pond. Conduct an impact assessment and consider mitigation in design. • Submit an application to the Environmental Protection Authority for installation of a PV system above the water reservoir. • Include the assessment of structural integrity of the reservoir in the Design Engineer contract. • Design Consultant to undertake thorough review of effectiveness of current treatment of water and monitoring program by MWSC prior to reticulation for public consumption and identify any recommendations • The project design will take into account the latest technical development of solar panel technology and any testing associated with rainwater harvesting from solar panels • Design engineers in consultation with MEC and EPA shall design a set of mitigation measures and response to any emergencies. • All sourced sand and aggregate will be imported from an offshore source. Imported aggregates must meet GoRMI Biosecurity requirements. • Hazardous wastes such as damaged solar panels and batteries that contain heavy metals shall be collected and stored prior to disposal offshore at a licensed facility as per the requirements of the Solid Waste Management Plan. • The Contractor will provide a 10ft container and a roofed structure over the container in a location determined by MEC for the storage of hazardous waste

	Concrete will be prepared on bunded and covered hard stand surface of laydown areas. • All waste water and slurry from concrete production will be collected and treated • No trees will be trimmed or removed without the permission of the PIU and the land owners. Removal of trees will be avoided unless absolutely necessary for achieving Project objectives. Agreement from the owner shall be given, and any compensation agreed to, prior to trees being trimmed or removed. • Any solar panels or batteries removed from the array for disposal will first be collected and stored in the covered 10ft container provided by the Contractor. • For final disposal, the MEC will ensure hazardous items are shipped offshore to a facility licensed to handle hazardous waste. • MEC shall undertake at least weekly monitoring of the condition of the individual solar panels to detect any damage. Damaged solar panels shall be immediately removed from the array to prevent particulate entering the water reservoir. MEC to advise Environmental Protection Agency (EPA) of any damage likely to have caused solar panel particulate to have entered the water reservoir. • MEC to comply with any requests made of them from EPA in relation to the EPA ongoing water quality monitoring program. • Should additional or extraordinary monitoring be required, this is to be funded by MEC • Routine tree trimming will be carried out with the permission of tree owners.
GenSet Installation	• Ensure, through design of spill containment at the genset and / or within the building, that 100 percent of fuel and oil held within the generators can be contained and collected for removal within the footprint of the building. All Project staff will be trained on this plan and attendance will be recorded. • Hazardous wastes such as old oil and fuel shall be collected and stored in self bunded containers prior to disposal offshore at a licensed facility as per the requirements of the Solid Waste Management Plan. • Oil and fuels will be drained from the old genset with a drip pan in place to catch any drips or minor spills • All removed parts will be contained and stored in a watertight container to prevent leaching of residual oils or fuel • For final disposal, the KAJUR will ensure hazardous items are shipped offshore to a facility licensed to handle hazardous waste. • Ensure that all manufacture recommendations for maintenance of generator are implemented to maintain efficiency and reduce risk of failure.
EE Investment	• Hazardous wastes such as discarded incandescent bulbs shall be collected and stored in water tight containers prior to disposal offshore at a licensed facility as per the requirements of the Solid Waste Management Plan. • Difficult waste such as appliances and building cladding shall be stored in the secure fenced and covered area. • Should any Asbestos Containing Material be uncovered while working on building insulation, the Contractor will develop an Asbestos Management Plan for review, approval and implementation. • Ensure that all manufacture recommendations for maintenance of energy efficient appliances are implemented to maintain efficiency and reduce risk of failure.

ESMP Implementation

The agencies with important responsibilities for ESMP and RPF implementation, monitoring and reporting are NEPA, MOF/DIDA, MEC and KAJUR. Details of the responsibilities are summarised below

A Project Steering Committee (PSC) will be established and comprise representatives of the MoF, Ministry of Resources and Development (represented by EPD), as well as MEC, KAJUR and the Kwajalein Atoll Development Authority (KADA), and others, as needed. The PSC will provide oversight and strategic guidance for the project implementation.

A Project Implementation Unit (PIU) will be established within MEC and will include a Project Manager, a Project Accountant, and if needed, a Procurement Specialist. The DIDA Safeguards Specialist will cover SEDeP safeguards responsibilities, including:

- Monitoring of the Contractor as per the requirements of the ESMP Monitoring Plan for compliance with the ESMP
- Managing the review process for all safeguard elements up to formal approval
- Providing safeguards screening and provide safeguards advice during the preparation and implementation of all subprojects.
- Updating the ESMP and RPF as necessary to reflect project changes. This includes the SWMP, Codes of Practice and Mitigation Tables.
- Applying for all RMIEPA approvals and permits.
- Supporting PIU to enable effective citizen engagement into the project and providing meaningful input and direction into community consultations for projects
- Conducting capacity gap assessments of implementing agencies (MEC and KAJUR) and develop capacity building tools and materials.
- Assisting MEC and KAJUR to integrate safeguards into their Standard Operating Procedures

The Project Manager will be responsible for overall project coordination and technical guidance and will support the procurement of various packages and studies. Technical staff will be recruited as necessary to support the implementation of technical advisory components. The Project Manager will report to the CEO of MEC and to the Project Steering Committee. The MoF will be responsible for processing project disbursement requests.

Safeguard Financing

An estimated budget for safeguards is USD$392,000 for SEDeP activities. MOF/DIDA will ensure this budget is approved and available to support safeguards implementation. This budget covers the cost of consultants, stakeholder engagement, engagement of part time safeguard specialist, institutional training, HIV/GBV training, disclosure of safeguards instruments, monitoring, reporting and GRM related costs.

1 Introduction

The Republic of the Marshall Islands (RMI) is one of the world's smallest, most isolated and vulnerable nations with a high reliance on expensive imported fuel to generate energy. The RMI, led by the Ministry of Resources and Development (MRD) adopted its National Energy Policy (NEP) in 2009 (reviewed in 2015). The NEP is managed through the Energy Planning Division (EPD) and was developed with the vision of "improved quality of life for the people of the Marshall Islands through clean, reliable, affordable, accessible, environmentally appropriate and sustainable energy services".

The Government of Republic of Marshall Island's (GoRMI) formally requested the Bank´s support in advancing its NEP objectives of i) increasing the use of RE to at least 20 percent by 2020 while reducing by 20 percent its greenhouse gas emissions; and ii) reducing subsidies to the sector by lowering the operating costs (i.e. by reducing the share of expensive imported fuels in its generation matrix and by increasing its energy sector utilities´ efficiency).

The Banks preliminary analysis determined that for the RMI to reach its targets in 2020 and 2050, centralized storage and control systems for renewable energy (RE) would be needed on Majuro and Ebeye with mini grids also being installed in outer islands. To achieve this the GoRMI is using a phased approach to implementation over a period of 5-7 years. As part of this phased approach, the Bank is funding several components through this Sustainable Energy Development Project (SEDeP). Section 2 discusses these components in detail.

1.1 ESMP Purpose and Scope

Project screening based on field investigations, stakeholder consultation and a review of potential options confirms an assessment of Category B for the Project. It finds that potential impacts are less than significant, site specific, mostly reversible and that a range of potential measures for mitigation can be readily designed in the majority of cases.

To support the implementation of Category B projects such as the SEDeP (where the project and any likely sub-project impacts are identifiable and not foreseen to involve serious impacts) it is a requirement to produce an Environmental and Social Management Plan (ESMP). Therefore, this ESMP has been produced to ensure the integration of environmental and social stewardship into the project as required by RMI's relevant laws and regulations and the Environmental and Social Safeguards Policies of the Bank.

The ESMP provides the set of mitigations, monitoring, and institutional measures to be taken during the implementation and operation of the SEDeP to eliminate adverse environmental and social impacts, offset them or reduce them to acceptable levels. The ESMP also includes the actions needed to implement these measures.

Specifically, this ESMP includes the following components:

Consultations: A summary of consultation to date, and further measures are detailed to ensure adequate ongoing consultations are held and affected people especially are involved in discussing how they are affected and the range of measures for reducing identified impacts.

Mitigation: The ESMP identifies feasible and cost-effective measures that may reduce potentially significant adverse environmental impacts to acceptable levels. The plan includes compensatory measures if mitigation measures are not feasible, cost-effective or sufficient.

Monitoring: The ESMP identifies monitoring objectives and specifies the type of monitoring, with linkages to identified impact and mitigation measure. For all monitoring requirements, the technical parameters are defined along with appropriate responsibilities and reporting procedures.

Grievance Redress Mechanism: A mechanism for receiving and addressing all grievances and complaints related to the Project is set out in the ESMP. It seeks to resolve all complaints as quickly as possible to the satisfaction of the aggrieved party.

Implementation Arrangements, Schedule and Costs: The ESMP includes a description of implementation arrangements, including the roles and responsibilities of the Project Management Unit, Implementing Agencies and Project consultants. The ESMP also builds scheduling of measures into its planning including phasing and coordination with overall Project implementation plans. Where appropriate, capital and recurrent costs estimates and sources of funds for implementation of the ESMP have been estimated.

Capacity Development and Training: The ESMP identifies any gaps in institutional capacity and recommends measures and costs to address them.

1.2 Integration of ESMP

It is the responsibility of the Project Implementation Unit under the Majuro Energy Company (MEC), to ensure that the SEDeP ESMP is fully integrated into the Project. The ESMP shall form part of any bid documentation for physical works, and it shall be the PIU's responsibility to ensure that the technical requirements and data sheets of Project bid documentation is subject to review against this ESMP to ensure that all appropriate safeguard measures are captured at the bid stage.

It is further the responsibility of the PIU to ensure that this ESMP is considered in review of any Terms of Reference for Technical Assistance developed for the Project. The safeguard requirements for any design or supervision of the Project will be fully integrated into TOR to ensure that all safeguard responsibilities allocated within the ESMP are realized at the tender stage.

In this way, the ESMP will be fully integrated within the Project so that the required measures will be fully appreciated by all responsible parties and successful implementation will be achieved.

1.3 Disclosure

As part of the requirements of RMI law and World Bank policy, the ESMP is to be publicly disclosed by Division of International Development Assistance (DIDA) as the agency responsible for project preparation. DIDA will ensure the ESMP Executive Summary is translated into Marshallese prior to disclosure in hard copy and online. A newspaper advertisement will alert the public to the disclosure of the instruments Likewise, DIDA and MEC will ensure that several copies of all prepared safeguard instruments are available locally at the DIDA office, MEC office and KAJUR office, easily accessible to affected groups and local NGOs.

The ESMP is a dynamic document and will be reviewed, updated and approved as necessary throughout the implementation of the Project. For each approved updated version of this ESMP, the PIU will be responsible for disclosure through the above channels.

2 Project Description

2.1 Background and Rationale

The Government of Republic of the Marshall Islands' (GoRMI) formally requested the Bank's support in advancing its energy sector objectives of (i) increasing the use of RE to at least 20 percent by 2020 while reducing by 20 percent its greenhouse gas emissions; and (ii) reducing subsidies to the sector by lowering the operating costs (i.e. by reducing the share of expensive imported fuels in its generation matrix and by increasing its energy sector utilities efficiency). In that context, the World Bank commissioned a pre-feasibility study to conduct the dependency on imported fuels. The recommendations of the Report are based on a technical mission to the country, a review of available studies in the energy sector and a review of a proposal from a US company – Solar City – submitted to the GoRMI for the development of a solar project on Ebeye and three outer islands.

The study made by Solar City forms the basis of a US$11 million financial request (non-concessional funding at 1% interest rate) submitted by the GoRMI to the Abu Dhabi Fund for Development (ADFD) via IRENA (Decision expected early in 2019). The Options Report proposes three options for the development of RE in Majuro, Ebeye and the outer islands. To undertake all three options concurrently would be extremely expensive for RMI, therefore the Government is planning a phased approach to implement the three options over a period of 5 – 7 years to achieve the RE goal as proposed.

The SEDeP, funded by the World Bank, forms part of that phased implementation and, through a series of components, is to finance the supply and installation of integrated PV solutions in Majuro; supply and install a new GenSet for Ebeye; develop an energy loss reduction program for MEC and KAJUR; supply and installation of energy efficient investments in RMI; develop policies and regulations for EE integration across RMI; prepare studies for the next phase of the RMI Options Report and build capacity within MEC for project management.

SEDeP will contribute to RMI's National Energy Policy (NEP) adopted in September 2009 and reviewed in 2015. The NEP's vision is 'improved quality of life for the people of the Marshall Islands through clean, reliable, affordable, accessible, environmentally appropriate and sustainable energy services'. It has the following broad goals –

i. strengthen financial, policy and legislative frameworks for the energy sector;
ii. supply 100 percent of urban households with electricity by 2015;
iii. provide 95 percent of rural outer atoll households with off-grid electricity by 2015;
iv. provide access to modern forms of cooking to 90 percent of all households by 2020;
v. make households and businesses 50 percent more energy efficient and government buildings 75 percent more energy efficient by 2020;
vi. achieve a 20 percent efficiency improvement in transport sector fuel use by 2020;
vii. reduce supply side energy losses from MEC by 20 percent by 2017; and
viii. provide 20 percent of power generation through indigenous renewable resources by 2020.

The NEP also identified four priority outcomes that are (i) improved enabling frameworks for reducing dependence on imported fossil fuel; (ii) all Marshallese have equitable access to modern energy services; (iii) smarter uses of energy in households, businesses, government, transport sector and power utilities; and (iv) reliable, sustainable and affordable energy supply.

SEDeP is thus well aligned with the strategic direction and frameworks that identify needs and priorities to respond to the effects of climate change and natural hazards identified by GoRMI, and the World Bank. SEDeP also contributes to strengthening RMI's economic resilience to external shocks, given its dependence on imported fossil fuel.

2.2 Current Conditions

The Marshalls Energy Company (MEC), a vertically integrated state-owned utility, oversees electric power generation and distribution in Majuro and has been committed by the EPD for the installation, operation and maintenance (O&M) of renewable energy (RE) installations in remote areas. MEC also imports and distributes petroleum products and is hierarchically under the Ministry of Public Works.

In Ebeye, the Kwajalein Atoll Joint Utility Resource (KAJUR) is responsible for providing power, water, sewer and potable water for the atoll. KAJUR is operated as a subsidiary of MEC, under the direction of MEC Chief Executive Officer (CEO). The company has its own separate power system and facilities. More than 90 percent of energy provision in RMI is dependent on imported fuels, and the rest comes from biomass and solar. Biomass energy in the country is produced from waste materials, coconut stalks and copra (coconuts oil), and used for cooking and water heating in households.
There are approximately 3,000 standalone Photovoltaic (PV) Solar Home Systems (SHS) in the Outer Islands and some small grid connected solar PVs in Majuro (described below). In 2014, estimated RMI's rates of access to electricity were 90 percent, desegregated to 81 percent in rural area, and 94 percent in urban. The rate of electrification in Majuro atoll is 93 percent and 97 percent in Ebeye[1], however, propane and petroleum are still broadly used for cooking.

Majuro electricity system. MEC operates two diesel power stations (located adjacent to one another) on Majuro. The utility has four generators in operation, two decommissioned and one that is awaiting rebuilt after a minor fire. The diesel power station is ageing and has been plagued with problems including a major fire that permanently damaged two generators. Loads have decreased over the last decade, mainly due to tariff increases, the introduction of prepayment meters and the loss of one large-scale customers (a major fisheries company) in Majuro. Since the first prepayment meters were installed in 2010, there has been a steady decrease in electricity demand averaging around 1.8 percent annually, consistent with the energy saving properties of prepayment meters.

There are also several grid-connected PV systems installed in Majuro, including a 600kW MASDAR system, located near the airport, a 209kW Japan International Cooperation Agency (JICA) system on the hospital roof, a 111kW at the College of Marshall Islands (privately owned system), a 55kW at the University of South Pacific (USP) campus and several small privately owned grid-connected PV systems (5=6kW each).[2] MEC's distribution network is aged (over 30 years old), and in need of significant reinvestment and modernization, and was not designed to accommodate any distributed generation from intermittent renewable resources (i.e. solar). Preliminary findings of an analysis conducted by JICA under its project on the formulation of a self-sufficient energy supply system reveal that the current system can accommodate no more than 890kW of PV-grid connected energy

[1] JICA. Marshall Islands Project on the Formulation of a Self-Sufficient Energy Supply System Final Report. January 2015.

[2] MEC 2016 Power Report.

without advanced control or storage. As the current amount on the grid is approximately 1 MW,[3] it is not recommended that any more grid-connected PV be installed without storage or advanced control. The report also states that upgrades to the diesel generation units are needed.

Ebeye electricity system. KAJUR has a generation capacity sufficient to meet Ebeye's population demand. The power station houses four high-speed generators and the last major upgrade of the diesel generating plant was carried out in 2012. The engines are rundown and would need to be replaced as part of any new generation project implemented in island. The last upgrade of the existing power distribution system was carried out in 2004/2005. During this upgrade, most community areas had their all high voltage overhead transmission lines replaced with the underground cables and all pole mounted transformers replaced with the cubicle type units mounted on the concrete plinths on the ground. KAJUR is technically and financially weaker compared to MEC on which it relies for important O&M aspects.

There is currently no solar PV or any other RE on Ebeye, but JICA has planned a 600kW grid-connected PV system to be located on land behind the power station. The installation will also include a new generator control system to allow automatic operation.

2.3 SEDeP Activity Areas Overview

The following investment areas have been identified and form the basis for the SEDeP. They are discussed in more detail in the sections below.

Table A: SEDeP Activity Area Overview

Energy Investments	Renewable energy investments will finance the supply and installation of up to 4.5 solar power-generation capacity, a Battery Energy Storage System (BESS) and grid-management equipment to increase the contribution of RE in RMI´s generation system and to reduce diesel generation in Majuro. The component will include assistance in O&M and capacity building for at least 2 years. SEDeP will finance the install solar PV arrays on Majuro, including a preliminary design and cost, preparation of bidding documents and supervision of the engineering, procurement and construction (EPC) contractor. SEDeP will finance diesel genset(s) for KAJUR´s power plant in Ebeye and MEC's power plant in Majuro.
Promotion of energy efficiency	This Project component will address issues related to supply side management (SSM). A loss reduction program for MEC and KAJUR will be designed and implemented. This will be prepared by external consultants to provide recommendations to achieve loss reduction in the two utilities. SEDeP will support a program of activities designed to enhance efficient use of energy. The program could include supply and installation of selected EE investments, such as enhanced insulation in

	replacement of inefficient lighting or appliances in said buildings; this component will also support information awareness campaigns, workshops, training, and education on DSM and EE. The development of policies and regulations for energy efficiency will be supported, as well as the development of standards and labeling for EE including phasing out inefficient incandescent bulbs, and more stringent standards for appliances. Activities aimed at raising consumer awareness on EE and related capacity-building activities and training will also be supported.
Technical Assistance, Capacity Building and Project Management	A program of activities designed to enhance the capacity of MEC, KAJUR and EPD will be carried out. These activities could include technical operation, procurement, financial management, environmental and social management, monitoring, evaluation, and reporting. This component will also support a study to assert EPD's role in the sector, defines its needs as one of the key actors and further provide means for EPD to undertake a few studies essential to the energy sector development as well as potential support for staffing. This sub-component will support the preparation of studies for the subsequent phases of the Project, including the design (up to the preparation of bidding documents) and safeguards studies and preparation of safeguards instruments for RE projects for Ebeye and the Outer Islands (Wotje, Jaluit, Rongrong and Santo). Set up of O&M (or Sinking Fund) Fund to maintain generation equipment is critical to ensure its sustainability, especially in the Pacific region. This sub-component will prepare the escrow account/sinking funds mechanism and support training of MEC and/or KAJUR on the O&M strategies. This sub component will support and strengthen MEC´s capacity for project management and implementation, coordination, monitoring and evaluation, and reporting. It will support the establishment of a PIU in MEC including the recruitment of a Project Manager, procurement, financial management, social and environmental safeguards capacity as needed. It could also include an energy specialist to support EPD on the technical supervision of relevant studies. Provision of technical assistance to support mainstreaming of gender dimensions in the Project will also be financed under this sub-component. The project's incremental operating costs will also be financed through this component as well as office equipment and Project audits.

2.4 Solar PV Investments on Majuro

2.4.1 Proposed Solar Options on Majuro

A detailed assessment of potential sites able to host the solar panel arrays by DIDA has identified 9 locations as being suitable to install PV power plants, with total installed capacity of about 4.13MW.

Table B: Potential Sites for PV Arrays

Site	Estimated Capacity (kW)
Water Reservoir	2,236
Airport Parking	513.5
School Building Roof	123.5
Nitijela Building Roof	182
ICC Roof	266.5
ECC Roof	208
Hospital Playground	455
Basketball Field	97.5
Public Parking	45.5
Total	**4,127.5**

The final locations of the solar panel arrays will be confirmed during a detailed design study during project implementation. The ESMP covers all sites.

2.4.1.1 Water Reservoir

The water reservoir is an primary candidate for the following reasons (i) multipurpose: would serve both MWSC and MEC generation purposes in a situation of limited land availability; (ii) water conservation: would reduce evaporation currently experienced by MWSC; (iii) size: concentrates half of the potential sites total capacity; (iv) location: avoids anticipated potential distribution constraints; thanks to its size and relative proximity with MEC's existing thermal generation facilities, a power distribution feeder can easily be erected to convey the generated energy from the reservoir site to the power plant.

However, co-operation and co-maintenance considerations between MEC and MWSC should not be neglected, in addition to the fact that the reservoir is the major source of freshwater for the 28,000 inhabitants of Majuro.

The technology and technical solutions to be applied to the proposed solar PV plant at the reservoir will ultimately be determined during implementation at the time of EPC contract awarding. Nevertheless, the Bank has conducted a thorough due diligence to ensure that this solution is viable and would not negatively impact MWSC's day-to-day operations and maintenance needs. At this stage, the technical assessment study identified two solutions likely to be applied:

i. ***The Rigid Steel Bracket Solution***: the photovoltaic modules will be laid above the water pool and supported with rigid steel brackets composed of H-type steel as the main bearing components. Connection between the photovoltaic modules and H-type steel will be made with Z-type steel or C-type steel, and each photovoltaic module will be supported with 2 pieces of Z-steel or C-type steel underneath.
ii. ***The Flexible Support Solution***: Flexible photovoltaic support eliminates the impact of photovoltaic cell module to daily operation of the impounding reservoir, which solved the problem of long span, and can also meet the requirement of wind load resistance. The flexible foundation solution is a patented technology owned by a company in Zhejiang

Province in China and currently has been applied in domestic projects such as sewage treatment plants, etc., and the first demonstration project with this solution was completed in Zhejiang Province in 2015.

Both solutions are suitable for the photovoltaic modules at the reservoir. The rigid steel bracket solution uses a lot of steel, needs two columns to be set on the pool bottom which will affect normal operation of the reservoir during construction, but it has simple and well-proven structural form, extensive engineering application and high reliability. The flexible support solution can reduce steel consumption, but because use of steel wire ropes, corrosion is likely to occur in the hypersaline environment in the later stage. Currently, there are only a few projects having employed the flexible support solution, only one company in China has the ability to independently undertake the design and construction of this solution, and there may also arise the issue regarding intellectual property right protection. Therefore, at this stage, and pending further consideration during implementation, it is the rigid steel bracket solution that would be recommended if the reservoir makes it to the final list of project sites. Finally, the proposed technical solution will not negatively impact on the operation of the existing PV arrays located on the left bank of the reservoir.

2.4.1.2 Building Roofs

Installation of panels on the roofs of buildings is an efficient way to increase solar PV surface area while minimizing the need for land. During the detailed design phase during Project implementation, the structural integrity of the proposed buildings will need to be assessed for their suitability to act as host for a solar array. Included in this assessment will be an assessment of resilience to cyclonic events.

Despite being government controlled or owned, access to targeted rooftops and open space must nevertheless be arranged through the official channels. While there is no formal protocol in place for this, it is precedence based and is therefore included in the SEDeP consultation plan to ensure that occupants and managers of the spaces are given the opportunities to guide logistics of installation.

For some targeted space managed by public corporations, the corporation has legal authority to allow improvements and developments on their facilities and properties including activities promoted by SEDeP.

2.4.1.3 Basketball Courts, Hospital Open Space and Car Parks

Installation of solar arrays above basketball courts, car parks and other green areas is included in the above list. During the detailed design phase, the proposed solution will also include consideration for foundation design of the array structure and the design should be sufficient to withstand cyclone events.

2.4.2 Land Acquisition

All sites are leased by the Government of RMI and there will be no involuntary land acquisition. No sites have squatters. The SEDeP RPF discusses in detail the arrangements for confirming access to Government-leased land.

2.4.3 Ancillary Works

It is expected that there will be ancillary works associated with the installation of the solar PV systems on Majuro. The final scope of these works will be confirmed during the detailed design phase, but it is expected to include the following:

Battery Storage Systems, Network and Grid Management Uprades: Depending on the outcome of the preliminary design and network efficiency and performance requirements for the integration of solar generation into the network. Battery storage will be at the MEC power plant. The network upgrades may include replacing or upgrading electrical distribution cables on existing poles and no new land will be required.

Aggregate Supply: Concrete will be required for the foundations of all solar PV installation options on Majuro except roof top. Feasibility studies[4] of the potential host location have identified that concrete will be required for foundations of arrays at the water reservoir, the hospital car park and the airport car park. However, it is also likely that concrete foundations will be required for other installation sites such as any greenfield spaces. At this stage in the project development, it is not confirmed how much concrete will be needed, however it can be expected that concrete will be needed for foundations at the reservoir, the carparks and any greenfield installations. It is also expected that these foundations will need to be strong enough to support the structures during typhoons.

Exact designs and volumes are unknown at this stage but sand materials will be needed by the Contractor to produce the concrete.

The supply of aggregates in the RMI is limited. The most common methods of aggregate extraction are beach mining, nearshore dredging and reef quarrying. All of these aggregate extraction methods been identified as potentially environmentally unsustainable and contributing factors to coastal erosion.[5] As a general rule, all aggregates for World Bank Projects must be imported

Laydown Site: A laydown site (or sites) will be required for the storage of construction materials needed for the installation of the various solar PV systems on Majuro. It is expected that the construction works associated with the installations will be relatively minor and limited to the preparation of concrete foundations, however storage of all imported solar PV array equipment will need to be catered for along with all other machinery and equipment necessary for installations. It is possible that lay down areas may move depending on active Project sites. The MEC is responsible for identifying government land to be used by the Contractor as temporary laydown areas.

Haulage Routes: As all materials, equipment and machinery will be imported to RMI for these works, it can be expected that haulage routes will need to be defined for each project site for all components. All imported items will need to be transported from the main port to the Contractors laydown areas. At this stage, the volume of imported items and the locations of the laydown area are considered to be low and unlikely to be a significant aspect of the project. It is expected that

[4] Feasibility Study Report for Solar Power & Microgrid Project in Majuro, Marshall Islands. Changjiang Institute of Survey, Planning Design and Research, July 2017
[5] Smith, R. & Collen, J., 2004, Sand and gravel resources of Majuro Atoll, Marhsall Islands. SOPAC Technical Report 360. South Pacific Applied Geoscience Commission, Suva, Fiji. 126pp.

haulage truck will be used to move all materials and equipment and that this will take place on the public road network.

2.4.4 Solar PV Design and Implementation Process

A feasibility study will conclude technical and financial feasibility of options and provide recommendations to the PMU.

In consultation with stakeholders, the PMU will make decision on the location(s) and total MW of investments, based on the technical feasibility, safeguards and costs.

Detailed design and bid documents will be prepared on the selected investment(s). At the same time, the ESMP will be updated to reflect any new or intensified impacts as a result of the detailed design.

Preliminary design and bid documents will be prepared on the selected investment(s). At the same time, the ESMP will be updated to reflect any new or intensified impacts as a result of the preliminary design.

The successful Contractor will complete the design, install all equipment and complete all civil works. The Main Contractor / Panel Supplier is likely to be from overseas and are likely to have a small workforce of technicians and labourers (10 -15 people). The civil works subcontractor may be local or international and may have a mix of local and overseas workers (maximum of 20 at any one time on the project). There is likely to be some temporary opportunities for local laborers.

2.5 Diesel Generators

On Ebeye, the existing KAJUR existing generators are leaking oil onto the concrete floor in the powerhouse and leaked waste oil is also observed in the compound, on concrete and soiled surfaces around and underneath the waste oil storage tanks, creating a highly hazardous and unsafe situation. An estimated 45 – 50 gal of waste oil is extracted from three operating gensets during maintenance operations every 250 hours of operation.

Several storage tanks – some are or near full – receive manually transferred waste oil as they are extracted during maintenance. The observed ground contamination points to improper extraction and transfer of waste oil from the generators to storage tanks, and to tankers for shipping to Majuro.

The KAJUR power station on Ebeye is proposed to have one, possibly two, new generators installed on the existing footprints to improve fuel consumption, system reliability and help to accommodate future planned grid solar capacity.

On Majuro, one or more diesel generators may be replaced and network connections may be improved or upgraded, depending on the recommendation of the preliminary design and the ability of the network to support the solar generation investments.

2.6 Energy Efficiency

2.6.1 Supply Side Management & Demand Side Management

To identify areas of energy loss and to develop a program to address this, a loss reduction study will be undertaken across MEC and KAJUR. Independent consultants will be commissioned to carry out

the study and develop a plan for loss reduction activities at the supply side management (SSM) of energy provision.

To support the development of energy efficient practices from the consumers, a demand side management (DSM) program will be developed. This program will hope to provide trainings and workshops for utilities on DSM and energy efficiency, additionally, information awareness campaigns and education will be developed to target consumers.

2.6.2 Energy Efficiency Investments

Based on the above studies, the SEDeP is proposing to finance the supply and installation of energy efficiency investments. This program could include investments such as the replacement of old equipment with more efficient and / or higher capacity equipment, streetlight replacement with LED light bulbs, replacement of incandescent lightbulbs or energy efficient equipment in selected public buildings.

2.7 Energy Efficiency Policy

To support the SSM work described above, policies and regulations will be developed for energy efficiency. As well as this, the development of standards and labelling for energy efficiency, possibly including phasing out inefficient incandescent bulbs, and applying more stringent standards for imported appliances.

2.8 Design of Future Renewable Energy Investments in Ebeye and Outer Islands

While the SEDeP is not current financing any renewal energy investments in Ebeye and the Outer Islands, it is financing the preparation of studies for the subsequent phases of renewable energy investment in RMI. These studies will include the design (up to the preparation of bidding documents) for RE projects for Ebeye and the Outer Islands (Wotje, Jaluit, Rongrong and Santo). It will also include the environmental and social impact assessment studies, land due diligence assessment and preparation of safeguards instruments.

3 Policy, Legal and Administration Framework

3.1 Environmental Legislation

3.1.1 National Environmental Protection Act 1984

The National Environmental Protection Authority (NEPA), established under the National Environmental Protection Act (NEPA) 1984, is the governing body for environmental protection in the RMI. The primary purpose of the Authority is to preserve and improve the quality of the environment of the RMI, and to that end, have the following objectives:

(a) to study the impact of human activity including redistribution, cultural change, exploitation of resources and technological advances on the environment;
(b) to restore and maintain the quality of the environment;
(c) to use all practicable means including financial and technical assistance to foster and promote the general welfare of the people by creating conditions under which mankind and nature can co-exist in productive harmony;
(d) to improve and coordinate consistently with other essential considerations of National policy, governmental plans, functions, and programs and resources to as to prevent, as far as practicable, any degradation or impairment of the environment;
(e) to regulate individual and collective human activity in such manner as will ensure to the people safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
(f) to attain the widest possible range of beneficial uses of the environment without degradation or impairment thereof and other undesirable consequences to the health and safety of the people; and
(g) to preserve important historical, cultural and natural aspects of the nation's culture and heritage, maintaining at the same time an environment which support the multiplicity and variety of individual choice.[P. L. 1984-3 1,s 19.]

The NEPA Act 1984 is supported and further elaborated in a set of 8 regulations for protection of surface and marine waters, and air quality, and managing of potential impacts from earth works, sanitation systems, waste and new infrastructure development. The Act, and these regulations along with the Coast Conservation Act 2008, provides the framework for the protection of resources and environmentally sustainable development in RMI. The eight (8) regulations are –

- Earthmoving Regulation 1988 (with amendments in 1994 and 1998);
- Solid Waste Regulations 1989
- Toilet Facilities and Sewage Disposal Regulation 1990
- Marine Water Quality Regulation1992
- Public Water Supply Regulation 1994
- Environmental Impact Assessment Regulation 1994
- Ozone Layer Protection Regulation 2004Pesticides and Persistent Organic Pollutants Regulation 2004.
- Sustainable Development Regulation – this is currently in draft and will replace the Earthmoving Regulation once it comes into force.

The three regulations of specific relevance to SEDeP are the EIA, the Solid Waste and the Public Water Supply regulations. These are discussed below.

<u>Environmental Impact Assessment Regulation 1994</u>

The Environmental Impact Assessment (EIA) Regulation (Section 21, NEPA) is the central environmental planning legislation. Its aim is to ensure that environmental concerns are given appropriate consideration in decision making for all new infrastructure projects. The EIA regulation requires a preliminary proposal for every development activity, and applies a two-step assessment process to determine the level of assessment required. Step 1 is an initial evaluation to determine if the activity has the potential for significant effect on the environment; the preliminary proposal is an initial evaluation to determine whether an activity or action has significant environmental effect. Step 2 is an EIA for proposals assessed to have potential significant impact which will be reviewed and form the basis of an approved or not approved decision. The EIA process requires extensive and inclusive consultations with all stakeholders. In preparing the EIA, the proponent shall follow the format and content, as detailed in Part IV of the regulation, unless otherwise directed by the Authority. The proponent shall remain subject to regulatory and permitting requirements pursuant to NEPA, Coast Conservation Act, and the Historic Preservation Act and Tourism Act 1991.

Solid Waste Regulation 1989

The purpose of these regulations is to establish minimum standards governing the design, construction, operation and maintenance of solid waste storage, collection and disposal systems. As all waste will be exported from the RMI, the Regulations shall only be applicable to the collection and storage of the solid waste while in the RMI. The Regulations cover the management of bulky waste such as appliances, tree branches or other oversize waste such as interior building cladding.
The Regulations also define hazardous waste as any waste or combination of wastes which pose a substantial present or potential hazard to human health or living organisms because such wastes are nondegradable, or persistent in nature, or because they can be lethal, or because they may otherwise cause or tend to cause detrimental cumulative effects. The Regulations list the general requirements for the storage of solid waste as well as detailing the type of containers that may be used to store solid waste. The Regulations also govern the handling of hazardous waste within the RMI.

Public Water Supply Regulation 1994

The purpose of the regulations is to establish certain minimum standards and requirements to be necessary for the public health and safety and to ensure that public water supply systems are protected against contamination an pollution and do not constitute a health hazard.

The regulations state that no person shall cause or allow the construction of or change to any public water supply without approval of final drawings and specifications. All work performed on a public water supply shall be in accordance with accepted engineering practices.

Any pipe, solder flux or fitting in a public water system or any building connected to a public water system shall be lead free. Flux and solder may not contain more than 0.2% lead. Pipe and fittings may not contain more than 8% lead.

The Authority shall review a notice of intent to construct or modify a public water supply system for completeness within 60 calendar days from receipt and shall either:

i) Fully or conditionally approve the notice for the preparation of formal plans and specifications for the proposed facility

ii) Request additional information
iii) Deny the proposal

3.2 Land Legislation

The Resettlement Policy Framework for SEDeP details the legal framework for the management of land in the RMI.

3.3 International Conventions and Treaties

RMI is a signatory to a number of international conventions and treaties. Those of particular relevance to SEDeP are (i) UN Framework Convention on Climate Change; (ii) UN Convention on Biological Diversity (iii) UN Barbados Program of Action and Mauritius Strategy; (iv) the Montreal Protocol, including the Kigali Amendment signed by RMI in 2016.

3.4 World Bank Safeguard Policies

Screening based on field investigations, stakeholder consultations and a review of potential options for implementation confirms an assessment of Category B for the Project. It finds that potential impacts are less significant, site specific, mostly reversible and that a range of potential measures for mitigation can be readily designed in the majority of cases.

The following Safeguard Policies are potentially triggered as a result of the Project, requiring the Borrower to prepare this ESMP and the Resettlement Policy Framework to address all requirements of these policies.

3.4.1 OP4.01 Environmental Assessment

The purpose of Environmental Assessment is to help ensure the environmental and social soundness and sustainability of investment projects, and to support the integration of environmental and social aspects of projects into the decision making process. The policy defines procedures to screen and assess potential impacts and mitigation, prepare safeguard instruments, ensure public consultation and transparency and that there are implementation and supervision of commitments relating to findings and recommendations of the environmental assessment.

This ESMP is an integral part of compliance with this policy. All activities proposed for funding and implementation under the Project are subject to the provisions and stipulations within this document. This includes the physical investments (solar and diesel) and associated facilities, the advice provided under Technical Assistance, the management of environmental and social risks relating to energy efficiency initiatives, and in the design of the future renewable energy projects.

3.4.2 OP 4.04 Natural Habitats

The conservation of natural habitats is essential for long-term sustainable development. The Bank therefore supports the protection, maintenance, and rehabilitation of natural habitats and their functions. The Bank does not support projects involving the significant conversion of natural habitats unless there are no feasible alternatives for the project and its siting, and comprehensive analysis demonstrates that overall benefits from the project substantially outweigh the environmental costs.

For Components 1 and 2 of SEDeP, the PV installations proposed for the airport freshwater reservoir, roof tops of public buildings and facilities and structures over car parks and open space in Majuro, will not affect any natural habitats. The replacement generators will occupy the old genset footprints and will not affect any natural habitats. However ancillary activities may have direct and indirect

impacts; aggregate mining for concrete production and waste management on the atolls have the potential to impact local reef and marine benthic ecosystems.

The policy is also relevant for the preparation of future projects. While the SEDeP is not funding the physical investments, it is funding the design of technology (including location and ancillary activities) and the preparation of the associated safeguard instruments. This policy is relevant to this aspect of the works as the Ebeye solar PV systems may require disturbances to the foreshore which may have natural habitat. Stand-alone PV systems proposed for outer islands will require land for PV arrays and possibly for ancillary infrastructure such as ship to shore facilities or access tracks. Some natural habitats may be affected and the ESMP will include measures to avoid or mitigate the damage or loss of sensitive habitats.

Limited land for contractor's use (laydown areas) may be required temporarily and land selection will avoid existing natural habitats. The ESMP will guide contractors' activities accordingly.

3.4.3 OP 4.37 Safety of Dams

Commented [GV1]: Ref 2

This policy is considered triggered given the possible use of the water reservoir for PV installation, since the project relies on an existing reservoir structure. This policy is also triggered because this Project is dependent on an existing dam structure with derived risks [albeit very low] to this investment. Any potential risk of damage to the reservoir and leaks or spill threatens the drinking water supply from Majuro's only public reservoir. The safety of the existing reservoir and the risks to this project, and the potential risk of impacts to the integrity of the reservoir structure will be assessed by qualified experts and appropriate safety measures, if required, will be addressed through project engineering design and will include any remediation required to the reservoir structures. Under OP 4.37

> *10 Necessary additional dam safety measures or remedial work may be financed under the proposed project.*
>
> *11. When the owner of the existing dam or DUC is an entity other than the borrower, the borrower enters into agreements or arrangements providing for the measures set out in OP 4.37 to be undertaken by the owner.*

For SEDeP, it is recommended that there is an MOU developed between MWSC and MEC.

The Environmental and Social Management Plan will be updated once the detailed design has been completed and the dam assessment completed. It will include any mitigation measures or emergency measures for any social or environmental risks, in accordance with OP/BP 4.01, *Environmental Assessment*.

3.4.4 OP 4.11 Physical Cultural Resources

The policy seeks to preserve physical cultural resources and avoid their destruction or damage. It encompasses resources of archaeological, paleontological, historical, architectural and religious (including grave yards and burial sites), aesthetic, or other cultural significance.

The environmental assessment has confirmed there are no PCR issues for the Majuro solar investment options and diesel generator replacements. The sites are all within urban areas and heavily modified from decades of earlier development.

There is a possibility that PCR may be identified during the ESIA/ESMP studies for renewable energy investments in the outer islands and Ebeye including graves and World War II relics. Should PCR be discovered during these studies, then the sites will be avoided, or if that is not possible, the ESMP will include appropriate mitigation measures.

3.4.5 OP 4.12 Involuntary Resettlement

There will be no involuntary land acquisition. Compulsory acquisition of land in RMI, although legally possible, is very difficult and not supported by the cultural norms of land tenure. All projects will either be located on Government-leased land or leases (or other legal forms of agreement) will be obtained from the private land owners. The SEDeP Resettlement Policy Framework sets out arrangements for the voluntary agreement of access to and use of land for project purposes. It also sets out protocols for the management of all involuntary resettlement impacts that may be generated. These are very unlikely, but would relate to relocation or damage to shelter, loss of assets or access to assets, and or loss of income sources or means of livelihood for tenants or squatters who have no choice.

4 Environmental and Social Conditions

This section provides information on the physical, biological and social elements of the environment within the Project's scope. The environments described in this section span the full physical and social influence area of the Project. The influence area is considered to include Project sites such as installation sites, laydown areas, ports and haulage routes.

4.1 Location and Setting

Majuro is home to the capital and also the largest city of the RMI, Delap-Uliga-Djarrit (D-U-D). It is also a large coral atoll of 64 islands in the southern end of the Ratak Chain It forms the legislative district of the Ratak Chain of the RMI. The atoll has a land area of 9.7km^2 and encloses a lagoon of 295 km^2. As with other atolls in the RMI, Majuro consists of narrow land masses.

Ebeye is the most populous island of Kwajalein Atoll as well as the center for Marshallese culture located in the center of the Ralik Chain. The land mass of Ebeye is 80 acres and it is the fifth most densely populated island in the world.

It is estimated that Majuro generates about 7.2 tons of residential waste per day and 13.2 tons of commercial waste per day. The main dump site at Jable- Batkan has exceeded it's design capacity. In 2014 it was estimated that about 56,600m3 of waste is stored at that dump site, which is prone to flooding and does not have leachate control, contributing to the pollution of the surrounding marine environment.[6]

Ebeye landfill is lacking in several areas and the landfill located at the north end of the island poses health, safety and environmental concerns.[7]

4.2 Physical Environment

4.2.1 Climate

The Climate of RMI is tropical throughout the year and is divided into two predominant seasons: a wet season from May to November and a dry season from December to April. Rainfall averages 300-380mm per month with October and November the wettest and December to April the driest. Average rainfall increases from the north to the south: the northern atolls receive less than 1,250mm annually and are very dry in the dry season, while atolls close to the equator in the south receive more than 2,500mm of rain each year[8]. Majuro itself is recorded as receiving an average of 3,200mm of rain per year while Ebeye has an average recording of 2,500mm per year[9].

The Intertropical Convergence Zone brings rainfall to the RMI throughout the year. Rainfall is also sometimes influenced by the West Pacific Monsoon, which brings wetter conditions when it is active over the country. Many Pacific typhoons begin as tropical storms in the RMI region and grow stronger as they move westwards.

[6] https://www.adb.org/sites/default/files/publication/42669/solid-waste-management-marshall-islands.pdf, Accessed Sept 2017
[7] https://www.usma.edu/cnrcd/CNRCD_Library/Ebeye%20Report.pdf Accessed Sept 2017
[8] Current and Future Climate of the Marshall Islands, Pacific Climate Change Science Program, 2011
[9] WMO Climate Normals for Majuro, PI 1961-1990, NOAA 2015

Typhoons, droughts and storm waves are the main extreme events that impact the RMI. Typhoons affect the country late in the typhoon season, between September and November. They are usually weak when they pass through the region but are more intense in El Nino years.

Droughts generally occur in the first four to six month of the year following an El Nino when the rainfall can be reduced as much as 80%.

Across the RMI the average temperatures is relatively constant year round, averaging between 25°C and 30°C for Majuro and Ebeye across the year. Changes in temperature from season to season are relatively small (around 1°C) and strongly tied to changes in ocean temperature.

4.2.2 Geology

Coral atolls are remnants of volcanic islands characterized by narrow islands ringing a shallow lagoon. The atolls of the RMI are formed of low lying islands with an average elevation of less than 4m above sea level.

Majuro consists of a series of islets connected by causeways on the south rim to form an almost continuous land mass. The atoll is elongated in shape and extends approximately 40k east to west. At the western end of Majuro atoll about 40km from the airport by road, is the highest elevation point on the atoll, estimated at less than 3m above sea level.

Kawajalein atoll, home of Ebeye island, is one of the world's largest coral atolls. Comprising of 97 narrow islands and islets, it surrounds one of the largest lagoons in the world. The average height above sea water for all of the islands in this atoll is about 1.8m.

4.2.3 Natural Hazards & Climate Change

The RMI have a low vulnerability to tsunami, earthquakes and landslides and a medium vulnerability to typhoons and droughts, and a high vulnerability to coastal flooding.[10]

RMI declared a state of disaster in 2013 and 2016 due to prolonged drought which impacted over 6,000 people. In early March 2014, king tides inundated Majuro Atoll and some of the outer islands with 1,730 people affected and 940 displaced. The inundation affected housing infrastructure and contaminated water supplies, agriculture and food crops.[4]

Pacific typhoons generally develop to the east of the RMI, but it is sometime subject to the full brunt of a typhoon, particularly in the northern atolls. Historically, the storms impact the atolls about once every four to seven years, although since 2014 there have been three major cyclones. Much more common are minor storms of the easterly wave type, especially from March to April and October to November. [11]

The Pacific Climate Change Science Program (PCCSP) has undertaken extensive climate prediction modelling of the entire Pacific region and has made detailed predictions about the likely climate change scenario for the RMI for 2030 and 2090. The models predict that both air and sea temperatures will continue to increase in the range of 0.4-1 C by 2030. The models also predict that, associated with this increase in air temperature, there will be an increase in the number of hot days and a decrease in the period of cooler weather. Almost all of the global climate models project an increase in average annual and seasonal rainfall over the course of the 21st century. Wet season increases are particularly due to the expected intensification of the West Pacific Monsoon and the Intertropical Convergence Zone. Model projections show extreme rainfall days are likely to occur

[10] http://www.unocha.org/pacific/country-profiles/marshall-islands, United Nations Office for the Coordination of Humanitarian Effort, accessed September 2017
[11] http://www.rmiembassyus.org/index.php/about/marshall-islands/geography, accessed September 2017

more often and linked to this, droughts are expected to become less frequent through the century. With regard to cyclonic activity, the RMI is in a region where projections tend to show a decrease in cyclone frequency by the late 21st century and a decrease in the proportion of more intense storms.

Under the PCCSP modelling, sea levels will continue to rise in the RMI and in 2030 under a high emission scenario, this rise in sea level is projected to be in the range of 30-160mm. The sea level change combined with natural year to year changes will increase the impact of storm surges and coastal flooding.

4.3 Biological Environment

4.3.1 Terrestrial Environment

The current proposed Project sites are within urbanized and altered terrestrial environments and the associated vegetation is dominated by grass and sporadic trees. Urban environments such as those in downtown Majuro and Ebeye are often characterized by a large proportion of traditional vegetation such as breadfruit, pandanus and some other food crops to a lesser degree. On Majuro and Ebeye there is low floral biodiversity but often high numbers of introduced species.
Some of the potential project sites may have large shade giving or food bearing trees in the immediate vicinity.

Lizards, insects and domesticated animals are the most common fauna at these sites, with migratory birds also being frequently spotted using the water reserve as a stopover.

There is one endemic species of bird in the RMI, the Ratak Imperial Pigeon (*Ducula Oceanica Ratakensis*, local name: Mule) which is found in the urbanised areas of Majuro. The Mule perches and feeds on breadfruit and papaya tress throughout its range. A 2010 conservation project managed by the Marshall Islands Conservation Society and funded by the Critical Ecosystem Partnership Fund (CEPF) undertook a planting program for papaya and breadfruit which has resulted in increased Mule population from 16 individuals during a 2008 count, to 83 individuals as of July 2009.

Migratory birds are documented as using the freshwater reservoir, along with other freshwater lakes within the RMI atolls, as a stopover during their migrations. While it is known that these birds are not nesting at this location, it has not yet been possible to determine the species, abundance, time or year or length of visit.

4.3.2 Marine Environment

The RMI is formed of coral atolls and as such are characterized by calmer sea conditions on the lagoon side shores and larger swells and rougher condition on the ocean side shore. The RMI coral reef is home to over 800 species of fish, 1,600 species of mollusks and more than 250 species of coral. While the current identified proposed Project sites do not fall directly within the marine environment, the Project will require aggregates in the form of sand for concrete production.

A major concern for both GoRMI and the general public is mining on the reef and lagoon shorelines, contributing to rapid erosion, especially in various parts of Majuro and Ebeye. Moreover, the sand and gravel aggregates in these areas are non-renewable and there is increasing awareness that the mining of these resources is at present unsustainable.[12]

[12] http://www.sprep.org/Marshall-Islands/marshall-islands-pein, Pacific Environmental Information Network, accessed via SPREP September 2017

The destruction of coral reefs is more pronounced adjacent to the urban centers as there is increasing demand for housing and infrastructure development. Primarily on Majuro and Ebeye, sand and gravel for construction is extracted by dredging from the lagoon intertidal and nearshore zones. This has heavily impacted the adjacent reefs. For instance, with suction dredging, the displaced sands and sediments are carried by ocean currents and deposited on reefs, leading to coral death.

4.4 Socio-Economic Environment

Government assistance from the United States of American is the mainstay of the RMI economy. Agricultural production, primarily subsistence, is concentrated on small farms, the most important commercial crops being coconut and breadfruit. Small scale industry is limited to tuna processing, handicrafts and copra. Tourism is a growing sector and it is hoped that this is the countries best option for growing future income. The islands have few natural resources, and imports far exceed exports.

With limited export and domestic production opportunities, public administration and social services constitute the largest share of the economy – approximately 45 percent of GDP. The fisheries sector comprises around 10 percent of GDP, while manufacturing makes up less than 2 percent. Copra and fisheries are the most significant exports, while the country is almost completely reliant on imports for food, fuel, and other basic needs. With substantial constraints to export-led growth, the Marshall Islands is heavily dependent on aid and other fiscal transfers. Foreign aid funds a very large public sector that dominates the economy.

The Marshall Islands' reliance on expensive imported fuel will continue to impose severe fiscal challenges, with effects felt throughout the economy, if not properly addressed. RMI currently spends a significant amount (between US$2-3 million annually) of the aggregate sectoral grants that the nation receives in imported fuel making energy the costliest sector of its fragile economy. The proposed project is expected to contribute to the long-term sustainability of energy supply in the country by supporting a shift from diesel power generation to renewable energy (RE) and to place the RMI on a sustainable, climate resilient development pathway.

The population of the RMI is estimated at 53,066[13] in 2016 of which the two largest urban centers, Majuro and Ebeye, have populations of 28,000 and 9,614, respectively. The islet of Ebeye has the highest population density in the Pacific (among the highest in the World), with the overall population living on the 0.31 km^2 area of the island, resulting in a population density of 31,013 persons per km^2. Majuro and Ebeye are the two main urban centers of the RMI and are home to nearly 75% of the total population.

Teenage pregnancy, domestic violence, non-communicable diseases (from diet and lifestyle issues) and human trafficking are critical social issues for Marshallese. NGO's note there is a well-established sex worker industry in Majuro and Ebeye. Decision making is still largely influenced by the land owners under traditional and cultural norms, and civic engagement in community issues is low.

4.5 Outer Islands – Wotje, Jaluit and Rongrong

The outer islands are atoll environments, with steady or declining populations. Wotje has 860 people, Jaluit has 1780 people and Rongrong (an island in the Majuro atoll) has 60 people. All three

[13] 2011 RMI Census

have high schools and while only two have government services. All three islands already have diesel mini-grids providing electricity.

5 Stakeholder Engagement

Stakeholders will require engagement across the SEDeP, for physical investments, policy development, energy efficiency initiatives and other aspects.

During the detailed planning phase for solar PV installations, diesel gensets, and outer island hybrid systems, stakeholder engagement is essential to the review of detailed designs, the selection of mitigation options for identified social and environmental impacts and the prioritisation of investments for funding and implementation scheduling. It is important that the affected communities – including women and vulnerable groups – are given the opportunity through consultations to be made aware of the proposed activities, and to comment and contribute to the project design. MEC will be responsible for ensuring meaningful consultations for all components of SEDeP.

5.1 Stakeholder Identification

A stakeholder is defined as a person or group who has an interest in a particular decision or activity relating to SEDeP, either as an individual or as a representative of a group. This includes people who can influence a decision, or can influence actions, as well as those affected by it.

For the SEDeP, stakeholder groups will vary between Majuro, Ebeye and outer islands (for future projects), policy development, energy efficiency etc. Stakeholders for project sites have been and will continue to be identified on a continuing basis by:

- Identifying the various categories of parties who may be affected by or interested in the project; and
- Identifying specific individuals or organisations within each of these categories taking into account:
    - The expected area of influence of the project, that is the geographic area over which it may cause impacts (both positive and negative) over its lifetime, and therefore the localities within which people and businesses could be affected;
    - The nature of the impacts that could arise and therefore the types of government bodies, NGOs, academic and research institutes and other bodies who may have an interest in these issues.

5.2 Stakeholder Groups

Stakeholder groups applicable to SEDeP are listed and described below.

5.2.1 National Government Authorities

National authorities are defined as those agencies of the GoRMI who have the power to regulate or influence the Project in terms of granting permits or other approvals for the Project, and monitoring and enforcing compliance with GoRMI law throughout the project implementation cycle. It is important to continue a productive dialogue with these national authorities throughout project implementation.

National Environmental Protection Authority (NEPA)

Under the MECC, the NEPA has the mandate to preserve and improve the quality of the environment. In 1987 the Authority was combined with the National Environmental Sanitation

office. The EPA operates as a government funded statutory authority with ties to the Ministry of Health and Environment. Serving today as the nation's primary agency for environmental protection, the RMIEPA's duties encompass the areas of nature conservation, waste disposal, public sanitation, public and marine water quality monitoring and environmental education. The NEPA also oversee the environmental and drinking water permitting that is relevant to SEDeP.

Lands Registration Authority

As part of the land due diligence for any future project under SEDeP, the Resettlement Policy Framework covers consultations with the Lands Registration Authority.

Ministry of Internal Affairs

This Ministry manages land leases for Government purposes on behalf of the Government of RMI. This Ministry will assist in the identification of government land and arranging leases.

5.2.2 Managers of Targeted Spaces in Majuro for PV Investments

Majuro Water and Sewer Company (MWSC): MWSC is the company providing the water & sewer services to the residents of Majuro Atoll and are responsible for the operations and maintenance of the freshwater reservoir.

Marshall Island Port Authority (MIPA): MIPA manages the Amata Kabua International Airport in Majuro, including the car park.

Ministry of Health: For the spare land on the hospital site, this ministry is a stakeholder.

Ministry of Education: For targeted spaces on school roofs, this ministry should be consulted.

5.2.3 Local Governance

Malgov is the local government agency responsible for public spaces and some public buildings on Majuro.

Kalgov: Is the local government agency responsible for public spaces and public buildings on Ebeye.

The Outer Islands are each led by their own local governance structure. Each of the local governments is led by a Mayor and jointly governed by the Local Government Council.

At the national level, the Office of Local Government Affairs falls under the Ministry of Cultural and Internal Affairs is responsible for coordinating with the Local Governments.

5.2.4 Affected Communities and Individuals

This group will include all people who may be directly or indirectly affected by the SEDeP investments at Majuro and Ebeye and for future projects prepared under this project (Ebeye and Outer Islands). It will include communities located adjacent to the installation sites, along the haul routes, users of targeted recreational spaces and car parks in Majuro, and building occupiers.

At this point in the works, the affected communities adjacent to the solar and diesel installation sites can be identified at all targeted spaces, however, the associated facilities for these investments, and the locations of future projects, are not yet confirmed therefore those communities have also yet to be identified.

5.2.5 Civil Societies and NGOs

This group includes smaller groups in society who may have an interest in the SEDeP and its social and environmental aspects.

Marshall Islands Conservation Society: The MICS has run a conservation project regarding increasing the habitat for the endemic Ratak Imperial Pigeon on Majuro.

Women United Together Marshall Islands (WUTMI) is a women's based NGO and has strong presence in the outer islands. They are active in promoting resilience, including renewable energy and energy efficiency.

Marshall Islands Mayors' Association (MIMA) is a NGO including all of local government mayors. This NGO would be strongly placed to support SEDeP implementation.

College of Marshall Islands (Environmental faculty).

International Organisation for Migration (IOM)

5.2.6 Land owners

All land is privately owned and land owners hold a large amount of influence over development projects, since land is scarce on all of the atolls. Land owners are very important stakeholders for any new infrastructure.

5.2.7 Public

The public will be stakeholders in the development and implementation of demand side energy efficiency and energy policy development.

5.3 Stakeholder Engagement and Consultation Program (SECP)

The SECP needs to be updated and refined throughout the lifecycle of the Project. During this process the focus and scope of the SECP will change to reflect the varying stages of project implementation and to encompass any changes to project design. The implementation plan is included in Table 4.

5.3.1 Engagement Mediums

Table 3 below lists the recommended engagement mediums that are appropriate for SECP activities proposed as part of the implementation plan components in Section 5.3.3. Because of the myriad of activities and different stakeholders needs at different times, a wide range of communications methods and mediums are proposed.

Table C: Recommended engagement mediums

Medium	Description
Stakeholder Meetings	
Structured Agenda	This agenda is developed based on project component under consultation and the stage of its implementation. Putting a focused agenda together will ensure that key strategic

	and risk items can be discussed with important decision-makers and influencers in an effort to mitigate risk proactively.
Focus Group Meetings	The aim of a focus group is to pull together stakeholders with the same interest into a single meeting to discuss issues. Meetings usually have a very specific objective which is aligned with the expectations and interest of the stakeholder's present.
Forum	A forum is established with specific set objectives and would comprise of a specific group of stakeholders who would need to ensure that actions are taken and monitored.
Community based consultations	These consultations are focused to identify and discuss stakeholder concerns or to provide feedback using detailed information. These consultations should, wherever feasible, be held within the community environment.
Written / visual communications	
ESMP Executive Summary	This needs to be a short and concise document providing jargon-free information describing the project actions, the potential social and environmental impacts, the need for the project and the contact details for the project team.
Notice boards	Notice boards (community, and work site entrances) are a good tool to use for communication of up-to-date project information such as timing and duration of works, upcoming consultations, project progress and other relevant project information.
Maps	Maps are effective when placing into context well known locations, linear and single site developments, change of fixed locations for developments, location options for developments and anticipated distances between developments or well-known locations.
Letters	Formal method of communication usually intended to convey very specific messages. Alternatively, it is used as a formal method for request of information.
Emails	Using emails for in-country stakeholders can pose a challenge because of limited internet access due to insufficient telecommunications and/or supporting IT infrastructure. NGOs and most of the Government Ministries do have access to email which can be utilised for communications, but arranging of formal community consultations is best arranged through other methods of communication.
Newspapers /adverts	Newspapers are usually best suited for formal announcements or to reach a wide spectrum of stakeholders quickly. It is however very important that the message content is carefully compiled since it is a one-way communication medium and can quickly cause misunderstanding or confusion if not clearly written.
Media	
Radio	Radio is a good medium to stimulate awareness and prepare stakeholders for larger events or refined communication to take place. This would be appropriate for Majuro but not for Ebeye (as there is no radio on island).
Other	
MEC	MEC PIU will be the 'familiar faces' of the project and will, for many stakeholders at the community level, represent the most direct channel to the project.

Telephone	Use of the telephone / mobile phone is still regarded as the preferred method for communication because of accessibility and speed. Having a discussion over a phone in order to ensure mutual understanding between two parties is quicker and easier compared to sending an email, waiting for reply.

The mode of consultation will vary according to the subproject and the participants, but in all cases will promote participation by ensuring that the venue is accessible, the timing convenient and the manner of conduct of the consultation socially and culturally appropriate. Consultations will be announced to give sufficient notice for participants to prepare and provide input to project design.

5.3.2 Key Messages

Key messages will need to be developed as each component is prepared in more detail during implementation. For the physical investments planned for Majuro and Ebeye, the key messages should be developed around the following and confirmed once the project details are confirmed:

Majuro Solar and Network Upgrade Key Messages:

- Solar is part of a renewable energy vision for Majuro / Marshall Islands. It is 'home grown', unlike diesel, so we are more resilient to fuel prices and delivery.
- Battery storage will help to capture solar energy for use at any time of day.
- The supply of electricity to your business / home shouldn't change – you probably won't notice any difference, but it may become more reliable.
- What will happen to my electricity tariff? The tariff is unlikely to change, although it may not increase as much in the future. Even though sunlight is free, the MEC still has to pay for operations and maintenance of equipment and the network. The fuel cost savings will mean the Government will pay fewer subsidies and will have more money to spend on other essential services.
- MEC is prioritising government land and buildings and the design will allow the existing land uses to continue, to avoid taking up valuable land. There will be no relocation of people or businesses because of this project.
- The installation of panels should take a couple of months. There may be some construction noise and some more traffic during this time if you live or work near the site. There won't be a large workforce required.
- Any local job opportunities will be advertised by the Contractor or MEC.

Diesel on Ebeye Key Messages:

- The project will replace existing equipment which will improve reliability of electricity supply.
- The supply of electricity to your business / home shouldn't change – you probably won't notice any difference.

5.3.3 Implementation Plan

The Implementation Plan (Table 4) for the SEDeP lifecycle constitutes the following components:

Activity: the various operational consultation activities that will be undertaken as part of the SECP

Objective: the target that each activity needs to reach

Stakeholder: the various stakeholders to be targeted during implementation of the SECP activity; and

Medium: the method by which the engagement or consultation will be done

Some elements of the implementation plan have yet to be confirmed. As project details develop, this SECP and implementation plan shall be updated by the Safeguards Advisor to reflect the current project status and timeframes.

Table D: Stakeholder Engagement and Consultation Implementation Plan

No	SEDeP Activity	Timetable	Objective	Stakeholders	Medium
A: Physical Investments (Solar, Diesel, Network Upgrades)					
A1	Feasibility, decision on the sites / technologies and preliminary designs	From Project effectiveness through to tendering.	Bring stakeholders along with the decision making around the site and type of investments. Discuss potential impacts and mitigation measures. Key messages	All identified	Structured Agenda One-on-One Consultations Public meetings Emails and letters
A2	Disclosure of updates to the ESMP	Prior to tendering Prior to works starting	To disclose ESMP	All identified	Newspaper Website
			Advise stakeholders of preliminary designs and updated mitigation and management plan.	Communities Site occupants (State owned enterprises. Government agencies) Site users (if different from above)	One-on-one consultations Executive Summary

No	SEDeP Activity	Timetable	Objective	Stakeholders	Medium
A3	Detailed design	Once Contractor is on board and prior to works starting	Keep stakeholders involved in any design updates. Public announcements	Government agencies, site occupants, site users	Emails, One-on-one consultations Newspaper and websites
A5	Commencement of Works	Week before commencement of works.	To advise all stakeholders of commencement of civil works.	All identified stakeholders Site occupants (State owned enterprises. Government agencies)	Newspaper Email
			To reconfirm ongoing consultation, feedback and GRM processes	Community Site occupants (State owned enterprises. Government agencies)	Community Notice Boards Building Notice Boards Website
B: Energy Efficiency Activities and Policies					
B1	Development of activities, policies etc.	Once consultants are engaged and assisting EPD and MEC Throughout duration, as required.	Seek input from stakeholders in Energy Sector to define issues	(Govt agencies, local government, large energy users, NGOs)	Meetings emails
		During drafting	Public consultation and awareness raising	Public	Newspaper Website
B2	Implementation of activities, programs, policies etc.	Drafting of solid waste plans or other safeguards instruments	Disclosure of instruments	All identified	Emails Newspaper Website
		Project implementation	Awareness raising Encouragement to participate Progress reporting	All identified	Newspaper Website Meetings Emails

No	SEDeP Activity	Timetable	Objective	Stakeholders	Medium
C: Development of Future Energy Generation Options					
C1	Feasibility, decision on the sites / technologies and preliminary designs Preparation of land due diligence, ESIA and ESMP	During project screening and feasibility phase Prior to final designs and bid document preparation	Understand stakeholder base to determine key messages and engagement mediums Undertake initial consultation on proposed project concepts Bring stakeholders along with the decision making around the site and type of investments. Discuss potential impacts and mitigation measures. Key messages	All identified	Structured Agenda One-on-One Consultations Public meetings Emails and letters
C2	Preparation of A/RAP	During feasibility phase prior to finalizing preliminary design	Detailed surveys and consultations with affected persons.	Affected persons	One-on-One consultations
C2	Disclosure of ESIA, ESMP and A/RAP (if required)	Prior to finalizing tender documents	To disclose ESMP	All identified	Newspaper Website Meetings

5.3.4 Resources and Responsibilities

The implementation of the SECP will be the overall responsibility of the SEDeP PIU, with support from the DIDA Safeguards Specialist as required. There are several facets to the works that are covered within this plan with MEC and KAJUR being the common denominator across the works as such, it is important that MEC and KAJUR are represented at each of the one-one-on consultations by a nominated staff member.

The DIDA Safeguards Specialist who will take the lead role in the implementation of the SECP. The PIU will be responsible for arranging and facilitating the meetings as it appropriate with their in-depth knowledge of the natural, social and traditional environments within RMI. The PIU will

also be the focal point for all stakeholder queries and contacts in relation to the implementation of the SECP or the GRM.

It is also the responsibility of the PIU to ensure that gender balance is achieved throughout the implementation of the SECP and the Safeguard Specialist will make culturally appropriate recommendations on strategies to achieve this such as separate meetings for males and females, or targeting female input through women's groups.

5.4 Public Consultations to Date

A series of public consultation meetings were held on 31st July 2017 with the aim of providing meaningful consultation with stakeholder groups and to provide an opportunity for all parties to provide input into the Project. The meetings targeting three groups of stakeholders: (a) Government agencies, authorities and SOEs in Majuro and Ebeye; (b) NGOs, non-governmental institutions and civil society groups; (c) donor agencies, especially those with experience and involvement in RMI's renewable energy sector.

The consultations for the various groups took place according to the following schedule:

Stakeholder group	Date and time
1. Relevant Government agencies, SOEs, donors	• 31 July, 2017; 10am MOF Conference Room
2. NGOs, civil society and local community at Majuro	• 31 July, 2017; 2:00pm MOF Conference Room

The following is a summary of the questions and issues raised during the consultation process.

5.4.1.1 Consultation 1: Relevant Government agencies, SOEs and donors

1. One of the targeted schools for possible roof-top installations is a private school co-funded by Go RMI, the Majuro Co-operative School. All other buildings assessed on the recommendation of MOF-DIDA are government or public owned.
2. In response to discussions over the issue of the cumulative impact of the project on the issue of accumulated waste oil in both MEC and KAJUR's compound, the JICA representative informed the consultation that JICA is funding a feasibility study for ways of reusing waste lubricant oils. The feasibility team is currently in RMI and have visited MEC and KAJUR's facilities to assess their facilities and capacities, and to collect used oil samples for testing. The JICA representative invited the Safeguards Specialist to meet with the JICA Feasibility Team before their return.[14]
3. A participant from KAJUR asked if there are resettlement impacts, and if so, how are these handled? Will the Project ensure that compensation owed are settled and paid out and not ignored? In response, it was explained that a resettlement action plan (RAP) will be prepared if there are resettlement impacts and all compensation and entitlements identified in the RAP will

[14] This meeting took place on the 1 August, 2017 at the JICA Office. Present were Sam Sesega - Safeguards Specialist, Mr Nobuaki Matsui – JICA Resident Representative, and six members of the Feasibility Study Team.

be paid out. Moreover, the Project will not start until WB is satisfied, based on the RAP Implementation report to be prepared and submitted by Government of RMI, that all entitlements have been fully paid to the rightful people.

4. There was clarification of the term resettlement which one participant misunderstood to mean there will be relocation of affected people. It was explained that the term is much broader and also refer to losses and or damage to assets, and that if people needed to be relocated temporarily from their homes, the Project will be responsible for their relocation including all costs associated with it.
5. Why is Ebeye not included in targeted areas for the replacement of incandescent streetlight bulbs with LED bulbs? The Ebeye participant noted that safety at night is an important issue for their densely populated atoll.
6. Ongoing operation and maintenance costs need to be properly calculated and considered.
7. In Ebeye, with the installation of R.O. units, the energy need and consumption is expected to be increased. The need for Renewable Energy Project in Ebeye is strong.
8. Donor coordination needs to be further strengthened to ensure complementary between approaches and investments.
9. Ministry of Public Works has been working with BECA (consulting firm) to design and construct public buildings with a specific consideration that solar PVs installation can be accommodated in the future.
10. Ministry of Public Works commented that the proposed flexible support structure for the solar PVs on water reservoir should be designed to withstand high wind speed. Typhoon is not very common in the RMI but the designing firm/consultant should also consider the impacts of typhoon.
11. MWSC requested that the technical feasibility study once finalized should be shared with stakeholders.

5.4.1.2 Consultation 2: NGOs, civil society and local community at Majuro

1. A few participants recalled there were whirlwinds in Delap that affected roof buildings in this location, and it's a regular occurrence in this area. Would this not have any impact on the proposed roof-top installations for schools in Delap?
2. Contrary to ESMF narrative that work opportunities from the Project for local people are likely to favour men over women, WUTMI Executive Director noted that the ESMF should not assume so, and that equal job opportunity should be offered to both genders.
3. Would the quality of drinking water in the reservoir be adversely affected by sunlight passing through PV panels?
4. CMI research on possible location of PV panels on reefs would be damaging to reef ecosystem.
5. WUTMI Executive Director also advised that should there be a sizeable number of foreign workers involved, proper orientation of workers regarding the local culture and traditions should be conducted. WUTMI also offered their services to conduct orientation.

6. Multiple NGO representatives have shared the similar comments on the operation and maintenance costs, including the necessary policy, the institutional mechanism, and the sinking funds management capacity to ensure 1) saving from RE investment is contributed to the future O&M and 2) the GRMI is committed to financially support the future O&M costs. O&M should be both MEC and GRMI's shared responsibility.
7. In addition to the RE facilities maintenance, the hosting building/structure maintenance needs to be included in the O&M plan.
8. The usage of batteries has significant environmental impacts and practical recycling plan needs to be looked into.
9. Gender needs to be addressed, including gender-based violence from local workers.

In response to these consultations, and as part of safeguarding requirements, the following measures are adopted in this ESMP:

- Only government owned buildings (plus Co-op School) are targeted for installation of solar PV arrays.
- To deal with the disposal of hazardous or bulky waste, a Solid Waste Management Plan based around the concepts set out in Annex D of this ESMP will be developed by the Contractors. Additionally, the elements of the Solid Waste Management Plan will be adapted into a Code of Practice for Solid Waste Management in the renewable energy sector and implemented for all future projects on Ebeye and the Outer Islands.
- A Resettlement Policy Framework has been developed for the SEDeP as part of the required safeguard instrumentations. The RPF governs due diligence of land ownership and also governs voluntary or involuntary acquisition of lands or assets to ensure that any affected persons are properly consulted and compensated before project works commence.
- The SEDeP provides for the preparation of an escrow account/sinking funds mechanism and support training of MEC and/or KAJUR on operational and maintenance strategies.
- Engineers are required to consider cyclonic events in the design of installations.
- Engineers are required to conduct a thorough assessment of solar PV technologies and select those most appropriate for installation over the water reservoir taking into account any potential impacts on the water quality and the treatment and monitoring procedures of MWSC.
- All imported project staff will abide by RMI immigration policy and provide all required documentation, including health checks. Overseas workers will undergo cultural familiarisation induction upon arrival and sign a code of conduct applicable for the duration of their contract.
- All project staff will undergo training by local services providers identified by the MEC PIU on prevention of HIV/AID and GBV.
- The Contractor will develop a Code of Conduct (to be approved by PIU) for all workers (local and overseas) to sign detailing the expected behaviours of Project staff, ESHS requirements, Cultural respect, OHS requirements, Community Health and Safety considerations

5.5 Grievance Redress Mechanism

A grievance redress mechanism (GRM) is presented below to uphold the project's social and environmental safeguards performance. The purpose of the GRM is to record and address any

complaints that may arise during the implementation phase of the project and/or any future operational issues that have the potential to be designed out during implementation phase. It should address concerns and complaints promptly and transparently with no impacts (cost, discrimination) for any reports made by project affected people (APs). The GRM works within existing legal and cultural frameworks, providing an additional opportunity to resolve grievances at the local, project level.

The key objectives of the GRM are:

- Record, categorize and prioritize the grievances;
- Settle the grievances via consultation with all stakeholders (and inform those stakeholders of the solutions);
- Forward any unresolved cases to the relevant authority.

As the GRM works within existing legal and cultural frameworks, it is recognized that the GRM will comprise community level, project level and RMI judiciary level redress mechanisms. The details of each of those components are described as follows.

5.5.1 Final Draft ESMP

The Final Draft ESMP was distributed to EPA, MPW and MEC for final comment / review 18-22 September 2017.

5.5.2 Community Level Grievances

Community level grievances are most likely with the proposed outer islands RE investments where the use of privately owned land is a possibility. Issues related to land ownership, boundaries and access rights and loss of assets and livelihoods should be expected and planned for. At the same time, project activities in Majuro and Ebeye, albeit on government land, may also generate community level grievances as a result of construction impacts.

Local communities in RMI have existing traditional and cultural grievance redress mechanisms. Consequently, to the extent possible, disputes at the community level may be best resolved using these mechanisms, without the involvement of the contractor(s), and or Government representatives at local and national level. Such types of disputes include differences between households over land, or boundaries, even on issues triggered indirectly by the Project such as employment, behaviour of imported workers etc.

These mechanisms will involve the landowners, which under Marshall Island's law mean principally the *Iroij*, *Alap*, and *Senior Dri Jerbal* who command considerable respect and influence among local communities.

Where issues caused by the project are raised and resolved through these existing community level grievance redress mechanisms, it is important that these are captured by the MEC PIU, which is responsible for recording all complaints/outcomes, and to provide assistance, as required for their resolution.

5.5.3 Project Grievance Redress Mechanism

The following GRM shall be put in place for all SEDeP sub-projects to register, address and resolve complaints and grievances raised by communities during implementation of the Project. Contractors are required to adhere to this formal process.

Complaints may be submitted in person, via telephone, electronically, in letter or through a representative of the above community level process to the PIU. All complaints must be formally registered in the MECs complaint register. Should the complaint be received by the Contractor's Site Supervisor directly, they will endeavour to resolve it immediately and submit notification of the complaints and resolution to MEC for entry into the complaints register. For all grievances across all sub-projects and components of the SEDeP the MEC is responsible for ensuring that, on receipt of each complaint, the date, time, name and contact details of the complainant, and the nature of the complaint are recorded in the Complaints Register.

Should the complainant remain unsatisfied with the response of the Contractor's Site Supervisor, the complaint will be referred to the PIU Project Manager located in MEC for activities in Majuro, or to the KAJUR GM for activities in Ebeye.

Specifically:

1. The PM and Safeguards Specialist will take earnest action to resolve complaints at the earliest time possible. It would be desirable that the aggrieved party is consulted and be informed of the course of action being taken, and when a result may be expected. Reporting back to the complainant will be undertaken within a period of two weeks from the date that the complaint was received.
2. If the MEC PM is unable to resolve the complaint to the satisfaction of the aggrieved party, the complaint will then be referred by the MEC PM to the Project Steering Committee. The PSC will be required to address the concern within 1 month.
3. Should measures taken by the Project Steering Committee fail to satisfy the complainant, the aggrieved party is free to take his/her grievance to the RMI Court, and the Court's decision will be final. Similar, the traditional landowner's decision on land related matter is final. The complainant may still exercise his/her right to take the matter to court.
4. To ensure broad public awareness of the grievance mechanism, the Project shall erect appropriate signage at all works sites with up-to-date project information and summarizing the GRM process, including contact details of the relevant Contact Person. Public information bulletins websites and other public information will also include this information. Anyone shall be able to lodge a complaint and the methods (forms, in person, telephone, forms written in Marshallese) should not inhibit the lodgement of any complaint.
5. The Complaints Register will be maintained by the PIU Project Manager, who will log the: i) details and nature of the complaint ii) the complainant name and their contact details iii) date iv) corrective actions taken in response to the complaint. This information will be included in MEC's progress reports to the Bank.

5.5.4 RMI Judiciary Level Grievance Redress Mechanism

The project level process will not impede affected persons access to the RMI legal system. At any time, the complainant may take the matter to the appropriate legal or judicial authority as per the laws of the Republic of the Marshall Islands.

6 Environmental and Social Impacts

The SEDeP has the potential to create a variety of impacts through the implementation of the various subprojects and components. These potential impacts can be either positive or negative depending on the receptors involved and the activity. The impact of this project on the physical, biological and social environment has been assessed to determine likelihood and identify effective mitigation measures.

There are site-specific and component specific impacts which have been identified and the significant impacts requiring specific mitigation are discussed below.

All impacts below are presented under the associated impact generating activity.

6.1 Solar PV Investments on Majuro

The following potential environmental and social impacts have been identified in relation to activities under component 1 which provides for the installation of solar PV array systems in a variety of potential locations including freshwater reservoir, airport and hospital carpark, building roofs and public recreation spaces in Majuro.

6.2 Environmental Impacts During Construction Phase

6.2.1 Concrete Production

Sediment suspended during sand dredging activities often settles on nearby coral colonies causing coral death. Additionally, the sand within the Majuro lagoon is non-renewable therefore removal of sand, even under permitted conditions, is contributing the rapid coastal erosion problems facing Majuro.[15]

Another environmental impact associate with concrete production is water pollution. Waste water and slurry from concrete production will have a high pH level making it alkaline and contains chromium. Highly alkaline water can result in the death of marine organisms should it enter the marine environment. There are also impacts associated with concrete waste water leaching into the groundwater and causing contamination.

6.2.2 Importation of Equipment and Materials

Solar panels and all associated structures and equipment will need to be imported into RMI. Additionally, sand/aggregate will be imported for the concrete works. If imported consignments are not properly treated and/or washed before shipping, there is the risk of introducing non-native and potentially invasive plants, animals and disease. The introduction of harmful species or diseases to small island nations such as the RMI, which have naturally low levels of biodiversity, can be devastating to the local ecosystems, flora and fauna.

Invasive marine organisms can also be introduced to the marine environment by unregulated discharge of cargo ship ballast water.

6.2.3 Installation in open spaces and roof tops

Rooftop PV and open space installations, depending on location and scale, may result in (i) the regular trimming and pruning or felling of valuable trees and (ii) some loss of visual aesthetics.

[15] http://www.sprep.org/Marshall-Islands/marshall-islands-pein, Pacific Environmental Information Network. Accessed Sept 2017 via SPREP

The small scale of open-space and rooftop PV installations envisaged for SEDeP will cause insignificant or negligible negative impacts.

All potential sites assessed for potential PV investments under SEDeP, except for airport parking space, will not require any loss of trees including contractors' staging areas and other space needs. In the case of the airport, existing palm trees in the airport parking area are integral to the airport landscape design, contributing to its visual aesthetics as well as providing parking shade. The PV installations proposed for the airport parking area will require the erection of raised platforms on which will mount PV panels, at the same time providing shaded parking space. To the extent possible, standing palms should be avoided wherever possible. Where avoidance is not possible, transplanting palms out of harms' way is a feasible option.

6.2.4 Social Impacts During Construction Phase

6.2.4.1 Installation in Public Spaces

During construction, it can be expected that there will be some pedestrian and traffic management required at the ground level installations sites. Should public recreation areas be used as installation site, it can be expected that the recreational use of these areas would be limited to some degree and therefore cause an impact to the recreational public. Traffic management in carparks during installation may mean temporary reduced access to parking areas which may have an impact on local traffic movements and increased instances of parking on roadsides. These impacts are expected to be short term and will cease completely once installation is complete.

6.2.4.2 Haulage of Materials and Equipment

Should the haulage route pass through residential communities or past other sensitive social receptors (schools, hospitals, churches, etc) the increased level of noise, dust and vibration is likely to impact on the quality of their daily activities. This impact will be short term and will cease completely once haulage is completed.

There is also the possibility of damage to the existing road surface associated with haulage of heavy loads. Damages to road surfaces can cause a traffic hazard and can also lead to a faster rate of overall road surface degradation in the long term. At the haulage route is unknown at this stage, the existing road surface condition cannot be assessed.

While not yet quantified, it is expected that these impacts will be negligible.

6.2.4.3 HIV/AIDs and Gender Based Violence

Impacts are associated with personnel recruited from outside the local community such as increased instances of HIV/AIDs. Additionally, the Contractor and/or Consultants accepts that gender based violence (GBV) might occur as an unintended consequence of increased income through employment and / or foreign workers taking advantage of locals. As such the contractor will responsibility for implementing actions to prevent instances of HIV/AIDs and GBV. As part of the Marshall Islands visa application process for foreign workers, they are required to submit HIV tests and visas will be denied to HIV positive applicants, as part of an existing Government health initiative. Training for workers can be provided by local NGOs (WUTMI or IOM).

6.2.5 Environmental Impacts During Operational Phase

6.2.5.1 Installation Over Reservoir

In general, on-the-water PV installations generate positive environmental impacts over the course of their design life. Most widely cited benefits are (i) reduced drinking water loss from evaporation (ii) reduced algae growth with reduced sunlight penetration to reservoir floor, thereby reducing cost of reservoir maintenance, and improving water quality (iii) does not require large areas of land to be allocated for permanent housing of arrays which is particularly important in a small island country like RMI.

There are potential negative impacts also associated with this type of installation. Consultations for this report found concerns by MWSC about the practical challenges associated with access to the reservoir floor for regular maintenance once PV modules are in place, fixed or floated. Maintenance involves the removal of algae growth, sludge and sediments by vacuuming and net-trawling. It is hoped that the reduction in algal growth that is associated with the shade giving benefits of the water will help to reduce this impact.

There are also potential implications for the integrity of the reservoir superstructure if a fixed array design is used on the floor of the reservoir. Should cracks or leaks occur due to superstructure damage, there is a possibility that the freshwater could leak from the reservoir thereby reducing the amount of drinking water available to the Majuro population. Adequate technical design and targeting SOPs will greatly reduce the likelihood of this impact and form a requirement of this ESMP.

Cadmium Telluride (CdTe) is a commonly used material in thin film solar panel modules. It is a black crystalline powder that does not occur naturally in the environment. The compound is inflammable, exhibits low water solubility and is toxic if ingested. In relation to solar panels, the CdTe is safe while encapsulated in the module, but if the panel is damaged and exposed to water, the CdTe will contaminate the water. There is very little scientific information on the impact of CdTe leaching into drinking water resources as this is a relatively new technology with a 25-30 year lifespan.[11]

Other types of solar panel include silicon based panels which contain lead. Test have shown that lead leaching potential of approximately 4 grams of lead per kilowatt installed to approximately 23 grams of cadmium per kilowatt installed for CdTe panels. Additionally, cadmium is considered to be more toxic than lead.[16] It is important to note that these statistics are not presented in relation to water quality, they are presented to provide comparative context.

Leaching from damaged solar panels is possible after disposal and contamination of ground water resources is possible at landfill site. No disposal of waste will occur in RMI for SEDeP, however damaged or end-of-life panel may be stored prior to shipment resulting a potential for leachate materials to enter the Majuro ground water system if incorrectly stored.

Occupation of the reservoir with panels will reduce the habitat for migratory birds that are known to use the reservoir. The scale of impacts will depend on the final design and further work on the species and the significance of the habitat will be required as part of the preliminary design process. This impact may be avoided or mitigated if MWSC completes their plan to build additional reservoirs next to the existing facility, concurrently with this project.

[16] https://www.energymatters.com.au/renewable-news/em1469/ accessed Sept 2017

6.2.6 Social Impacts During Operational Phase

6.2.6.1 Installation in Public Spaces

Proposed installation solutions for public spaces such as car parks provide for raised structures to house the arrays. This will also have the added benefit of providing areas of shade for the public and under which to park cars, recreate, etc.

There are no direct beneficiaries, but all consumers connected to the grid will benefit from more reliable energy generation.

6.2.6.2 Battery Management and End of Life Management

Batteries will be collected for offshore recycling by MEC, using MEC's existing system that is supported by the EPA.

6.3 Diesel Genset Installation

6.3.1 Environmental Impacts During Installation Phase

6.3.1.1 Disposal of Equipment

The old, removed generators have the potential to create a waste legacy for the project if not properly disposed of.

Once removed, the old generator will contain hazardous substances such as oil and fuel which has the potential to cause contamination if it is not properly drained and stored prior to export.

6.4 Cumulative Impacts

The volume of used oil extracted from replaced and new generators to be funded under the SEDeP is minimal. However, they will add to the mounting volume of used oil accumulating nationwide in Majuro, Ebeye and other islands, with no clear option for reuse, recycling and or safe disposal. A similar situation faces solid waste management with the increasing proliferation of scrap metal, derelict vehicle and machine bodies – including old gensets and power engine bodies. Capacity building measures as part of SEDeP will look to help alleviate this problem.

6.5 Energy Efficiency Activities

Consultants, EPD and MEC shall consider the safeguards issues related to the implementation of energy efficiency programmes during the studies. The benefits will be greater efficiency in the network deferring further investments in energy generation and minimising the wastage of diesel fuel.

6.5.1 Environmental Impacts

6.5.1.1 Installation of EE Investments

SEDeP includes the potential supply and installation of energy efficient investments such as light bulbs, appliances and building insulation. As such, these activities will create a yet unknown volume of solid waste. Because of the lack of recycling or sanitary landfills in the Marshall Islands the indirect impacts of these initiatives will be the dumping and inappropriate disposal of equipment and leaching of metals and other pollutants into the soil and marine environment and expose the public to hazardous waste.

Each programme must have an associated waste management plan / protocol to ensure all waste is recycled or disposed off island. These waste management plans must adhere to the SEDeP Code of Practice for Solid Waste Management and EPA requirements.

6.5.1.2 Ongoing Replacement of Equipment

Any GoRMI EE policies and regulations developed as part of SEDeP, as well as the loss reduction study and program for MEC and KAJUR are expected to result in the replacement of parts as part of recommended upgrades and regular maintenance leading to waste generation. Waste created as part of these developments have the potential to impact negatively on the current landfills and connected environments.

Each programme must have an associated waste management plan / protocol to ensure all waste is recycled or disposed off island. These waste management plans must adhere to the SEDeP Code of Practice for Solid Waste Management and EPA requirements.

6.5.2 Social Impacts

6.5.2.1 LED Lighting and Human Health

As part of EE investments, SEDeP plans to replace incandescent street lights with LED bulbs will improve energy efficiency, reduce energy consumption and decrease the use of fossil fuels. Improved public safety at night is an expected social benefit. However, experiences in developed countries are raising concerns about the risk to human health of LED streetlights. The first is discomfort and glare. Because LED light is so concentrated and has high blue content, it can cause severe glare, resulting in pupillary constriction in the eyes. Blue light scatters more in the human eye than the longer wavelengths of yellow and red, and sufficient levels can damage the retina. This can cause problems seeing clearly for safe driving or walking at night.

Secondly, there is impact on the human circadian rhythm, which involves the physiological processes that control the daily cycle of sleep and wake, hunger, activity levels, body temperature, melatonin level in the blood, and many other physiological traits that comprise the endogenous circadian rhythm. Disruption of this rhythm is known to increase the risk of developing health conditions such as obesity, diabetes and breast cancer.

6.6 Energy Policy

Development of policy could have indirect environmental and social impacts on the waste stream from e-waste, appliances, light bulbs etc. There may be social inequities with the impacts on consumers. These issues can be addressed as part of policy dialogue and development.

As part of the TOR for policy development the PIU will ensure that safeguards are integrated into the work plan and outputs.

6.7 Design of future energy generation projects

6.7.1 Environmental and Social Impact Screening - Ebeye

As these future projects have yet to be identified, the screening and scoping processes of safeguard documentation development will be needed to assess potential project impacts.

Initial screening has been undertaken as follows:

Site Selection and land availability and land acquisition: Land on Ebeye is very scarce. Innovations for solar locations will be required, similar to Majuro. Technical options identified in early studies include the reef flats and adjacent islets. The waste landfill, land reclamation, roof tops and shelters

may also be options. All land is privately owned and site selection will require negotiation with the land owners. Reef flat options and land reclamations will also require land owner approvals.

Reef flat options for solar will modify the environment with structures and shade. Earthworks for installation purposes will create sedimentation. Land reclamation will remove and modify foreshore environments. The habitat impacts are screened as minor to moderate as the foreshore environment at Ebeye is highly modified and water quality is poor. The impacts on coastal protection are considered moderate and mitigation against any increased erosion or inundation will need to be factored into the design and costs. Laydown areas and ship-to-shore facilities will also need to be identified and could have other impacts on the foreshore or land areas.

Labour workforce: Ebeye is experiencing a large increase in development projects. It is already a very densely populated island, with all food imported and fresh water supplies from desalination. Accommodation and food providers are likely to be overwhelmed with an influx of labour. Workers camps / barracks may be required due to the lack of local options. This project may have cumulative impacts with other projects such as coastal protection works, school building projects, water and sanitation upgrade projects and other infrastructure investments that are in the pipeline. Health services are very basic and are unlikely to cope with additional workers.

The demand for sex workers may increase as a result of imported labour, and the incidences of communicable diseases, gender-based violence and other forms of harassment could also increase, if the workforce is not well managed and trained.

Physical Cultural Resources: According to the RMI PREP project ESMF and site visits to Ebeye, cemeteries and World War II relics have already been identified but there are no cultural or spiritual sites on Ebeye or nearby islets. The risk of impact is minor but will be addressed in the ESIA process.

Disposal of installation waste, old equipment and end of life batteries: Similar to the Component 1 activities, all waste will need to be exported for safe disposal or recycling as there is no secure landfilling on Ebeye

Aggregates: There is no identified location for the sustainable sourcing of sand at Ebeye. All aggregates will need to be imported.

6.7.2 Environmental and Social Impact Screening – Outer Islands

The investments will have small footprints and will add to the existing diesel infrastructure. With good community consultations and engagement all risks should be avoided through the site selection and design. The potential risks identified through initial screening are as follows:

Site Selection and land availability and land acquisition: Land will require leasing from land owners. Government leased land will be prioritized. There is a risk that no agreement will be made with land owners. There is a small risk that modifications to ship to shore facilities may be required to transport equipment to site.

Indirect impact on boat links to outer islands": The targeted outer islands of Jaluit, Wotje and Rongrong's rely on the MEC chartered boat that delivers fuel on a regular basis for existing outer island generators, for inter-island travel to and from Majuro. This boat service also allows the two-way flow of goods and supplies including food, medicine and other livelihood essentials. Thus, while the intended result of SEDeP is reduced reliance on diesel generators through the use of stand-alone PV mini-grids, an unintended consequence is the reduced frequency and regularity of boat trips required to freight fuel and the possible reduction of a critical lifeline for outer island populations.

Jaluit and Rongrong have secondary level boarding schools serving nearby atolls and are also heavily dependent on the frequency of boat trips.

Labour workforce: A small workforce will be required and the risks of disruption to the communities is low if the contractor adheres to the Workers Code of Conduct mentioned elsewhere in the ESMP and can be adapted for small, remote villages. Issues such as ensuring workers are self-sufficient in freshwater, food supplies and healthcare will be important to ensure there isn't unnecessary impacts on locals.

Disposal of old equipment and end of life batteries: Similar to the Component 1 activities, all waste will need to be exported for safe disposal or recycling as there is no secure landfilling on outer islands.

7 Environmental and Social Management Measures

7.1 Management Plans

Annex A, B and C contain the required Management Plans for solar PV installations, genset installations and energy efficient investments. The Management Plans for each activity area include details of the mitigation measures required, the responsible entity and the applicable project phase.

Supervision Plans are also provided for each SEDeP physical investment type. Supervision plans are divided into three sections: (i) one-off pre-construction checklist; (ii) weekly checklist for the physical implementation or construction phase; and, (iii) supervision checklist for the operational phase of the investment.

The MEC PIU Safeguard Specialist is responsible for the overall responsibility for safeguards supervision. MEC and KAJUR is responsible for incorporating the operational phase supervision requirements into their SOP for O&M.

7.2 Solid Waste Management

Annex D contains the stipulated requirements for a Solid Waste Management Plans which are required for all physical works contracts and energy efficiency programmes (any activities that will generate waste). The SWMP requirements set that at a minimum:

i. No RMI landfills are to be used for any waste. All waste is to be recycled or disposed of offshore at a permitted facility.
ii. No dumping of any waste in RMI.
iii. Compliance with Waigani Convention and any other relevant international conventions for export of hazardous and non-hazardous waste.
iv. Identify and utilise suitable local recycling and reuse options.
v. Damaged solar panels and used batteries will be stored in a 10ft container (provided by Contractor) and a roofed structure over the containers in a location to be determined by MEC.
vi. Hazardous wastes such as old oil and fuel shall be collected and stored in self bunded containers. Containers shall be stored in a bunded covered area prior to collection at MEC for overseas recycling.
vii. Hazardous wastes such as discarded incandescent bulbs shall be collected and stored in water tight containers. Containers shall be stored in bunded covered area prior to export for recycling or disposal.
viii. Difficult waste such as appliances and building cladding shall be stored in a secure fenced and covered area.

In addition to this, it is a requirement that best practices are implemented through the SWMP. These include:

i. Segregation of waste
ii. Secure storage for waste
iii. Adopting the waste hierarchy: (i) avoid; (ii) reduce; (iii) reuse; (iv) recycle
iv. Collaborating with other sectors, waste generators and government initiatives for cumulative benefits

v. Build capacity and sustainability within the energy sector in the approach to waste management through SEDeP implementation.

The MEC PIU Safeguards Specialist will use these instructions as a basis for the development of the SEDeP Code of Practice for Solid Waste Management. Once developed, this Code of Practice will become a requirement for all SEDeP Projects in Ebeye and Outer Islands and will be contained within their safeguard instruments.

7.3 Technical Assistance and Capacity Development

7.3.1 Loss Management Study

The loss management study shall assess and, where necessary, make recommendations for the improvement of the SEDeP Code of Practice for Waste Management in relation to energy efficiency and loss management practices. Where recommendations are approved, the consultant will update the Codes of Practice for review and approval.

The TOR for the loss management study will required the consultant to comply with the ESMP and the WB policy for waste management issues, EE training and EE consumer awareness activities.

The loss management study will incorporate the requirements of the SEDeP Codes of Practice for Waste Management where appropriate.

7.3.2 Policy and Program Development

Any development of these items through SEDeP will follow the citizen engagement, gender and safeguards policies ensuring that all affected parties are engaged in the process of development and that broader impacts on gender, environment, etc. are considered.

7.3.3 Raising Consumer Awareness and Capacity Building for EE

As part of the loss management report, the consultant shall develop a series of materials and awareness raising events aimed at the general public for raising consumer awareness on energy efficiency.

The loss management consultant shall also design and conduct a training program on energy efficiency and develop strategies for raising consumer awareness.

7.3.4 O&E Capacity Development

The TOR for the SEPD Safeguard Specialist shall include the requirement to conduct a capacity gap assessment for environmental and social safeguard operational management within MEC, KAJUR and EPD.

Based on the outcome of the capacity gap assessment, the SEPD Safeguard Specialist will develop and support the delivery of a program of activities specifically targeting safeguards management of renewable energy and energy efficiency.

One program which is expected to be implemented as part of the capacity development is the encouragement of MEC, KAJUR and EPD to adopt the SEDeP Code of Practice for Solid Waste Management as a SOP for all Energy Generation and Energy Efficiency programs across the sector.

7.3.5 Safeguard instruments for RE projects in Ebeye and Outer Islands

The preparation of safeguards instruments for future SEDeP projects have been screened and the required safeguard instruments along with potential environmental and social impacts have been identified.

A draft TOR has been developed (Annex E) which provides a basis for development of the safeguard documentation including all environmental and social assessments, stakeholder consultations, land due diligence, document preparation, etc. The SEDeP RPF provides methods for identifying and

confirming land ownership and securing land leases, and residual involuntary resettlement, if any.

The final design and bid documents for generation projects must reflect the safeguard aspects of the project as identified by the Safeguards Consultants in the screening and scoping phases and as prescribed in the final safeguard instruments.

The draft TOR for preparation of future SEDeP safeguard instruments will be updated and finalised once the scope of the proposed projects is known, during Project implementation.

The safeguard instruments will take into account the social context of the outer islands and Ebeye and include any measures appropriate to safeguard against HIV/AID transmission, GBV, CAE, gender based discrimination, negative impact of influx of any labour.

The SEDeP Codes of Conduct for Solid Waste Management developed by the MEC PIU Safeguards Specialist will be a required element of these safeguard instruments.

8 Roles & Responsibility

The agencies with important responsibilities for ESMP and RPF implementation, monitoring and reporting are NEPA, MOF/DIDA, MEC and KAJUR. Details of the roles assigned to various agencies / organizations are summarised below –

8.1 Project Steering Committee

A Project Steering Committee (PSC) will be established and comprise representatives of the MoF, Ministry of Resources and Development (represented by EPD), as well as MEC, KAJUR and the Kwajalein Atoll Development Authority (KADA), and others, as needed. The PSC will provide oversight and strategic guidance for the project implementation. The Chair of the PSC will be defined at a later stage by the GoRMI.

The Project Steering Committee is directly involved in the Grievance Redress Mechanism, to resolve grievances that will be referred to it by the Project Manager.

8.2 MOF/DIDA

- Employs the Safeguards Advisor to assist the MEC PIU

8.3 Safeguards Specialist and Project Implementation Unit under MEC

A Project Implementation Unit (PIU) will be established within MEC and will include a Project Manager, a Project Accountant, and if needed, a Procurement Specialist. The DIDA Safeguards Specialist will cover SEDeP safeguards responsibilities, which including:

- Monitoring of the Contractor as per the requirements of the ESMP Monitoring Plan for compliance with the ESMP
- Provide support to the PIU regarding instances of Contractor non-compliance and GRM responses
- Integrate ESMP into TORs and bid documentation for all suppliers and contractors
- Managing the review process for all safeguard elements up to formal approval
- Providing safeguards screening and provide safeguards advice during the preparation and implementation of all subprojects.
- Developing a SEDeP Codes of Practice for Solid Waste Management based on the SWMP requirements of this ESMP.
- Updating the ESMP and RPF as necessary to reflect project changes. This includes the SWMP, Codes of Practice and Mitigation Tables.
- Applying for all NEPA approvals and permits.
- Supporting PIU to enable effective citizen engagement into the project and provide meaningful input and direction into community consultations for projects
- Providing monthly reporting to the PIU Project Manager on all aspects of safeguards compliance of the projects including results of scheduled reporting, any instances of non-compliance, any environmental incidents and any GRM submission/responses.
- Conduct capacity gap assessments of implementing agencies (MEC and KAJUR) and develop capacity building tools and materials.
- Provide training to contractors and MEC/KAJUR

- Assist MEC and KAJUR to integrate safeguards into their Standard Operating Procedures
- Prepare TORs for safeguards specialists to undertake environmental assessments, land due diligence and prepare safeguards instruments for future projects (Component 3) and otherwise as required.
- Manage the outputs of the external safeguards specialists and liaise with World Bank safeguards specialists for clearance of instruments.
- Manage the GRM.
- Manage stakeholder engagement and consultation.
- Facilitate the SWMP

The Project Manager will be responsible for overall project coordination and technical guidance and will support the procurement of various packages and studies. Technical staff will be recruited as necessary to support the implementation of technical advisory components. The Project Manager will be responsible for ensuring that the requirements of safeguard policy OP4.37 Safety of Dams is included in the TOR for the Design Consultant and that any required remedial measures will be budgeted for and included in the final design. The Project Manager will report to the CEO of MEC and to the Project Steering Committee. The MoF will be responsible for processing project disbursement requests.

8.4 Design Consultants

The design consultant will be employed by MEC as the Owners Engineer. It is the Design Consultant's responsibility to:

- Comply with this ESMP in the development of feasible options, detailed designs, bid documents and other advice to the PIU.
- Avoid impacts where possible in site selection and design.

8.5 Technical Advisors / Consultants

All technical advisors are required to comply with the ESMP in terms of the work methodologies and outputs. They are encouraged to work with the PIU to ensure adequate citizen and stakeholder engagement in their work programme.

8.6 Contractors

It is the Contractors responsibility to:

- Prepare and have cleared by the appropriate project supervising body any implementation plans required for the contract under this ESMP
- Carry out contracted works in accordance with this ESMP and any required implementation plans
- Conduct daily and weekly safeguard inspections to ensure compliance with this ESMP and report the results to the contracts supervising body
- Provide meaningful input to any consultations required for the project
- Report all environmental and OHS incidents to the PIU for any action
- Respond to any reports of non-compliance within the directed timeframe

9 Capacity Development & Training

9.1 Capacity Development

MEC has no inhouse safeguards specialists, therefore the safeguards position in the PIU will be filled by the engagement of the DIDA Safeguards Specialist on a part time basis for the full duration of the Project.

As part of the Safeguards Specialist role, under component 3.1, they will undertake a safeguards capacity gap assessment within MEC and KAJUR [taking account of the findings of a recent ADB review of operational capability in MEC – TOR and outputs to be provided by MEC] with the goal of supporting the operationalisation of safeguards into their standard operating procedures (SOP). This includes, in full consultation with key stakeholders, developing the outline of a Waste Management Code of Practice for the Renewable Energy Sector in this ESMP into a functional Code of Practice to be adopted by MEC and KAJUR with the long-term goal of national implementation of this sector-based code of practice.

They will contribute to capacity building of NEPA through the technical support and advisory role delivered during the preparation and implementation of subprojects, the review of safeguards instruments, and in ESMP monitoring and reporting.

Experienced environmental and social consultants will be employed to prepare safeguards instruments under Component 3 for the preparation of future renewable energy investments, since the PIU will not have these skills in-house.

Other short term consultants may be engaged from time to time to perform specific tasks including, as necessary, the preparation of safeguards instruments for subprojects, monitoring and evaluation, external monitoring of RAP implementation.

9.2 Training

The PIU Safeguards Specialist consultant shall have the skills and expertise to train and mentor local counter-part staff and others.

Areas recommended for MOF/DIDA, MEC and NEPA training include the following –

- World Bank's Safeguards Policies, in particular those triggered and relevant to the Project;
- Roles and responsibilities of different key agencies in safeguards implementation.
- How to effectively review WB safeguards instruments and to integrate the ESMP and RPF into project management and implementation.
- Detailed measurement surveys of losses for RAP preparation and entitlement calculation;

Training in the above areas is recommended to be held within three (3) months of project effectiveness.

On-going support will be provided by the World Bank Task Team for the duration of the project including during environmental and social screening of subprojects and review of prepared safeguards instruments.

10 Budget

The following is an approximate budget for implementing the EMSP, based on the tables in Annexes A, B, C and Section 7. These items are over and above those considered to be covered by normal operations.

Table 8: Indicative Budget for ESMP Implementation

Budget Item	Detail	Cost Estimate (USD)
Component 1, 2 and 3		
Stakeholder consultations	Catering, venue hire, media, materials, travel and accommodation, translation and interpretation services, etc.	10,000
Consultant costs	For preparation of safeguards instruments for future investments in Ebeye and Outer Islands.	100,000
Engagement of part time Safeguards Specialist (shared with PREP Phase 2)	Fees, operating costs, office support and maintenance, communication etc.	250,000
Institutional Training	Venue, stationery, refreshments, training materials	10,000
HIV/GBV Training	Costs of training by local organisations	5,000
Disclosure of safeguards instruments	Translation, report production, distribution	4,000
Monitoring and reporting	Travel and accommodation costs in Ebeye and Outer Islands; report production costs (non-staff costs);	8,000
GRM related costs	Personnel, communication, transportation, office support costs	5,000
	Estimated Total Budget	**392,000**

Annex A: Solar PV Installations Management Plan

Solar PV Installation Design Phase Mitigation Plan

Environmental or social impact	Majuro Pre-Construction Mitigation Actions	Costs	Responsible	Start	End
General / all impacts	• The ESMP shall be included in the TOR for the Design Engineer. • Feasibility and detailed design studies to be informed by the ESMP. All impacts shall be avoided where possible through site selection, prioritistion of sites and technologies, consultation, and array design.	Minor	Design Consultant MEC PIU	Feasibility Study	Tender Preparation
General / all impacts	• The ESMP will be included in the Contractors / Suppliers specification and contract. • Specific mitigation measures for the contractor / supplier shall be highlighted in the general conditions.	Minor, included in tendering costs	MEC PIU	Tender preparation	Award of tender.
General / all impacts	• Submit Initial Environmental Examinations (IEE) Assessments to the GM RMI EPA in accordance with the Environment Impact Regulation of the RMI EPA 1984. • Obtain permits from RMI NEPA prior to construction as required under EIA Regulation and Earthmoving Regulation.	Minor	MEC Safeguards Specialist	Design phase	Prior to construction starting
Installation of array over reservoir	• Conduct a bird survey of the reservoir to identify the species and habitat features of the pond. Conduct an impact assessment and consider mitigation in design. • Submit an application to the Environmental Protection Authority for installation of a PV system above the water reservoir in accordance with the Public Water Supply Regulations of the National Environmental Protection Act. • Application will include Engineers Water Reservoir Protection Plan and design plans. • Consultations with MEC maintenance staff during design process to allow input in relation to access to water reservoir for cleaning. • Include the assessment of structural integrity of the reservoir in the Design Engineer contract in accordance with OP4.37 Safety of Dams. • Ensure the scope of works for remedial measures are included in the PV installation contract documents, or as a separate contract. Ensure supply specifications avoid inappropriate PV technologies • Design Consultant to undertake thorough review of effectiveness of current treatment of water by MWSC prior to reticulation for public consumption and identify any recommendations • Design Consultant to undertake thorough assessment of the current water quality monitoring program by MWSC and make recommendations.	Moderate. Already scoped in existing TOR for Design Engineer and Safeguards Advisor. If works are required, then the costs could be moderate to major but would be factored into the solar project costs.	MEC PIU Design Engineer Safeguards Advisor	Tendering for Design Consultant	Prior to construction starting.

Environmental or social impact	Majuro Pre-Construction Mitigation Actions	Costs	Responsible	Start	End
Siting and accessing targeted solar array locations	• Avoid impacts on private land and assets by locating solar PV arrays on government leased land. • Review and confirm leases prior to construction. • Consultations will be carried out with identified organisations or agencies that manage any targeted spaces for cooperation and logistical support with planned works.	Minor	MEC Design Consultant	Design phase	Prior to construction starting
Health and Safety	• The tender shall be prepared in accordance with the health and safety guidelines in the IFC / World Bank Environment, Health and Safety Guidelines for Occupational Health and Safety.	Minor, included in tendering costs	MEC	Tender preparation	Award of tender.
Waste Management	• The Contractor shall develop a Solid Waste Management Plan in accordance with the guidelines included in Annex D of the ESMP. • All Project staff will be trained on this plan and attendance will be recorded.	Minor, part of standard practices	Contractor	Design phase	Prior to Construction Starting
Public Water Supply Protection	• The Design Engineer shall develop a Water Reservoir Protection Plan for construction and operational phases of the project. The plan shall incorporate design engineers plan for emergency response. • The project design will take into account the latest technical development of solar panel technology and any testing associated with rainwater harvesting from solar panels • All Project staff will be trained on this plan and attendance will be recorded.	Minor, part of standard practices	Design Consultant Contractor	Design Phase	Prior to construction starting
Water Reservoir Failure	• Design engineers in consultation with MEC and EPA shall design a set of mitigation measures and response to any emergencies.	Minor	MEC/Engineer	Design Phase	Prior to construction starting
Traffic Management	• The Contractor shall develop, as part of the MOWP, a Traffic Management Plan. The TMP shall also include requirements that are in accordance with the stipulations of this ESMP	Minor, part of standard practices	Contractor	Design Phase	Prior to construction starting
Spill Response	• The Contractor will have a spill response plan in place to account for all potential instances. • All Project staff will be trained on this plan and attendance will be recorded.	Minor, part of standard practices	Contractor	Design Phase	Prior to Construction Starting
	•				

Environmental or social impact	Majuro Pre-Construction Mitigation Actions	Costs	Responsible	Start	End
Recruitment of overseas workers	• All imported project staff will abide by RMI immigration policy and provide all required documentation, including health checks. Overseas workers will undergo cultural familiarisation induction upon arrival and sign a code of conduct applicable for the duration of their contract. • Overseas workers will have the technical skills and experience for solar PV array installation.	Minor, part of standard practices	Contractor	Upon recruitment	Prior to construction starting
HIV/AIDs & GBV Training	• All project staff will undergo training by local services providers identified by the MEC PIU on prevention of HIV/AID and GBV. • Attendance will be recorded. • The Contractor will develop a Code of Conduct (to be approved by PIU) for all workers (local and overseas) to sign detailing the expected behaviours of Project staff, ESHS requirements, Cultural respect, OHS requirements, Community Health and Safety considerations	Minor, part of BoQ	Contractor and MEC	Design phase	Prior to construction starting
Sourcing of aggregate	• All sourced sand and aggregate will be imported from an offshore source. The identified source must be compliant with OHSAS 18000, have an existing permit for extraction and have been operational for at least 12 months prior to award of contract. • Imported aggregates must meet GoRMI Biosecurity requirements.	Minor, part of BoQ	Contractor and MEC	Design phase	Prior to construction starting

Solar PV Installation Construction Phase Mitigation Plan

Environmental or social impact	Construction Mitigation Actions	Costs	Responsible	Start	End
Non-toxic solid wastes (metal, packing, etc.)	• Solid Waste Management Plan will be fully implemented. • Metal, cardboard and plastic will be recycled, where local facilities exist. • Waste that cannot be recycled will be collected and securely stored prior to offshore disposal at a licensed facility.	Moderate but included in tender preparation	Contractor / supplier	In the beginning of construction	After completion of construction
Hazardous wastes	• Hazardous wastes such as damaged solar panels and batteries that contain heavy metals shall be collected and stored prior to disposal offshore at a licensed facility as per the requirements of the Solid Waste Management Plan. • The Contractor will provide a 10ft container and a roofed structure over the container in a location determined by MEC for the storage of hazardous waste	Moderate but included in tender preparation	Contractor / Supplier	In the beginning of construction	After completion of construction

Environmental or social impact	Construction Mitigation Actions	Costs	Responsible	Start	End
Importation of aggregate	• All imported aggregate will be subject to customs and quarantine clearance by GoRMI. • Additional treatment of aggregate will be undertaken should this be required by the GoRMI. • Ballast water from any cargo vessel chartered by the Contractor will be exchanged in the open ocean prior to arrival in RMI EEZ	Minor, part of standard practices	Contractor and MEC	Prior to aggregate shipment	Upon clearance of aggregate
Importation of equipment and materials	• All imported equipment and materials will be subject to customs and quarantine clearance by GoRMI • Additional treatment or cargo will be undertaken should this be required by the GoRMI • Ballast water from any cargo vessel chartered by the Contractor will be exchanged in the open ocean prior to arrival in RMI EEZ	Minor, part of standard practices	Contractor	Prior to shipment	Upon clearance of shipment
Concrete waste water and slurry	• No concrete will be prepared within the water catchment area of the water reservoir • Concrete will be prepared on bunded and covered hard stand surface of laydown areas. • All waste water from concrete production will be collected and treated to lower the pH and allow particulates to settle out before being recycled for construction purposes. • Treated and tested waste water may be discharged for absorption into the ground. Discharge will be at a rate to allow absorption without causing surface flooding. • Slurry from concrete production will be collected and treated. Treatment can vary depending on viscosity of slurry but can include the same measures described for treating concrete waste water, or can be by facilitating the solidification of the slurry to form a gel which can be stored and disposed of according to the Solid Waste Management Plan. • Solid and cured concrete waste is considered safe to be reused by the community or the GoRMI for infrastructure maintenance. • The Contractor's will have a spill response plan in place to manage accidental spills or leakages of concrete waste water or slurry.	Minor, part of standard practices	Contractor	Start of construction	Completion of construction

Environmental or social impact	Construction Mitigation Actions	Costs	Responsible	Start	End
Lay down areas	• Laydown areas will be sited on government owned land. • Areas will be securely fenced. • Bunded and covered areas will be installed for the storage and handling of hazardous materials and/or substances, the wash down of machinery, the preparation of concrete and the prefabrication of solar arrays. • Run off from these bunded areas will be collected, treated and tested before being either reused for construction purposes or allowed to discharge into the ground, away from the marine environment. Discharge will be at a rate to allow absorption without causing surface flooding • Stock piles of sand shall not be more than 2m high, shall be bunded at the base using sandbags or similar to prevent sediment laden run off and erosion of stock piled materials. • Segregated storage for solid waste will be provided. This area will be clearly marked and designed to ensure that as waste is secure. • Worker inductions will include a tour of the laydown area and required practices from workers. • Spill response kits will be available and workers trained in their use. • Ensure unhindered public access to recreational park bordering the water reserve on the airport side.	Minor, part of standard practices	Contractor	Start of construction	End of construction
Tree trimming or removal	• No trees will be trimmed or removed without the permission of the PIU and the land owners. • Removal of trees will be avoided unless absolutely necessary for achieving Project objectives. • Agreement from the owner shall be given, and any compensation agreed to, prior to trees being trimmed or removed. • Whenever possible, land owners and occupiers should be allowed to benefit from cut vegetation for firewood and other uses. • For any removal of trees, the Project will ensure that three specimens per one removed tree of each species are planted as a replacement. This may be in addition to the requirements of the RPF. • Should it be required, the standing palm trees at the airport car park will be moved to an alternative location. • No trees will be trimmed unless absolutely necessary for achieving Project objectives.	Minor as no tree removal outside of the airport is anticipated	Contractor and IA	Design phase	Completion of construction

Environmental or social impact	Construction Mitigation Actions	Costs	Responsible	Start	End
Haulage of materials and Equipment	• Implement the TMP. • Haulage will be by existing roads only. • Where appropriate employ traffic control measures on the road to prevent traffic accidents. The workers shall have the relevant training and safety equipment. • Hours of haulage shall be regulated to avoid peak time traffic and night hours. • Speed controls shall be in place when passing through residential areas or past sensitive social receptors. • All vehicles will be well maintained and operated by experienced and licensed drivers. • Spill kits will be available on the vehicles and drivers will be trained in their use. • Any damage to road surface will be reported immediately to PIU.	Minor, part of standard practices	Contractor	Start of construction	End of construction
Access to public areas during construction	• Identify key user groups. • Conduct consultation with user groups to advice of planned disruptions to access. • Ensure working area is securely fenced during construction. • Display notifications of predicted duration of disturbance of access and contact details for GRM	Minor, part of standard practices	Contractor, MEC	Start of construction	End of construction
Health and Safety	• All work shall be in accordance with the World Bank /IFC Environment, Health and Safety Guidelines for Occupational Health and Safety. • Contractors shall prepare a Health and Safety Plan which will include a risk register and safe work method statements. • All workers will be provided with hard hats, hearing protection, high visibility jackets and covered boots. • Workers involved in panel installation and handling will be provided with suitable gloves, such as leather gloves with padding in the palm and finger areas. • Buoyance aids or life jackets to be available and stored close to the area of over water works. All workers to be aware of their location and trained in their use. Training attendance should be recorded.	Minor, part of standard practices	Contractor	Start of construction	End of construction

Solar PV Installation Operational Phase Mitigation Plan

Environmental or social impact	Operation Mitigation Actions	Costs	Responsible	Start	End

Environmental or social impact	Operation Mitigation Actions	Costs	Responsible	Start	End
Disposal of hazardous materials (broken/ decommissioned solar panels, batteries)	• SEDeP Solid Waste Management Code of Practice will be integrated into MEC SOP • Any solar panels or batteries removed from the array for disposal will first be collected and stored in the covered 10ft container provided by the Contractor. • For final disposal, the MEC will ensure hazardous items are shipped offshore to a facility licensed to handle hazardous waste.	Major for MEC – funding of offshore waste disposal will need to be secured	MEC	During operation	Continuous
Solar Panel inspections	• MEC shall undertake at least weekly monitoring of the condition of the individual solar panels to detect any damage. • Damaged solar panels shall be immediately removed from the array to prevent particulate entering the water reservoir. • MEC to advise Environmental Protection Agency (EPA) of any damage likely to have caused solar panel particulate to have entered the water reservoir. • Regular inspections to be carried out on solar array foundations by MEC and EPA staff. Any defects to the foundations must be immediately reported to the Authority and rectified.	Minor unless repair works are needed to array foundations.	MEC and EPA	During operation	Continuous
Emergencies, leaks catastrophic failures of water reservoir	• If necessary, following the review of structures and risk assessment, the appropriate EPA response plan, incorporating the design engineers recommended mitigation measures, will be immediately actioned	Major	EPA and MEC	During operation	Continuous
Water Quality Testing	• MEC to comply with any requests made of them from EPA in relation to the EPA ongoing water quality monitoring program. • Should additional or extraordinary monitoring be required, this is to be funded by MEC	Minor, part of existing monitoring	MEC, EPA	During operation	Continuous
Tree trimming	• Routine tree trimming will be carried out with the permission of tree owners.	Minor, part of O&M budget	MEC	During Operation	Periodic

Solar PV Installation Supervision Plan

Impact Area:	Management Measures:
Solar PV Installations: Pre-Construction Checklist	
Solid and hazardous waste	• Approved Solid Waste Management Plan in place • Waste collection at laydown area is secure, well signed and clean • Waste collection storage arrangements in place and compliant with approved SWMP
Public health and safety	• HIV/GBV/Code of Conduct training and acknowledgements have been conducted
Protection of Water Reservoir	• EPA permit for installation works is approved
Soil and water pollution	• Appropriate spill response plan in place
Occupational Health and Safety	• OHS Management Plan in place • All workers have undergone appropriate OHS training
Materials Supply	• All imported materials with appropriate biosecurity clearances
Laydown Area	• Laydown areas established on pre-approved sites • Water run off management systems in place

Impact Area:	Management Measures:
Solar PV Installations: Construction Weekly Supervision Checklist	
Solid and hazardous waste	• Approved Solid Waste Management Plan effectively implemented • Waste collection at laydown area is secure, well signed and clean • Hazardous waste is stored according to SWMP • Good housekeeping around project sites • All waste is disposed of offshore
Public health and safety	• Approved Traffic Management Plan is under effective implementation • Public signage of complaints procedure • Signs and fences restrict or direct pedestrians and public where appropriate.
Protection of Water Reservoir	• Solar panels are inspected for damage before installation • No damage to water reservoir structure
Soil and water pollution	• Appropriate spill response plan/kit in place for waste area • No visible spills on soil or uncovered ground • Drainage, water treatment and soakage systems clear and fit for purpose

Impact Area:	Management Measures:
Hazardous substances storage	• Substances stored in self-bunded vessels or within bund on impermeable surface • Spill kit complete and accessible • Spill training completed • No evidence of spills on the ground
Occupational Health and Safety	• Workers have access to, and using appropriate, PPE for the task. • All workers have undergone appropriate OHS training • Proper briefing of staff before undertaking work activities
Materials Supply	• All quarries licensed to supply materials • All imported materials with appropriate biosecurity clearances
Laydown Area	• Laydown areas established on pre-approved sites • Laydown areas dust levels managed efficiently • Traffic management plan correctly implemented at laydown site • Water run off management systems operating correctly • Dust management effectively implemented • PPE present and correctly used

Impact Area:	Management Measures:
Solar PV Installations: Operations Supervision Checklist	
Solid and hazardous waste	• Solid Waste Management Code of Practice Integrated into SOPs • Hazardous waste collected and stored in provided facility • Hazardous waste transported offshore for disposal in licensed facility
Protection of Water Reservoir	• Engineers recommended emergency mitigations and response integrated into Water Reservoirs and MEC SOP • No broken or damaged solar panels in array

Annex B: Genset Installation Management Plan

Genset Installation Design Phase Mitigation Plan

Environmental or social impact	Majuro Pre-Construction Mitigation Actions	Costs	Responsible	Start	End
General / all impacts	• The ESMP shall be included in the TOR for the Design Engineer. • Feasibility and detailed design studies to be informed by the ESMP. All impacts shall be avoided where possible through site selection, prioritistion of sites and technologies, consultation, and array design.	Minor	Design Consultant MEC PIU	Feasibility Study	Tender Preparation
General / all impacts	• The ESMP will be included in the Contractors / Suppliers specification and contract. • Specific mitigation measures for the contractor / supplier shall be highlighted in the general conditions.	Minor, included in tendering costs	MEC	Tender preparation	Award of tender.
General / all impacts	• Apply for and secure permits to construct / install gensets, under the appropriate national legislation (NEPA Act 1984 Section 123). • Submit an Initial Environmental Assessment to the General Manager of the RMI NEPA in accordance with the RMI NEPA Act 1984.	Minor	MEC	Design phase	Prior to construction starting
Reduction in air quality due to emissions from gensets	• Apply for and secure permits to construct / install gensets, under the appropriate national legislation (NEPA Act 1984 Section 123) • Provide a specification for the gensets that are consistent with the requirements of the NEPA Act 1984 and the IFC / World Bank Environment, Health and Safety Guidelines for Air Emissions and Ambient Air Quality	Minor	MEC	Design phase	Prior to construction starting
Health and Safety	• The tender shall be prepared in accordance with the health and safety guidelines in the IFC / World Bank Environment, Health and Safety Guidelines for Occupational Health and Safety.	Minor, included in tendering costs	MEC	Tender preparation	Award of tender.
Waste Management	• The Contractor shall develop a Solid Waste Management Plan in accordance with the requirements included in Annex D of the ESMP. • All Project staff will be trained on this plan and attendance will be recorded.	Minor, part of standard practices	Contractor	Design phase	Prior to Construction Starting
Spill Response	• The Contractor will have a spill response plan in place to account for all potential instances. • Ensure, through design of spill containment at the genset and / or within the building, that 100 percent of fuel and oil held within the generators can be contained and collected for removal within the footprint of the building. • All Project staff will be trained on this plan and attendance will be recorded.	Minor, part of standard practices	Contractor	Design Phase	Prior to Construction Starting

Environmental or social impact	Majuro Pre-Construction Mitigation Actions	Costs	Responsible	Start	End
General / all impacts	• The ESMP shall be included in the TOR for the Design Engineer. • Feasibility and detailed design studies to be informed by the ESMP. All impacts shall be avoided where possible through site selection, prioritistion of sites and technologies, consultation, and array design.	Minor	Design Consultant MEC PIU	Feasibility Study	Tender Preparation
Recruitment of overseas workers	• All imported project staff will abide by RMI immigration policy and provide all required documentation, including health checks. Overseas workers will undergo cultural familiarisation induction upon arrival and sign a code of conduct applicable for the duration of their contract. • Overseas workers will have the technical skills and experience for solar PV array installation.	Minor, part of standard practices	Contractor	Upon recruitment	Prior to construction starting
HIV/AIDs & GBV Training	• All project staff will undergo training provided by local services providers advised by MEC PIU on prevention of HIV/AID and GBV. • Attendance will be recorded. • The Contractor will develop a Code of Conduct (to be approved by PIU) for all workers (local and overseas) to sign detailing the expected behaviours of Project staff, ESHS requirements, Cultural respect, OHS requirements, Community Health and Safety considerations	Minor, part of BoQ	Contractor and MEC	Design phase	Prior to construction starting

Genset Installation Construction Phase Mitigation Plan

Environmental or social impact	Construction Mitigation Actions	Costs	Responsible	Start	End
Non-toxic solid wastes (metal, packing, etc.)	• Solid Waste Management Plan will be fully implemented. • Metal, cardboard and plastic will be recycled, where local facilities exist. • Waste that cannot be recycled will be collected and securely stored prior to offshore disposal at a licensed facility.	Moderate but included in tender preparation	Contractor / supplier	In the beginning of construction	After completion of construction
Hazardous wastes	• Hazardous wastes such as old oil and fuel shall be collected and stored in self bunded containers prior to disposal offshore at a licensed facility as per the requirements of the Solid Waste Management Plan. • All hazardous waste will be exported under the terms of the Waigani Convention. • Containers shall be stored in a bunded covered area prior to export for disposal.	Moderate but included in tender preparation	Contractor / Supplier	In the beginning of construction	After completion of construction

Environmental or social impact	Construction Mitigation Actions	Costs	Responsible	Start	End
Removal and disposal of old genset	• Spill response kit will be available at work site and all workers will be trained on its use • Oil and fuels will be drained from the old genset with a drip pan in place to catch any drips or minor spills • All removed parts will be contained and stored in a watertight container to prevent leaching of residual oils or fuel • All waste will be removed and disposed of offshore as per the requirements of the SWMP				
Oil spills or leaks prior and during construction / installation	• Oil sorbents will be kept on-site to contain spills, and staff shall be trained in spills procedures. • Any contaminated soils because of construction activities will be removed by and stored prior to disposal offshore at a licensed facility. Records to be kept of the amount of material, contaminants, and destination of the waste material.				
Soil and water contamination	• Oil / diesel containment devices such as bunds and separators will be constructed as per tender documents.	Moderate, included in construction contract.	Contractor / Supplier	Prior to the beginning of construction	At completion of construction
Importation of equipment and materials	• All imported equipment and materials will be subject to customs and quarantine clearance by GoRMI • Additional treatment or cargo will be undertaken should this be required by the GoRMI • Ballast water from any cargo vessel chartered by the Contractor will be exchanged in the open ocean prior to arrival in RMI EEZ	Minor, part of standard practices	Contractor	Prior to shipment	Upon clearance of shipment

Environmental or social impact	Construction Mitigation Actions	Costs	Responsible	Start	End
Lay down areas	• Laydown areas will be sited on government owned land. • Areas will be securely fenced. • Bunded and covered areas will be installed for the storage and handling of hazardous materials and/or substances. • Run off from these bunded areas will be collected, treated and tested before being either reused for construction purposes or allowed to discharge into the ground water, away from the marine environment. Discharge will be at a rate to allow absorption without causing surface flooding • Segregated storage for solid waste will be provided. This area will be clearly marked and designed to ensure that as waste is secure. • Worker inductions will include a tour of the laydown area and required practices from workers. • Spill response kits will be available and workers trained in their use.	Minor, part of standard practices	Contractor	Start of construction	End of construction
Health and Safety	• All work shall be in accordance with the World Bank /IFC Environment, Health and Safety Guidelines for Occupational Health and Safety. • All workers will be provided with hard hats, hearing protection, high visibility jackets and covered boots. Workers involved in genset installation and handling will be provided with suitable PPE. • All construction workers will have site inductions by the State Utility on health and safety. • Appropriate health and safety signs such as “Danger”, “Entrance Prohibited”, etc. will be placed in proper places.	Minor, part of standard practices	Contractor	Start of construction	End of construction

Genset Installation Operational Phase Mitigation Plan

Environmental or social impact	Operation Mitigation Actions	Costs	Responsible	Start	End
Disposal of hazardous materials (oil/fuel)	• SEDeP Solid Waste Management Code of Practice will be integrated into KAJUR SOP • Any hazardous waste will first be collected and stored in self bunded containers in a bunded covered area. • For final disposal, the KAJUR will ensure hazardous items are shipped offshore to a facility licensed to handle hazardous waste.	Major for MEC – funding of offshore waste disposal will need to be secured	MEC	During operation	Continuous

Environmental or social impact	Operation Mitigation Actions	Costs	Responsible	Start	End
Genset Maintenance	• Ensure that all manufacture recommendations for maintenance of generator are implemented to maintain efficiency and reduce risk of failure.	Minor, part of existing monitoring	MEC, EPA	During operation	Continuous

Genset Installation Supervision Plan

Impact Area:	Management Measures:
Genset Installations: Pre-Construction Checklist	
Solid and hazardous waste	• Approved Solid Waste Management Plan in place • Waste collection at laydown area is established and secure
Public health and safety	• HIV/GBV/Code of Conduct training and acknowledgements have been conducted
Soil and water pollution	• Appropriate spill response plan in place
Occupational Health and Safety	• OHS Management Plan in place • All workers have undergone appropriate OHS training
Equipment Supply	• All imported materials have appropriate biosecurity clearances
Laydown Area	• Laydown areas established on pre-approved sites

Impact Area:	Management Measures:
Genset Installations: Weekly Construction Supervision Checklist	
Solid and hazardous waste	• Approved Solid Waste Management Plan effectively implemented • Waste collection at laydown area is secure, well signed and clean • Hazardous waste is stored according to SWMP • Good housekeeping around project sites • All waste is disposed of offshore
Public health and safety	• Signs and fences restrict or direct pedestrians and public where appropriate.
Soil and water pollution	• Appropriate spill response plan/kit in place for waste area • No visible spills on soil or uncovered ground
Hazardous substances storage	• Substances stored in self-bunded vessels or within bund on impermeable surface • Spill kit complete and accessible • Spill training completed • No evidence of spills on the ground
Occupational Health and Safety	• Workers have access to, and using appropriate, PPE for the task. • All workers have undergone appropriate OHS training • Proper briefing of staff before undertaking work activities
Equipment Supply	• All imported materials have appropriate biosecurity clearances
Laydown Area	• Laydown areas established on pre-approved sites • Water run off management systems operating correctly • PPE present and correctly used

Impact Area:	**Management Measures:**
Genset Installations: Operations Supervision Checklist	
Solid and hazardous waste	• Solid Waste Management Code of Practice Integrated into SOPs • Hazardous waste collected and stored in appropriate facility • Hazardous waste transported offshore for disposal in licensed facility
Air Quality	• Air quality monitoring requirements as per the requirement of the NEPA permit

Annex C Energy Efficiency Investment Management Plan

EE Investment Design Mitigation Plan

Activity Area	Majuro Pre-Construction Mitigation Actions	Costs	Responsible	Start	End
General / all impacts	• The ESMP will be included in the Contractors / Suppliers specification and contract. • Specific mitigation measures for the contractor / supplier shall be highlighted in the general conditions.	Minor, included in tendering costs	MEC	Tender preparation	Award of tender.
LED Impacts on Human Health	• LED light specification to minimise glare and circadian disruption. Specification considerations should include investigating the use of cooler LED colours in streetlighting in residential areas and direction and location of light spill to minimise disruption to circadian rhythm.	Minor, addressed in design	MEC Consultants	Project design	Project implementation
Health and Safety	• The tender shall be prepared in accordance with the health and safety guidelines in the IFC / World Bank Environment, Health and Safety Guidelines for Occupational Health and Safety.	Minor, included in tendering costs	MEC	Tender preparation	Award of tender.
Waste Management	• The PIU Safeguard Specialist shall develop SEDeP Codes of Practice for Solid Waste Management based on the SWMP requirements of this ESMP • All Project staff will be trained on these codes of practice and attendance will be recorded.	Minor, part of standard practices	Contractor	Design phase	Prior to Construction Starting
Recruitment of overseas workers	• All imported project staff will abide by RMI immigration policy and provide all required documentation, including health checks. • Overseas workers will undergo cultural familiarisation induction upon arrival and sign a code of conduct applicable for the duration of their contract. • Overseas workers will have the technical skills and experience required for works under this component.	Minor, part of standard practices	Contractor	Upon recruitment	Prior to construction starting
HIV/AIDs & GBV Training	• All project staff will undergo training by services providers identified by MEC PIU on prevention of HIV/AID and GBV. • Attendance will be recorded. • The Contractor will develop a Code of Conduct (to be approved by PIU) for all workers (local and overseas) to sign detailing the expected behaviours of Project staff, ESHS requirements, Cultural respect, OHS requirements, Community Health and Safety considerations	Minor, part of BoQ	Contractor and MEC	Design phase	Prior to construction starting

EE Investment Construction Phase Mitigation Plan

Environmental or social impact	Construction Mitigation Actions	Costs	Responsible	Start	End
Non-toxic solid wastes (metal, packing, etc.)	• SEDeP Code of Practice for Waste Management will be fully implemented. • Metal, cardboard and plastic will be recycled, where local facilities exist. • Waste that cannot be recycled will be collected and securely stored prior to offshore disposal at a licensed facility.	Moderate but included in tender preparation	Contractor / supplier	In the beginning of construction	After completion of construction
Hazardous and difficult waste	• SEDeP Code of Practice for Waste Management will be fully implemented • Hazardous wastes such as discarded incandescent bulbs shall be collected and stored in water tight containers prior to disposal offshore at a licensed facility as per the requirements of the Solid Waste Management Plan. • Difficult waste such as appliances and building cladding shall be stored in the secure fenced and covered area. • Should any Asbestos Containing Material be uncovered while working on building insulation, the Contractor will develop an Asbestos Management Plan for review, approval and implementation. • Containers shall be stored in a bunded covered area prior to export for disposal.	Moderate but included in tender preparation	Contractor / Supplier	In the beginning of construction	After completion of construction
Importation of equipment and materials	• All imported equipment and materials will be subject to customs and quarantine clearance by GoRMI • Additional treatment or cargo will be undertaken should this be required by the GoRMI • Ballast water from any cargo vessel chartered by the Contractor will be exchanged in the open ocean prior to arrival in RMI EEZ	Minor, part of standard practices	Contractor	Prior to shipment	Upon clearance of shipment
Lay down areas	• Laydown areas will be sited on government owned land. • Areas will be securely fenced. • Newly imported equipment for installation will be stored in a secure container on site. • Segregated storage for solid waste will be provided. This area will be clearly marked and designed to ensure that as waste is secure. • Worker inductions will include a tour of the laydown area and required practices from workers.	Minor, part of standard practices	Contractor	Start of construction	End of construction
Health and Safety	• All work shall be in accordance with the World Bank /IFC Environment, Health and Safety Guidelines for Occupational Health and Safety. • All workers will be provided with appropriate PPE for contract works.	Minor, part of standard practices	Contractor	Start of construction	End of construction

Environmental or social impact	Construction Mitigation Actions	Costs	Responsible	Start	End
Consumer Awareness	• The EPD supported by the consultant shall implement the consumer awareness program developed by the loss management consultant				

EE Investment Operational Phase Mitigation Plan

Environmental or social impact	Operation Mitigation Actions	Costs	Responsible	Start	End
Disposal of hazardous materials (light bulbs)	• SEDeP Solid Waste Management Code of Practice will applied • Any hazardous waste will first be collected and stored in water tight containers in the provided secure covered facility. • For final disposal, hazardous items will be shipped offshore to a facility licensed to handle hazardous waste.	Major for MEC – funding of offshore waste disposal will need to be secured	MEC	During operation	Continuous
Appliance Maintenance	• Ensure that all manufacture recommendations for maintenance of energy efficient appliances are implemented to maintain efficiency and reduce risk of failure.	Minor, part of existing monitoring	MEC, EPA	During operation	Continuous

EE Investment Supervision Plan

Impact Area:	Management Measures:
Energy Efficiency Installations: Pre-Construction Checklist	
Solid and hazardous waste	• SEDeP Codes of Practice (CoP) for Solid Waste Management are approved and in place • Fenced, secured and covered storage facility is in place for hazardous and difficult waste
Public health and safety	• HIV/GBV/Code of Conduct training and acknowledgements have been conducted
Occupational Health and Safety	• OHS Management Plan is in place. • All workers have undergone appropriate OHS training
Equipment Supply	• All imported materials have appropriate biosecurity clearances
Laydown Area	• Laydown areas established on pre-approved sites

Impact Area:	Management Measures:
Energy Efficiency Installations: Weekly Construction Supervision Checklist	
Solid and hazardous waste	• SEDeP Codes of Practice (CoP) for Solid Waste Management are applied efficiently • Waste collection at laydown area is secure, well signed and clean • Fenced, secured and covered storage facility is in place for hazardous and difficult waste • Old light bulbs and difficult waste is stored according to CoP • Good housekeeping around project sites • All waste is disposed of offshore
Public health and safety	• Public signage of complaints procedure.
Occupational Health and Safety	• Workers have access to, and using appropriate, PPE for the task. • All workers have undergone appropriate OHS training • Proper briefing of staff before undertaking work activities
Equipment Supply	• All imported materials have appropriate biosecurity clearances
Laydown Area	• PPE present and correctly used

Impact Area:	Management Measures:
Energy Efficiency Installations: Operations Supervision Checklist	
Solid and hazardous waste	• Solid Waste Management Code of Practice Integrated into SOPs • Hazardous waste collected and stored in provided facility • Hazardous waste transported offshore for disposal in licensed facility

Annex D: Solid Waste Code of Conduct Requirements

These requirements will form the basis for the development of the SEDeP Code of Practices for SEDeP Solid Waste Management. The key objectives of these requirements is to assist the PIU Safeguard Specialist to develop a sector based code of practice for waste management. The requirements for the Code of Practice are:

1. Compliance with GoRMI Solid Waste Management Regulations.
2. Satisfies the EHS requirements of the ESMP
3. Satisfies the EHS requirements of the World Bank
4. Meets the following minimum standards:
   - ix. No RMI landfills are to be used for any waste. All waste is to be recycled or disposed of offshore at a permitted facility.
   - x. No dumping of any waste in RMI
   - xi. Compliance with Waigani Convention and any other relevant international conventions for export of hazardous and non-hazardous waste
   - xii. Identify and utilise suitable local recycling and reuse options
5. Implements the usual good practice of solid waste management, including:
   - vi. Segregation of waste
   - vii. Secure storage for waste
   - viii. Adopting the waste hierarchy: (i) avoid; (ii) reduce; (iii) reuse; (iv) recycle
   - ix. Collaborating with other sectors, waste generators and government initiatives for cumulative benefits
   - x. Build capacity and sustainability within the renewal energy sector in the approach to waste management through SEDeP implementation

When developing, and implementing the Code of Practice, the Safeguard Specialist will consider:

1. Waste streams: identify which waste streams are likely to be generated and estimate the approximate amounts of materials

   Undertake inventory of materials that can be reused, recycled or recovered from the project:

   - Specific types of materials: a full list of options is provided in the assessment table below
   - Amount of material expected
   - Possible contamination by hazardous materials like asbestos or lead: these materials will limit reuse/recycling options and require special disposal.

Waste and/or Recyclable Mater ials		**Destination**		
		Reuse and recycling		**Disposal**
Possible Materials Generated (Add or Delete as necessary)	Estimated Volume (m3) or Area (m2) or weight (t)	On-site (How will materials be reused and/or recycled on site)	Off-site (Specify the proposed destination and/or recycling facility)	Specify the off-island disposal site and the process for collection, storage and eventual disposal
Timber (specify type)				
Wood waste (e.g. MDF, plywood)				
Cardboard				
Ferrous materials (e.g. iron, steel)				
Nonferrous materials (e.g. copper wiring)				
Concrete				
Roofing tiles				
Ceramic tiles				
Gravel				
Gypsum board (e.g. drywall)				
Plaster				
Plumbing fixtures and fittings				
Carpet and underlay				
Stone				
Asphalt				
Glass				
Sand/fill				
Topsoil				
Green waste				
Asbestos				
Fluorescent light bulbs				
Hydrocarbons and fuel				

Damaged solar panels				
Batteries				
Plastics				
PVC				
Co-mingled recyclables (e.g. paper, cans, glass and plastic bottles, carboard, etc)				
General waste (e.g. food waste, contaminated food packaging, non-recyclable plastics)				
Mixed waste				

2. Collection and Storage: How and where will the difference waste streams be collected and stored prior to their disposal offshore. Detail the types of containers to be used and the storage areas that will be created for this waste. Differentiate between regular, bulk and hazardous waste. This must be compliant with the minimum standards detailed in the ESMP:

    a. Damaged solar panels and used batteries will be stored in a 10ft container (provided by Contractor) and a roofed structure over the containers in a location to be determined by MEC.

    b. Hazardous wastes such as old oil and fuel shall be collected and stored in self bunded containers. Containers shall be stored in a bunded covered area prior to export for disposal
    c. Hazardous wastes such as discarded incandescent bulbs shall be collected and stored in water tight containers. Containers shall be stored in bunded covered area prior to export for disposal.
    d. Difficult waste such as appliances and building cladding shall be stored in a secure fenced and covered area.

3. On-site: understand how the waste management system (housekeeping, sorting and storage) will work on-site, including bin placement and access.

    Determine storage requirements (separate bins or co-mingled), things to consider include:

    - Ease of use: ensure that containers are easily accessible by workers and that storage areas are clearly sign posted
    - Safety: ensure that the containers and storage can be managed safely, including limiting public access to the storage areas
    - Hazardous waste materials storage

- Aesthetics: ensure that the project sites and storage area appears orderly and will not raise concern from local residents or businesses – for example screening for dust and litter containment and daily collection of windblown material
- Establish a collection/delivery plan in collaboration with waste contractors for waste and recyclable materials generated on-site.

4. Clearly assign and communicate responsibilities: ensure those involved in the project are aware of their responsibilities in relation to the Codes of Practice.
5. Training: be clear about how the various elements of the Codes of Practice will be implemented.
6. Monitor: to ensure the plan is being implemented, monitor on-site as per the ESMP monitoring plan.

Annex E: Draft TOR for ESIA and Land Due Diligence for Renewable Energy Projects

DRAFT TERMS OF REFERENCE (TOR)

ENVIRONMENTAL and SOCIAL IMPACT ASSESSMENT, LAND DUE DILIGENCE

Republic of Marshall Islands (RMI) Sustainable Energy Development Project (SEDeP)

1. INTRODUCTION

This Terms of Reference (TOR) is for an individual consultant to provide specialist safeguard instrument development services and Land Due Diligence services to the SEDeP Implementation Unit (on behalf of the Government of RMI (GoRMI)) for the proposed SEDeP *sub-project to be inserted*.
The GoRMI is in the process of preparing the project with proposed financing from the World Bank.

The development of safeguard documentation must follow GoRMI laws and regulations and World Bank Safeguard Policies for a Category B project. The process shall include screening, scoping, defining baseline scenarios, predicting impacts, providing input into the options analysis and design process and developing management and monitoring plans to avoid, mitigate or remedy significant potential impacts and enhance benefits.

The consultant will prepare a Land Due Diligence Report and, if necessary, a Resettlement Action Plan or Abbreviated Resettlement Action Plan for land acquisition consistent with World Bank Safeguard Policy 4.12 Involuntary Resettlement and the Resettlement Policy Framework for SEDeP.

SEDeP PROJECT OVERVIEW

2. Project Description

INESRT UPDATED PROJECT DESCRIPTION BASED ON ESMP SECTION 2.1, 2.2, 2.3 and 2.4.

2.1 Scope of the Investments subject to ESIA and Land Acquisition

Under Component 3 the SEDeP the World Bank will support the preparation of studies for renewable energy projects, including the design (up to the preparation of bidding documents) for RE projects for Ebeye and the Outer Islands. The projects may be funded by the World Bank or other development partner, but will not be funded by the SEDeP. The appropriate safeguard instrument and Land Due Diligence assessment will cover proposed works at all identified sub projects. The scope will include *update once scope of project is known*.

The ESIA/ESMP and Land Due Diligence baseline studies and preliminary assessments shall cover all investment options at the early phase of the process and contribute to optimisation and decision-making on the preferred development solution for each island. The ESIA, ESMP, Land Due Diligence Report and Resettlement Action Plan (if required) shall focus on the final, proposed development solution.

2.2 Overview of Study Area

UPDATE ONCE PROJECT SITES ARE KNOWN

3. REGULATORY AND POLICY FRAMEWORK

3.1 ESIA and ESMP

The ESIA/ESMP process and documentation should meet both GoRMI laws and regulations and World Bank Safeguard Policies.

The National Environmental Protection Authority (NEPA), established under the National Environmental Protection Act (NEPA) 1984, is the governing body for environmental protection in the RMI.

The NEPA Act 1984 is supported and further elaborated in a set of 8 regulations for protection of surface and marine waters, and air quality, and managing of potential impacts from earth works, sanitation systems, waste and new infrastructure development. The Act, and these regulations along with the Coast Conservation Act 2008, provides the framework for the protection of resources and environmentally sustainable development in RMI. The eight (8) regulations are –

- Earthmoving Regulation 1988 (with amendments in 1994 and 1998);
- Solid Waste Regulations 1989
- Toilet Facilities and Sewage Disposal Regulation 1990
- Marine Water Quality Regulation1992
- Public Water Supply Regulation 1994
- Environmental Impact Assessment Regulation 1994
- Ozone Layer Protection Regulation 2004Pesticides and Persistent Organic Pollutants Regulation 2004.
- Sustainable Development Regulation – this is currently in draft and will replace the Earthmoving Regulation once it comes into force.

Environmental Impact Assessment Regulation 1994

The Environmental Impact Assessment (EIA) Regulation (Section 21, NEPA) is the central environmental planning legislation. Its aim is to ensure that environmental concerns are given appropriate consideration in decision making for all new infrastructure projects. The EIA regulation requires a preliminary proposal for every development activity, and applies a two-step assessment process to determine the level of assessment required. Step 1 is an initial evaluation to determine if the activity has the potential for significant effect on the environment; the preliminary proposal is an initial evaluation to determine whether an activity or action has significant environmental effect. Step 2 is an EIA for proposals assessed to have potential significant impact which will be reviewed and form the basis of an approved or not approved decision. The EIA process requires extensive and inclusive consultations with all stakeholders. In preparing the EIA, the proponent shall follow the format and content, as detailed in Part IV of the regulation, unless otherwise directed by the Authority. The proponent shall remain subject to regulatory and permitting requirements pursuant to NEPA, Coast Conservation Act, and the Historic Preservation Act and Tourism Act 1991.

3.2 Land Acquisition

The framework for land acquisition and resettlement is based on the laws and regulations of the Republic of the Marshall Islands Government and the World Bank's Safeguards Policies. The

principal Marshall Islands laws governing land acquisition, resettlement and compensation presently include (i) RMI Constitution (ii) Land Acquisition Act 1986 and (iii) Coast Conservation Act 1988.

4. OBJECTIVES OF THE ASSIGNMENT

The objectives of the Assignment are to:

i) Undertake an ESIA/EMP study for the RE projects as describe above (including all relevant ancillary facilities). The process shall include screening, scoping, defining baseline scenarios, predicting impacts, and developing robust and applicable management and monitoring plans to avoid, mitigate or remedy significant potential and enhance benefits.

ii) Accurately identify the project's 'area of influence' and implement an ESIA/ESMP study that reflects the nature, scale and intensity of the impacts in the area of influence. This includes the geographical and temporal scale of cumulative impacts.

iii) Focus on the significant / key environmental and social issues related to all proposed facilities and activities under the project (including design aspects, construction methods and operational activities, and including all associated facilities and activities such as temporary construction facilities, source of aggregates etc.). Cumulative impacts with concurrent infrastructure projects should also be considered.

iv) Identify and analyze any opportunities to enhance social and environmental benefits, as well as avoiding and mitigating the potential adverse impacts.

v) Provide expert advice to the MEC PIU and the design team throughout the process to ensure that risks are identified and managed as early as possible, and that infrastructure designs are optimized to address significant environmental and social impacts;

vi) Facilitate a comprehensive stakeholder engagement process with MEC PIU to ensure all stakeholders (host communities, affected people, NGO's, etc.) are fully informed about the projects and are engaged in the ESIA/ESMP process, and contribute to project outcomes.

vii) Prepare ESIA and ESMP instruments to meet the RMI permitting processes and safeguards requirements under World Bank Safeguard Policy 4.01 Environmental Assessment. Support the PIU to apply for permits.

viii) Prepare a Land Due Diligence report to identify the land parcels, land owners, assets that may be damaged or removed and land acquisition processes (lease, compulsorily acquire). Prepare a Resettlement Action Plan or Abbreviated Resettlement Action Plan in accordance with the SEDeP RPF, to comply with World Bank Safeguard Policy 4.12 Involuntary Resettlement, if involuntary land acquisition and / or resettlement will be required.

5. SCOPE OF WORK

5.1 Overview

A consultant will be hired to conduct the following Scope of Work. In summary:

Task 1.**ESIA Study:** Undertake a detailed qualitative and quantitative ESIA/ESMP study for Component 3.2 of the SEDeP including all ancillary infrastructure and works.

Task 2.**Stakeholder Consultation and Engagement:** Assist the PIU to consult broadly and effectively engage with all stakeholders who have an interest in, or will be affected by, the project. This includes preparing and implementing a comprehensive Stakeholder Engagement Plan.

Task 3.**Prepare a Land Due Diligence Report** to accurately assess the land, foreshore and seabed requirements and the possibility of involuntary land acquisition.

Task 4.**Prepare relevant safeguards documentation** and facilitate the public disclosure and approvals processes.

The four tasks are interrelated and in some cases concurrent.

5.2 Task 1 –ESIA Study

The ESIA study shall follow international best practice for the screening, scoping, baseline definition, impact assessment and management for impacts and benefits on the environment and people. Task 1 will be undertaken concurrently and will interrelate with the design and consultation tasks (Tasks 2, 3 and 4).

Start up and Review of Existing Information

Conduct initial information gathering from all available resources. The scoping work will be based on the known design features of the infrastructure and possible alternatives, even if detailed design has not been completed. It is expected that the majority of information gathering will be from secondary sources. Existing GIS data, satellite imagery and topographic and bathymetric data will be collated.

Baseline Data Gathering, Site Visits and Interviews

The Consultant shall visit all project sites to collect field data and information. During the site visit to Ebeye the Consultant shall visit government agencies, NGO's and other organizations to identify project stakeholders, obtain secondary data and discuss ongoing consultation arrangements with stakeholders. During the visits to the outer islands, the Consultant shall collect biodiversity and environmental data, social data and confirm the plan for ongoing communications and engagement with the community about the project.

- The Consultant shall conduct baseline data gathering as required to adequately describe the existing environmental and social context relevant for each of the design options for the proposed project sites:
- Island and reef geology, topography, climate change and natural hazards profiles, erosion potential and, if necessary, bathymetry, hydrography, hydrogeology, metocean characteristics, ;
- Terrestrial, marine social and urban environments;
- Foreshore, reef and ocean uses for subsistence, cultural and economic purposes,
- Land cover, land ownership, land use, assets and physical cultural resources within the project footprint, and wider area of influence;

- Socio-economic profile of each island and the resilience of the community to withstand the influx of workers and provide labour and other services. The value and significance of the existing and proposed transport infrastructure.

Preparation of Baseline

With the data collected in 0 and 0 the Consultant will prepare a description of the environmental and social context that will serve as the baseline for assessing potential impacts and benefits. This information should be shared with the design team to inform the detailed design process (to incorporate mitigation into design).

The description of the existing environment shall conclude the existing quality and values of the land, foreshore and reef and detail the existing threats (climate change, existing developments etc.). It should identify the interrelationships and dependencies between people and the environment, vulnerable species or habitats, physical cultural resources, and other significant features of each area.

Data shall be captured and presented spatially wherever possible and relevant. Data shall be presented and analyzed in context, such as the weather conditions leading up to the time of sampling, data gaps and limitations of sampling methodologies used.

Description of the Project Activities

Once confirmed by PIU, the Consultant will prepare a project description that captures all activities, in order to confirm the project area of influence and the scenario on which to base the impact assessment. The project will include the pre-construction activities as well as land clearances, excavations, dredging/blasting, construction of infrastructure, sources of aggregates, laydown areas, work camps, transportation and ship-to-shore operations for all imported equipment and materials to the island, and all waste materials and equipment from the island at the end of the project, waste management, land-based buildings, roads, spoil disposal areas, harbor operations and maintenance.

The Consultant should have the capacity to work efficiently in parallel with the design process and need to be aware that designs / project description may change throughout the period of the consultancy.

Impact Assessment

Impact assessment shall include direct and indirect impacts, the connections between primary, secondary and tertiary impacts, cumulative impacts, cover the entire project area of influence, and consider and analyze alternatives. Impact assessment should focus on significant impacts only. Minor impacts may be briefly described and managed under the ESMP. A general scope of work is provided in this section. Specific requirements for impact assessment for biodiversity and social impacts Annexes 2 and 3 respectively.

Qualitative impact assessment shall be conducted. The methodology for impact assessment shall be described by the Consultant in detail in the proposal.

The anticipated outcomes of mitigation and monitoring measures shall also be analyzed (and modelled if necessary) for any new impacts and benefits, before they are confirmed in the ESMP.

The preliminary results of impact assessment shall be shared with PIU and the design team; particularly high risk issues and / or issues that may alter design or delay the project. These should

be discussed and evaluated amongst the team during this phase before the final impact assessment is completed to allow for an iterative process between the ESIA and the design.

Assessment of Alternatives

The ESIA/ESMP process serves to provide evidence for an investment as the best alternative with respect to minimising and mitigating social and environmental risks and impacts, thus complementing the project's financial and technical considerations. The analysis of alternatives is therefore an essential step in the scoping and assessment of impacts. Important factors in the analysis of alternatives are:

- site location and project footprint orientation;
- alternative ancillary services such as onshore facilities and spoil locations (location, type, design);
- construction methodology;
- operations; and
- the 'without project' scenario.

A summary of the analysis and the findings will be provided in the ESIA document. Early assessments shall be shared with the design team (Task 1.3, 1.5), allowing the design team to consider the analysis prior to the confirmation of the layout and design.

Mitigation and Monitoring

The impact assessment process shall include consideration of potential management measures, following the hierarchy of avoid, mitigate, remedy, offset then compensate. Benefits should be identified and methods to protect and enhance them shall be developed. Each phase of the project shall be considered – preconstruction, construction and operation. The probable outcomes of management measures shall be analyzed for any new impacts and benefits, before the ESMP is prepared.

The construction-phase management shall include clear expectations of the level of mitigation required by PIU and the Contractor, for significant aspects and impacts, such as:

- The requirement for the Contractor to prepare a management plans such as Health and Safety Plan, Community Health and Safety Plan,
- Community health and safety –Preparation of protocols for worker-local interactions, health services, HIV/AIDS/communicable disease awareness, prohibiting access to work sites, workers camp design and management, community engagement and grievance redress mechanism, maintaining access to fishing and harvesting grounds etc. This may include a shipping management or traffic management plan, depending on the nature of risks on-island.
- Economic impacts and benefits – options for jobs and provision of food and services by host communities. Managing the reliance on local services and facilities to avoid overwhelming the communities.
- Outer islands rely on the MEC boat that delivers fuel on a regular basis for existing outer island generators, for inter-island travel to and from Majuro. This boat service also allows the two-way flow of goods and supplies including food, medicine and other livelihood essentials. Thus while the intended result of SEDeP is reduced reliance on diesel generators

through the use of stand-alone PV mini-grids, an unintended consequence is the reduced frequency and regularity of MEC boat trips and the possible severing of a critical lifeline for outer island populations. Some outer islands have secondary level boarding schools serving nearby atolls and are also heavily dependent on the MEC boat trips.

- Biodiversity –avoiding and mitigating damage through sediment control, controls over dredging and disposal areas and other matters.
- Emergency plans for spills and other incidents
- Worker health and safety
- Waste management – the removal of all waste from the island for safe recycling or disposal; spoil management.
- Training, staffing, resources and budgeting requirements for the Contractor, Supervising Engineer, PIU and other stakeholders.

The operational-phase ESMP shall include procedures to avoid environmental, social, health and safety incidents and accidents during operation, and how these will be operationalized into MRD. It should include procedures for avoiding and managing impacts during repairs and maintenance.

The ESMP shall follow the format of World Bank Safeguard Policy 4.01 Environmental Assessment, while also covering the requirements of the Environmental Protection Act (2008) and regulations.

Mitigation and monitoring shall take into account the capacity of MRD, the community, the Contractor and third parties such as NGOs and the amount and source of funding required for implementation. Institutional arrangements (who is responsible for what), supervision responsibilities, capacity strengthening (training, recruitment, equipment) and budgets shall be included in the ESMP.

The ESMP shall clearly articulate the procedures for preparing the safeguards aspects of the bid documents for the Contractors, following World Bank procurement guidelines and Safeguards Policies. The bid documents shall insist that the Contractor must comply with the ESMP, must have their own safeguards specialists, and prepare their own Contractor's ESMP which will articulate in detail how the Contractor will ensure compliance with the tasks they are responsible for.

The EMSP shall also include a grievance redress mechanism that allows for complaints and grievances to be reported and managed in culturally appropriate ways, consistent with World Bank policies.

ESIA and EMP Reporting

Draft ESIA and ESMP will be prepared and provided to MRD and the World Bank for review and comment. Following comment, the draft ESIA and ESMP will be publicly disclosed and consulted in RMI, and on the World Bank website. Final documents will be prepared based on feedback from consultation and disclosure, and will be submitted to the Department of Environment for approvals and the World Bank for clearance. Refer to Section 0 for details on documentation, disclosure and approvals.

5.3 Task 2 – Stakeholder Consultation and Engagement

The Consultants shall support MRD to continue to undertake regular consultations with each island community and on Funafuti with key stakeholders.

Consultation will be led by MRD, but will be facilitated by the Consultant. The Consultant will be expected to develop plans, provide training, develop consultation materials and resources and otherwise assist MRD to undertake meaningful and appropriate consultation in compliance with World Bank safeguards policies and GoRMI policies and laws.

Task 2.1 Stakeholder Engagement Plan

The Plan will prescribe the consultation activities with project stakeholders and host communities as well as: (i) procedures and mechanisms for information dissemination and community access to the project in a format that is meaningful and acceptable to the recipients; (ii) consideration of various consultation methods to include all community members (including women, elderly, youth, people who work during the day etc.); (iii) processes for including feedback into the project design and the impact assessment; (iv) roles and responsibilities of MRD, Contractor, Community and other players; (v) how the Grievance Redress Mechanism will be integrated into stakeholder engagement; and (vi) timetable or programme.

The Stakeholder Engagement Plan should cover the entire project, not just the ESIA phase. The methods of engagement and the messages and desired outcomes should be nuanced for the various project phases.

The draft Plan will be reviewed by MRD and the World Bank and the comments will be adapted into the final Consultation Plan.

Task 2.2: Consultation and Stakeholder Engagement – ESIA Phase

For budgeting purposes the Consultant shall plan for at least one community-consultation sessions during the ESIA to present the draft findings of the impact assessment phase.

The Consultant shall prepare relevant consultation information in a form/format that is meaningful and acceptable to the groups to be consulted (e.g. using local language, non-technical language, relevant imagery etc.). Radio announcements, social media, text alerts and posters can be used to disseminate information and obtain comments and feedback. Note that the internet services in Tuvalu are slow and unreliable, and people will not be able to access large files, videos and similar materials.

Face-to-face consultations shall be undertaken at times and locations to suit the particular needs, cultural norms and vulnerability of stakeholders. For example, separate sessions may be required for women, or evening sessions may be required for people who work during the day. All consultation shall be adequately documented including lists of attendees (name, gender, role / job if relevant), key issues discussed, key outcomes, and photos.

The Stakeholder Engagement Plan will be updated and appended to the ESIA.

Task 2.3: Consultation Record Keeping and Reporting

The Consultants will be responsible for keeping records of all consultation for the ESIA phase. The use of stakeholder engagement software is optional. A final report attached to the ESIA will provide details of consultation held during the ESIA stage, details of communications methods, attendees details, key discussion points and outcomes, photos and compendium of consultation materials (fliers, articles, mass media announcements, etc.).

5.4 Task 3 – Land Due Diligence

Voluntary land acquisition via leases under GoRMI land law is the preferred and prioritised method of land access for this project. The Consultant shall assist MRD to undertake the consultations and surveys for land acquisition and produce relevant documentation in accordance with OP4.12 Involuntary Resettlement.

Task 3.1: Prepare a Land Due Diligence Report

A Land Due Diligence Report shall be prepared and should be based on the final project footprint. The methods and procedures to determine the value of assets to be offered to land/assets owners for each type of affected assets should be documented and should reflect fair replacement value of acquired assets. The processes for leasing should follow the GoRMI laws and World Bank safeguards policies.

The report should clearly explain the institutional responsibilities, timetable / program, land area / survey details, maps, land ownership and others with attachments to land, and cost and budget covering the voluntary land transaction implementation, including estimated cost for assets compensation. This is a practical tool that 1) documents the process carried out to date; 2) contains the matrix of land parcels with the best-known details of voluntary transactions known at the time and 3) plans to complete each land transaction. It should specify the process and documentation required for voluntary land transactions that will ensure that coercion is avoided and the transaction is entirely based on the willingness of land owners, and in compliance with OP4.12 and the laws of GoRMI. It should specify how the SEDeP GRM will be used for land acquisition and how it has been communicated to the affected people. The Plan should include the matrix of land parcels with notations for each site on the land owner (Government, private, etc.), likelihood of voluntary negotiated lease, and highlight any risky sites and their potential alternatives (including involuntary land acquisition). The Plan should also identify any residual land parcels will need to be acquired using involuntary / compulsory means and the requirement for the Consultant to carry out Task 3.3.

Task 3.2: Resettlement Action Plan (RAP) (if necessary, following Task 3.1)

For any involuntary land acquisition that is identified through the process in the steps above, a Resettlement Action Plan will be prepared following the specific requirements of OP4.12 Involuntary Resettlement. The consultant must provide a cost estimate and program to complete the RAP, for approval by MRD and the World Bank, prior to starting the RAP.

5.5 Task 4 - Preparation of Safeguards Documentation, Disclosure and Approvals Documentation

The following documents will be prepared by the Consultant:

1. Stakeholder Engagement Plan

The Plan shall be prepared in accordance with 0.

*The Plan is due **xx** after Contract signing.*

2. Land Due Diligence Report

The Report shall be prepared as per Task 3.

The Draft Report is due within xx months after Contract Signing. The Final Report will be appended to the ESIA.

3. ESIA Report, ESIA Executive Summary and ESMP

The documents shall follow the prescribed aspects of ESIA and EMP documents under World Bank Safeguard Policy 4.01 Environmental Assessment and NEPA (2008). This includes a stand-alone, non-technical, executive summary of the ESIA that will go to the World Bank board as part of project appraisal.

The Consultant shall present data in a clear and succinct way, using graphs, maps (GIS format) and tables where possible. All technical data and detailed analyses shall be appended or provided as a 'supporting technical document'.

Management and monitoring plans shall be robust, relevant for the nature, scale and intensity of potential impacts and roles and responsibilities clearly articulated. The Stakeholder Engagement Plan shall be updated at the end of the ESIA phase and appended to the ESIA. The Land Due Diligence Report shall be appended to the ESIA.

Early drafts of the ESIA, ESIA Executive Summary and ESMP shall be prepared for review by MCT and World Bank. A final draft, taking into account the feedback, shall be prepared for consultation and disclosure purposes.

*The Final Draft Reports are due **within xx months** after Contract signing.*

The Consultants shall take into account the feedback on the draft ESIA, ESIA Executive Summary and ESMP from the project affected people and other stakeholders, and produce final reports ready for submission to the Department of Environment and to the World Bank for clearances and permitting.

*Final reports due **within xx months** after Contract signing.*

4. Resettlement Action Plan (if required)

If the land due diligence assessment identified involuntary land acquisition is required for project to be successfully implemented, then the consultant shall prepare a Resettlement Action Plan (RAP) or an Abbreviated Resettlement Action Plan (ARAP), in accordance with World Bank Policy 4.12 Involuntary Resettlement.

Early drafts of the RAP/ARAP shall be prepared for review by MRD and World Bank. A final draft, taking into account the feedback, shall be prepared for consultation and disclosure purposes.

*The Final Draft Reports are due **within xx months** after Contract signing.*

The Consultants shall take into account the feedback from the project affected people and other stakeholders, and produce final reports ready for submission to the World Bank for clearances ***within xx months*** *after Contract signing*.

5. NOTE:

1) Each deliverable listed above should be presented by the Consultants in a Skype / teleconference meeting with MRD (which may also be attended by Word Bank representatives) within two weeks of submission of the deliverable.

2) Allow two weeks for MRD and the World Bank to provide feedback.

3) All documents shall be submitted in English. The non-technical ESIA Executive Summary and consultation materials shall also be prepared in Tuvaluan.

4) Number of copies of each deliverable: 2 electronic versions on flash drive and 1 electronic version on an online file sharing server. Files shared via email or via online file sharing servers shall be no larger than 5MB each. All reports to be delivered in English, and the non-technical ESIA Executive Summary to be translated into Tuvaluan.

6. PUBLIC DISCLOSURE

The Consultant shall provide support and assistance to MRD in meeting the disclosure requirements, which at the minimum shall meet the World Bank's policy on public disclosure. The consultants shall prepare a plan for RMI disclosure, specifying the timing and locations and allowing time and budget for translation of documents. The Consultants shall draft newspaper and on-line announcements for disclosure and other media based materials as necessary.

7. APPROVALS

The Consultant is to assist MCT in applying for an environmental permit from the Department of Environment. These tasks include submission of the applications, responding to queries, providing additional information and maintaining regular communications with the relevant staff members.

8. TIME FRAME

The Assignment is expected to take **xx months**.

9. OUTPUTS OF THE ASSIGNMENT

The expected outputs of the Assignment are:

1 Stakeholder Engagement Plan.

2 Consultation materials.

3 Draft and Final ESIA, ESIA Executive Summary and ESMP.

4 Land Due Diligence Report.

5 Resettlement Action Plan (if required).

10. SELECTION PROCEDURE AND FORM OF CONTRACT

The consultants will be selected following Quality Based Selection (QBS) criteria under the World Bank Guidelines for selection of consultants. The contract will be financed by a Project Preparation Advance, and will be a LUMP SUM contract.

11. REQUIRED CONSULTANT AND EXPERTS

The Consultant will be at least one environmental and one social specialist. They will have international experience in preparing environmental and social impact assessments and management plans for renewable energy projects in small island states. The consultant shall be able to demonstrate experience in sustainable energy development, with a proven record of following international good practice and internationally recognized impact assessment methodologies.

Preferably the consultant shall also have experience with consultation, stakeholder engagement and / or social surveys in RMI, but otherwise in the Pacific.

The Environmental Specialist shall have a minimum of 10 years of relevant professional experience in environmental assessments of sustainable development projects. He/she should have demonstrated ability to work with small communities, government officials, civil society organizations, and should have a proven track record on managing and coordinating ESIA studies. The specialist shall have an advanced degree in impact assessment, resource management, environmental science, environmental engineering or similar. A professional certification of ESIA expertise and experience is desirable (such as Certified Environmental Practitioner (CEnvP) or equivalent).

The Social Specialist shall have a minimum of 10 years of relevant professional experience in land acquisition and social impact assessments of sustainable development projects. He/she should have demonstrated ability to work with small communities, government officials, civil society organizations. The specialist shall have an advanced degree in impact assessment, sociology, anthropology, international development or similar. Experience working in Marshall Islands or other North Pacific island states is an advantage.

12. RELEVANT INFORMATION TO BE PROVIDED BY THE CLIENT

Please update once project is identified

Annex F: Consultation Report

SEDeP RMI

Stakeholder Consultations Report, 31 July, August 2017

Introduction –

Stakeholder consultation is mandatory in the preparation of safeguards instruments for all the four safeguards policies triggered under SEDeP. These policies are OP/BP 4.01 Environmental Assessment, OP/BP 3.6 Natural Habitats, OP/BP 4.11 Physical Cultural Resources and OP/BP 4.12 Involuntary Resettlement.

The following report documents the consultations undertaken for the draft ESMF and RPF, held on 31 July 2017. Following consultation the ESMF was changed to an ESMP.

Target groups

The following groups of stakeholders were targeted for the consultations –

a) Government agencies, authorities and SOEs in Majuro and Ebeye
b) NGOs, non-governmental institutions and organizations, and civil society groups
c) Donor agencies especially those with experience and involvement in RMI's renewable energy sector.

Methods

Invitation and solicitation –

Formal invitations were sent out by MOF-DIDA to targeted government agencies, state owned enterprises, donor organizations for the first formal consultation to discuss and disclose the ESMF and RPF. Similar invitations were sent out for non-governmental organizations, academic institutions and other civil society organizations.

Both consultation meetings were held at the Ministry of Finance Conference Room in Majuro.

Schedule –

The consultations for the various groups took place according to the following schedule -

Stakeholder group	Date and time
3. Relevant Government agencies, SOEs, donors	• 31 July, 2017; 10am MOF Conference Room

4. NGOs, civil society and local community at Majuro	• 31 July, 2017; 2:00pm MOF Conference Room

Consultations Format and Presentations –

The consultations agenda consisted of the following –

- Introductory remarks by Ms Jennifer Tseng
- First presentation – Overview of the Project covering objectives, rationale, components, delivered by Jennifer Tseng, MOF-DIDA;
- Questions and Answers session
- Second presentation – Environmental and Social Management Framework (ESMF), and Resettlement Policy Framework (RPF) delivered by Sam Sesega, Safeguards Consultant
- Questions and answer session
- Close of consultation.

Each consultation ran for two hours, from 10 – 12 noon, and 2 – 4 pm respectively.

Powerpoint presentations of both presentations are annexed to this report.

Questions and Issues raised and discussed during Consultation 1 for Government agencies, SOE's and donors

1. On discussions of waste oil storage facility in MEC's Majuro compound, the MEC and ADB representatives advised that ADB is funding a project to refurbish the tank farm in Majuro.

2. One of the targeted schools for possible roof-top installations is a private school, the Majuro Co-operative School. All other buildings assessed on the recommendation of MOF-DIDA are government or public owned. If this is a mistake (because presentation says targeted buildings are government and public buildings), please include this.

3. A strong plea to include private buildings that are suitable was received including the private school buildings, in the context of ensuring there is sufficient surfaces and spaces to help achieve the RMI RE target by the year 2020.

4. In response to the interest expressed about private buildings, the MEC representative intervened to explain that proper structural assessments of all buildings are necessary to ensure they are structurally sound and capable of carrying PV panels. There is also the issue of liability invol ved in the on-going repairs and maintenance of buildings hosting PV installations that complicates project financing. Part of the preference given to government buildings in the current design is to simplify project design and to avoid such complications which are often likely to delay and or disruptions to project preparation and implementation.

5. Participants were also advised that all compensation payments associated with the Project will be RMI's responsibility and will not be funded out of the Project grant. It is therefore in the best interest of RMI that compensation is minimized.

6. In response to discussions over the issue of the cumulative impact of the project on the issue of accumulated waste oil in both MEC and KAJUR's compound, the JICA representative informed the consultation that JICA is funding a feasibility study for ways of reusing waste lubricant oils. The feasibility team is currently in RMI and have visited MEC and KAJUR's facilities to assess their

facilities and capacities, and to collect used oil samples for testing. The JICA representative invited the Safeguards Specialist to meet with the JICA Feasibility Team before their return.[17]

7. A participant from KAJUR asked if there are resettlement impacts, and if so, how are these handled? Will the Project ensured that compensation owed are settled and paid out and not ignored? In response, it was explained that a resettlement action plan (RAP) will be prepared if there are resettlement impacts and all compensation and entitlements identified in the RAP will be paid out. Moreover, the Project will not start until WB is satisfied, based on the RAP Implementation report to be prepared and submitted by Government of RMI, that all entitlements have been fully paid to the rightful people.
8. There was clarification of the term resettlement which one participant misunderstood to mean there will be relocation of affected people. It was explained that the term is much broader and also refer to losses and or damage to assets, and that if people needed to be relocated temporarily from their homes, the Project will be responsible for their relocation including all costs associated with it.
9. Why is Ebeye not included in targeted areas for the replacement of incandescent streetlight bulbs with LED bulbs? The Ebeye participant noted that safety at night is an important issue for their densely populated atoll.
10. Who is in the Project Steering Committee?
11. When will the next mission be?
12. What is the timeframe for the SEDeP?
13. Ongoing operation and maintenance costs need to be properly calculated and considered.
14. In Ebeye, with the installation of R.O. units, the energy need and consumption is expected to be increased. The need for Renewable Energy Project in Ebeye is strong.
15. Donor coordination needs to be further strengthened to ensure complementary between approaches and investments.
16. Private sector engagement: Private buildings/spaces could be considered for solar PVs installation but the structure and the suitability of those buildings/spaces needs to be evaluated.
    a. In response, it was explained that from a safeguards' perspectives, the project is targeting the public buildings/spaces for solar PVs installation to avoid the issues associated with building/spaces ownership and compensation which would be a cost to GRMI. Also dealing with private buildings will likely to complicate and project preparation.
17. Ministry of Public Works has been working with BECA (consulting firm) to design and construct public buildings with a specific consideration that solar PVs installation can be accommodated in the future.
18. Ministry of Public Works commented that the proposed flexible support structure for the solar PVs on water reservoir should be designed to withstand high wind speed. Typhoon is not very

[17] This meeting took place on the 1 August, 2017 at the JICA Office. Present were S Sesega - Safeguards Specialist, Mr Nobuaki Matsui – JICA Resident Representative, and six members of the Feasibility Study Team).

common in the RMI but the designing firm/consultant should also consider the impacts of typhoon.

19. MWSC requested that the technical feasibility study once finalized should be shared with stakeholders.

Comments and views expressed and discussed in Consultation 2 for NGOs, civil society groups, academic institutions etc.

1. RMI EPA noted that a shipment of used batteries (~16,000 lbs) was despatch to South Korea in June; an initiative led by MEC. This was partly donor funded (under a NEPA implemented project).
2. A few participants recalled there were whirlwinds in Delap that affected roof buildings in this location, and it's a regular occurrence in this area. Would this not have any impact on the proposed roof-top installations for schools in Delap?
3. Contrary to ESMF narrative that work opportunities from the Project for local people are likely to favour men over women, WUTMI Executive Director noted that the ESMF should not assume so, and that equal job opportunity should be offered to both genders.
4. Would the quality of drinking water in the reservoir be adversely affected by sunlight passing through PV panels?
5. CMI research on possible location of PV panels on reefs would be damaging to reef ecosystem.
6. WUTMI Executive Director also advised that should there be a sizeable amount of foreign workers involved, proper orientation of workers regarding the local culture and traditions should be conducted. WUTMI also offered their services to conduct orientation.
7. Multiple NGO representatives have shared the similar comments on the operation and maintenance costs, including the necessary policy, the institutional mechanism, and the sinking funds management capacity to ensure 1) saving from RE investment is contributed to the future O&M and 2) the GRMI is committed to financially support the future O&M costs. O&M should be both MEC and GRMI's shared responsibility.
8. In addition to the RE facilities maintenance, the hosting building/structure maintenance needs to be included in the O&M plan.
9. The usage of batteries has significant environmental impacts and practical recycling plan needs to be looked into.
10. Gender needs to be addressed, including gender-based violence from local workers.

Disclaimer: This document is provided for information only.

Neither Mitton ElectroNet, ITP nor MEC are responsible for
(i) the accuracy and completeness of such information
(ii) assumptions made by potential bidders based on the information.
Bidders shall make their own assessment of any or all the information provided in this document
and conduct their own studies.

Marshal Islands Majuro Power System

Load flow study

Document: MEL-R3679, Rev 01

Project Reference: ITP4270

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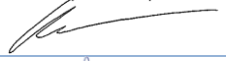
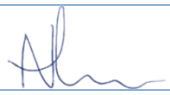
Filename: MEL-3679 Marshall Islands Majuro Load Flow Study Rev 01

Revision Log

Rev	Date	Description		Signed	Name
00	26/09/2018	First Issue to Client	Prepared		K. Schicker
			Reviewed		N. Adam
			Approved		B. Henderson
01	20/03/2019	Updated with new PV and new 2.5 MW generators. BESS considered in N-1. Maximum PV investigated.	Prepared		M. Steady
			Reviewed		K. Schicker
			Approved		N. Adam

Executive Summary

Mitton ElectroNet was engaged by ITP Renewables to undertake load flow analysis of the Majuro power system 13.8 and 4.16 kV distribution system. The objectives of the study were to determine the following:

- Network analysis of the Majuro Power system considering the effect planned projects will have on thermal loading of transmission lines, bus voltages and voltage steps.
- PV penetration of the installation of 4 MW of new solar PV, with 1,450 kW being distributed rooftop PV and 2.6 MW at a specific site.
- The effects on N-1 for the replacement of the Majuro Power station 1 Pielstick diesel generators with three 2.5 MW diesel generators.

The scope of the study only considers steady-state analysis and looks at cable and component loadings, and system voltages. There are possible transient voltage and system frequency stability issues that, in the interests of thoroughness, should also be investigated when the proposed development plan is finalised.

Revision 1 of this report includes changes to the new and existing PV installations. The four Pielstick generators are to be decommissioned and replaced by three new 2.5 MW diesel generators. Simulations for the existing system have not been changed in this revision, only those involving the new PV.

Methodology

Mitton ElectroNet prepared a DIgSILENT PowerFactory model of the Majuro 13.8 kV and 4.16 kV cable system which included all HV lines and cables, 13.8/4.16 kV transformers, PV arrays and synchronous diesel generators. Load information at a 15 minute resolution provided by ITP for August 2018, was loaded into the model to allow simulations to be run for each 15 minute period over a day.

The study was carried out by considering two operating scenarios; modelling the current system with existing PV generation and modelling the new PV generation provided by:

- 2,640 kW of new PV arrays at Airport Reservoirs
- 277 kW of new PV arrays at the College of the Marshall Islands (CMI)
- 1,177 kW of new rooftop PV arrays

An N-1 study was carried out with the existing diesel generator situation with only five available diesel generators. A second N-1 study was carried out to include the installation of three new 2.5 MW Diesel Generators at Majuro Power Station 1.

Results

The analysis of component loadings shows that under both the existing PV and new PV scenarios, there are no components that become thermally overloaded. The feeder two line becomes 80% loaded during the evening peak and may require attention in the future.

Analysis of the voltage profiles on the system identified that voltages on feeder one at the Laura 13.8 kV substation can drop below the ANSI C84.1 minimum service voltage of 0.95 pu during the evening peak. It is assumed that the Laura transformer has been set to tap 5 to provide + 5% voltage support. Note also, that local distribution transformers can compensate for this voltage drop on the LV side via a change in tap position. However this does not alleviate the sag on the 13.8 kV side. The voltage sag can be alleviated by an adjustment to the power station voltage setpoint or installation of reactive power support at the Laura substation.

Reasonable solutions to this problem, which require a cost-benefit analysis would be:

1. Increasing the voltage setpoint of the Majuro 1 and 2 power stations to 14.2 kV.
2. Installation of a 1 Mvar capacitor bank at the Laura substation to provide voltage support.

Results showed that the PV penetration as a percentage of the load will increase above 60% during some peak daylight periods with the new 2.5 MW PV arrays. This is above typically recommended levels [1] for asynchronous inverter generation and consideration should be made to system stability in the event of a sudden loss of PV generation. No over-voltage issues were found with the installation of the new PV systems.

To manage this increase in PV penetration, the installation of battery storage could be considered. This could be charged during the solar peak and discharged at night, smoothing out the ramp rate and fluctuation of the diesel generators. It should be noted that as PV generation starts to replace diesel generation, reactive power support will be required from the new inverters. With new PV and BESS installations, inverters with reactive power capability should be considered.

An N-1 study identified a system security issue with the existing situation with the two Deutz, one Cat and two Pielsticks generators operating. The normal service condition is to run one Deutz, and a combination of the two other generators from the Cat and Pielsticks. A failure of the Deutz generator will result in a likely blackout of the Majuro system as there will be insufficient generation to meet demand. With the existing situation, the security of the system can be increased by running a single Deutz, the Cat and both Pielsticks, although there is still a risk of overload if the failure was to happen during the evening peak. Alternatively, two Deutz generators and the Cat or one Pielstick could be run but the fuel usage would be much higher in this configuration due to the reduced efficiency of the machines when operating at a lower average output.

Ultimately, a determination of the optimal operating scenario, depends on the trade off that the power utility is willing to make between additional security and the cost of additional fuel consumption and maintenance on the diesel generators. Such work could be completed as an addendum to this study, if desired.

The installation of three new 2.5 MW diesel generators will increase the availability and flexibility of the power system, allowing planned maintenance to be carried out. An N-1 study for the smaller generators was considered to determine if the system could be run without the larger Deutz generators. N-1 security is only achieved with two new generators and the Cat

generator in service, however, a blackout is likely to occur during evening peak loading when the generators may become slightly overloaded. The installation of a BESS at the Majuro Power Station may provide some contingency in the event of a Deutz failure, which could reduce the risk of a system blackout if the Deutz failed during the evening.

In terms of line capacity, feeder 1 has capacity for an additional 3,100 kW of PV resulting in a 14.49 kV line voltage and conductor current of 240 A. Feeder 2 has capacity for an additional 3,950 kW of PV resulting in a line voltage of 13.8 kV and conductor current of 165 A if installed at the Jenrok Substation, installation to these maximum amounts would result in the system being fully renewable during midday.

Recommendations

Following the results of the analysis, Mitton ElectroNet has the following recommendations:

1. Address Laura substation voltage sag by adjusting the Mauro power station one and two voltage setpoints or installation of a 1 Mvar capacitor bank at the Laura 13.8 kV substation.
2. Consider the installation of battery storage to smooth out the PV peaks and troughs and to allow the use of all generated PV energy. This has the added benefit of reducing fuel consumption and providing contingency in the event of a diesel generator trip or a transient reduction in PV generation.
3. Consideration is given to N-1 security if the reliability of the system is given more weighting over fuel economy. The installation of three new diesel generators will increase the flexibility and reliability of the system. The system could be run on four of the smaller generators instead of running a Deutz.
4. When the planned network configuration is finalised, a dynamic stability study should be undertaken to assess voltage and frequency stability of the system with high PV penetration.

Mitton ElectroNet is available to assist with any of these activities when they are required.

Contents

Abbreviations

BESS	Battery Energy Storage System
MEC	Marshall Energy Company
MW	Mega Watt
PV	Photovoltaic
var / Mvar	Volt amps reactive,
XLPE	Cross-linked Polyethylene

1 Background

ITP Renewables engaged Mitton ElectroNet to undertake load-flow studies on the Marshall Islands Majuro electrical network to inform generator refurbishment and new connections of solar PV.

The Majuro electrical system consists predominately of three radial 13.8 kV feeders with radial 4.16 kV feeders at each end of feeder one and feeder two. The system comprises of overhead and underground copper XLPE cabling of size 2/0 at 13.8 kV and #2 at 4.16 kV. The load consists of a mix of industrial, commercial, and residential along the length of the approximately 33.5 mile system. The system is operated at 60 Hz nominal frequency.

Reciprocating diesel synchronous generators, located at Majuro power station, with a maximum capacity of 21.15 MW, are the predominant means of supplying the system. There is an increasing penetration of PV systems, consisting mostly of rooftop with a peak capacity of 2,400 kW. Plans for the network include the introduction of 4,000 kW of additional PV capacity.

The system peak load in 2017 was 8,500 kW with an average load of 7,670 kW.

2 Scope

The scope of this study was as follows:

1. Development of PowerFactory model of existing Majuro Power System, suitable for load-flow studies.
2. Incorporating planned projects into the PowerFactory model, considering:
    a. Refurbishments to old diesel powerplants, and 3 x 2.5 MW high speed diesel gensets
    b. Approximately 4 MW of new solar PV, with 1.4 MW being distributed rooftop PV and 2.6 MW at a specific site.
3. Load-flow analysis of the power system, considering the effect the planned projects will have on:
    a. Thermal loading of transmission lines.
    b. Bus voltages.
    c. Voltage steps.
4. Analysis will consider:
    a. System conditions based on the load characteristics from the August 2018 load data and PV characteristics provided in “pv_and_load_shapes.dss”.
    b. All circuits in service.
    c. Unplanned outages (N-1).

3 Assumptions and Methodology

3.1 Assumptions

We have sourced our data from ITP renewables through email correspondence. Where data gaps have been identified, we have attempted to make reasonable assumptions and have indicated if we think the assumption has a significant impact on the results and conclusions of the analysis.

Distribution transformers have not been included in the study as load data was only available for each feeder which will include distribution transformer losses.

The following sections outline the assumptions used in constructing the network model.

3.1.1 Network Topology

We have based the network model on the provided SLD from ITP Renewables. The schematic of the model is shown in Figure 1, overleaf.

3.1.2 13.8/4.16 kV Transformers

The MEC data handbook [2] provides information regarding the 13.8/4.16 kV transformer parameters. The key information is shown in Table 1.

Table 1 – 13.8/4.16 kV Transformer Parameters

Rating	Jenrok	Laura
Transformer Rating (kVA)	3150	1725
Impedance (%)	5.5	5.56
No Load losses (W)	6775	3455
Full Load Loss (W)	33100	15716
Tapchanger (On load / No load)	No Load	No Load
Taps	5	5
Tap range	+9/-5%	+/- 5%
Tap 1 (kV)	14.4	14.49
Tap 2 (kV)	13.8	14.145
Tap 3 (kV)	**13.2**	13.8
Tap 4 (kV)	12.87	13.455
Tap 5 (kV)	12.54	**13.11**

After consultation with ITP and MEC, the Jenrok transformer has been set to tap position 3 (13.2 kV) and the Laura transformer has been set to tap position 5 (13.11 kV).

3.1.3 13.8/0.48 kV Transformers

For PV greater than 300 kW, a 13.8/0.48 kV transformer has been included in the model to simulate losses. An assumption was made on transformer size, losses and impedance which are shown in Table 2.

Table 2 – 13.8/0.48 kV Transformer Parameters

Rating	**RES 1, 2, 3 and Existing Airport PV**	**Res 6 & 7 PV**	**Future Res PV & MEC BESS**
Transformer Rating (kVA)	750	1500	2000
Impedance (%)	5.7	6.5	7
No Load losses (kW)	1.8	3.6	3.5
Full Load Loss (kW)	10.2	20.4	25
Tapchanger (On load / No load)	No Load	No Load	No Load
Taps	5	5	5
Tap range	+/- 5%	+/-5 %	+/-5 %
Tap 1 (kV)	14.49	14.49	14.49
Tap 2 (kV)	14.145	14.145	14.145
Tap 3 (kV)	**13.8**	**13.8**	**13.8**
Tap 4 (kV)	13.455	13.455	13.455
Tap 5 (kV)	13.11	13.11	13.11

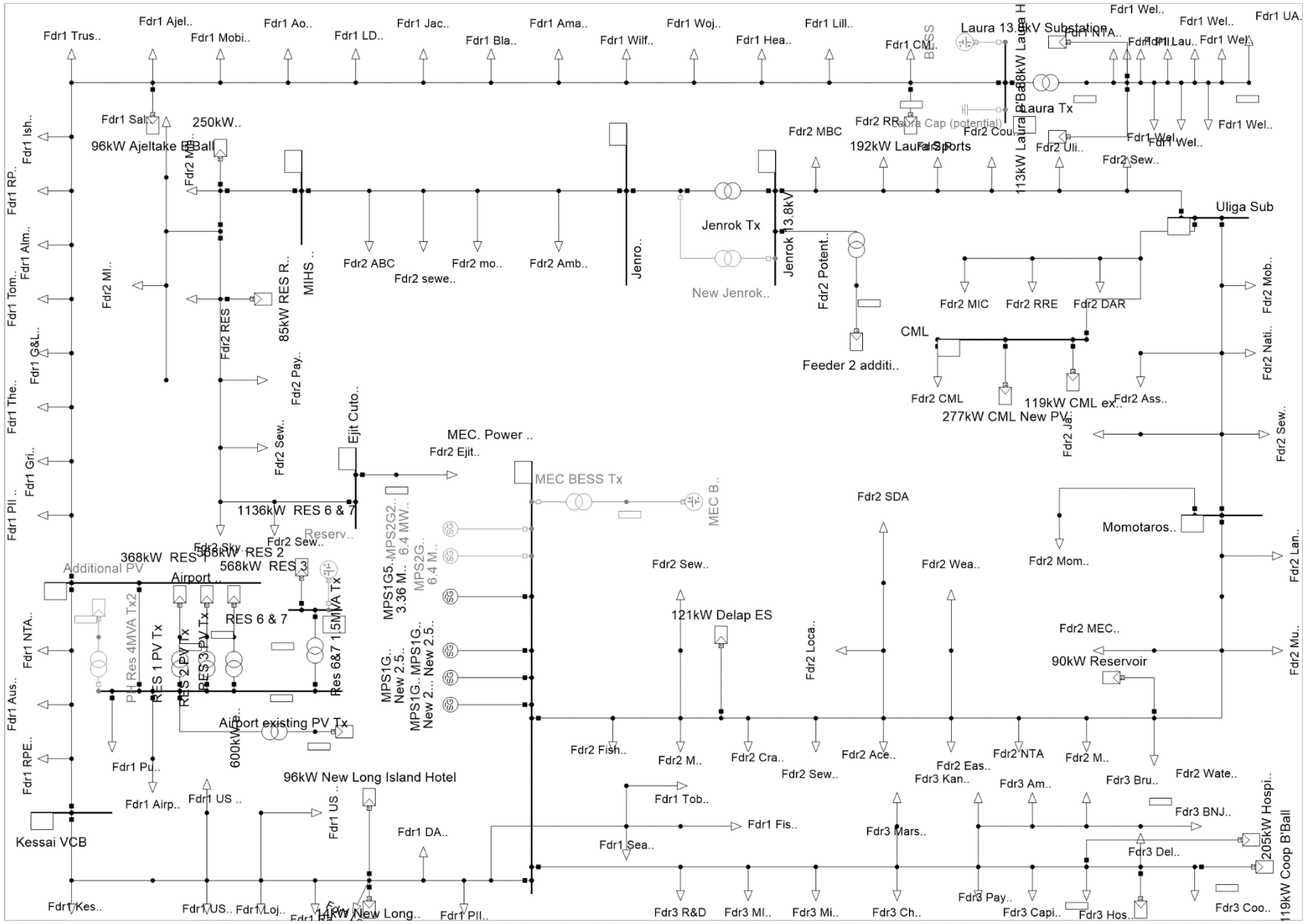


Figure 1 – Majuro Network SLD

3.1.4 Network Loads

Detailed data on each individual load was not available but an overall value was provided by ITP on feeder load distribution in the file "build_network_master.dss" and individual feeder loading was provided for a week of the month of August 2018.

Wednesday the 28th August was selected to model the load profile as the weather conditions were checked [3] and noted to be cloudy, reducing the generation of PV on the network and giving a more accurate representation of the actual system load. Individual feeder loading has provided separate load characteristics for each feeder, the load profiles for each feeder and total load profile are shown in Figure 2, Figure 3, Figure 4 and Figure 5 below.

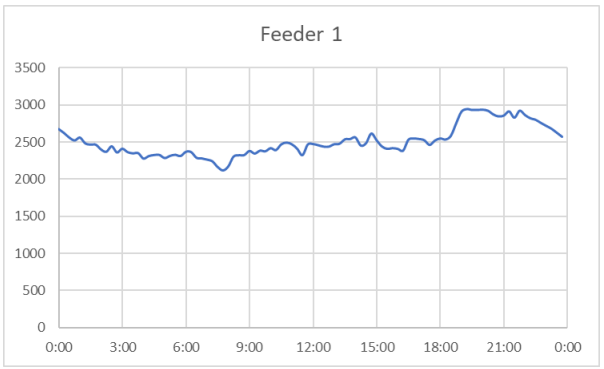


Figure 2 – Feeder 1 Daily Load profile, 28th August 2018.

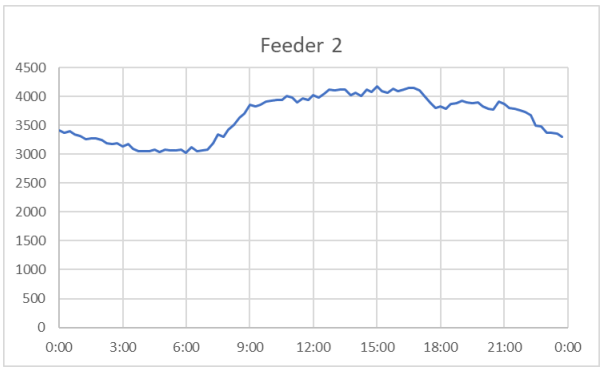


Figure 3 – Feeder 2 Daily Load profile, 28th August 2018.

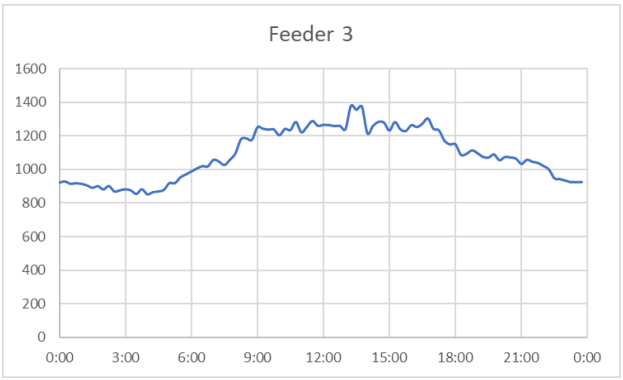


Figure 4 – Feeder 3 Daily Load profile, 28th August 2018.

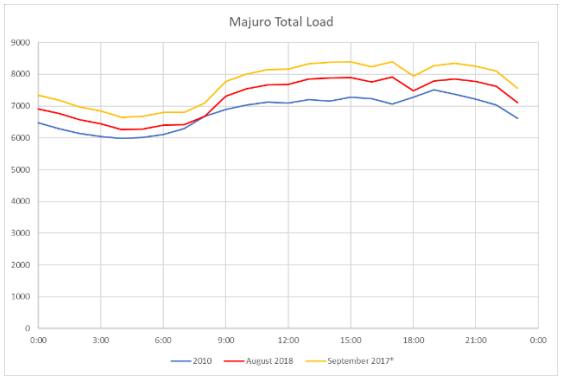


Figure 5 – Majuro Daily Load comparison between 2010, 2018 and September 2017.

The individual feeder loads were added together and compared against the 2010 data found in "build_network_master.dss" to check for consistency. A scaling factor of +6.2% based on the growth in average load was applied to the August data to calculate the September load profile, the comparisons are shown in Figure 5.

A percentage distribution was calculated based on the file "build_network_master.dss" and applied to the 28th August feeder data. The feeder three load in 2018 is lower than 2010, we have assumed the recorded data from 2018 being more applicable to this study.

Individual loads were identified in the single line diagram and put into the model. In most cases the loads have been split evenly based on the total load at each feeder.

Power factor data was provided in the August 2018 data file, the average, minimum and maximum are shown in Table 3. These were measured at the Majuro power station. To be conservative, a fixed power factor of 0.9 was applied to all loads.

Table 3 – Majuro Feeder Power Factor

Feeder	Average	Minimum	Maximum
Feeder 1	0.98	0.9	0.99
Feeder 2	0.96	0.84	1
Feeder 3	0.92	0.88	0.94

Data provided on the loads on each feeder is shown in Table 4.

Table 4 – Majuro Feeder Loadings

Feeder	kW (2010)	August kW (2018)	PF	Average kW per load
Feeder 1				
Power station to Fish base	299	302	0.9	101.7
Power station to Kessai	1063	1074	0.9	119.3
Kessai to Airport	411	415	0.9	53.8, Airport 200
Airport to Laura 13.8 kV	456	461	0.9	22
Laura 4.16 kV to end	258	261	0.9	26.1
Feeder 2				
Power station to Momotaro	1037	1267	0.9	79.2
Momotaro to Uliga	314	384	0.9	64
Uliga to Uliga Backroad	660	806	0.9	201.5
Uliga to Jenrok 13.8 kV	745	910	0.9	92, Docks 450
Jenrok 13.8 kV to MIHS	122	149	0.9	29.8
MIHS to Rita	61	75	0.9	10.7
Rita to Ejit	44	54	0.9	50
Feeder 3				
Power station to Hospital	915	749	0.9	19.9, Hosp 400, K&K theatre 150
Hospital to Co-op School	413	338	0.9	169
Total	**6796**	**7245**	0.9	

The August 2018 load has an average of 7245 kW and a peak of 8020 kW.

A financial year 2017 report was provided showing the peak load and average load at Majuro over the 12 months from October 2016 to September 2017. For 2017, September had the maximum load, the peak was 8,500 kW and largest average load was 7,693 kW.

The minimum monthly load occurred in January, with a peak load of 7,950 kW and average load of 6,660 kW.

A maximum and minimum monthly loads were used in the study, A scaling factor was calculated and applied to the August 2018 load profile to simulate the maximum and minimum loadings. The calculations are shown below;

$$Max\ load\ scaling\ factor = \frac{Average\ September\ 2017\ load\ (\max)}{Average\ August\ 2018\ load} = \frac{7693}{7245} = 1.062$$

$$Min\ load\ scaling\ factor = \frac{Average\ January\ 2017\ load\ (min)}{Average\ August\ 2018\ load} = \frac{6660}{7245} = 0.919$$

These scaling factors have be applied to the August 2018 load profile to simulate the maximum and minimum monthly load profiles.

The maximum load has been considered for voltage sag, thermal rating of equipment and N-1 studies. The minimum load has been used for determining voltage swell and calculating the highest PV penetration.

3.1.5 Synchronous Generation

The Majuro network is currently supplied by seven synchronous machines at two adjacent power stations. Units 1, 2, 3 and 4 will be decommissioned, ITP are intending to replace these units with three new 2,500 kW diesel generators.

The size and salient parameters of the machines are based on the data provided in the "MEC data handbook" and via email correspondence with ITP, however, some assumptions were made regarding the machine nominal rating and power factor based on typical machine parameters. These assumptions do not affect the results of the study.

Sub-transient machine impedance was not included in the provided information, however, this is only critical for fault calculations, which were not part of this scope. This information would be required for any future protection system evaluation.

Table 5 shows the machine parameters.

Table 5 - Synchronous Machines

Unit	Make	Location	Rating (kVA)	Power factor	Rating (kW)	Voltage setpoint
No. 1	Pielstick	Station 1	3125	0.8	2500	1.00
No. 2	Pielstick	Station 1	3125	0.8	2500	1.00
No. 3	New Diesel Generator	Station 1	3125	0.8	2500	1.00
No. 4	New Diesel Generator	Station 1	3125	0.8	2500	1.00
No. 5	Caterpillar	Station 1	4200	0.8	3360	1.00
No. 6	New Diesel Generator	Station 1	3125	0.8	2500	1.00
No. 1	Deutz	Station 2	8000	0.8	6400	1.00
No. 2	Deutz	Station 2	8000	0.8	6400	1.00

The machines at MEC Power Station were set to voltage control mode and to regulate the local station bus to 1.00 pu.

3.1.6 Photovoltaic Generation

There are nineteen photovoltaic sites that have been included in the network model. Table 6 shows the details of each of the sites.

Table 6 - PV Generation in Majuro

Site	Existing Capacity (kW)	New Capacity (kW)
Kessai Rooftop	127.7	0
Airport Reservoirs	600	3240
Laura HS	63.8	88
Laura B'Ball	0	113
Delap ES	63.8	121
Water Treatment plant A Reservoir	100	90
MEC Head office	170	0
Town Feeder 2 CMI	119	396
Jenrok	170	0
MIHS Highschool rooftop	250	250
RES rooftop	85	85
Hospital rooftop	205	205
Co-op B'Ball	63.8	119
Long Island Hotel	0	110
N. Delap ES	0	114
Adjeltake B'Ball	0	96
Laura Sports	0	192
Momotaros	170	0
Total	**2411.1**	**5219**

The Kessai rooftop, Airport Quarry, MEC head office, Jenrok and Momotaros PV have either not been originally installed or decommissioned since the last revision of this report (Rev 00). These have been included in the existing simulation but have now been removed from the model.

The photovoltaic generation was assumed to have no reactive power control capability and that it operates at unity power factor as is typical for such plant. PV generation has been modelled by a sinusoidal time characteristic from 0545 to 1715 with peak generation at 1130. The PV characteristic can be found in Appendix A.

As PV penetration increases, the PV arrays may need some capability to control voltage. Plant of this size usually has the option to engage in reactive power control, and it may be important to ensure the new PV arrays have this capability that can be activated when required.

3.1.7 Quasi-Dynamic Parameters

A load and PV profile was provided by ITP in the file "pv_and_load_shapes". Feeder data from a week in August 2018 was provided. Wednesday the 28th August was selected in the model because it showed the highest daily demand. The weather was checked and it appeared cloudy so existing PV generation would be considered to be low. The simulation was carried out in 15 minute time steps.

For the maximum September load, a scaling factor of +6.2% was applied to all loads, for the minimum January load a scaling factor of -8% was applied to all loads.

The parameters for each profile are shown in Appendix A

3.1.8 Underground / Overhead Conductors

ITP advised MEL that all HV cables in Majuro are 3C copper XLPE of 2/0 gauge (67.4 mm^2) or 2 gauge (33.6 mm^2).

ITP was unable to provide detailed electrical parameters of any of the cables. Cables were selected from the PowerFactory global library. Imperial cables sizes are not listed in the PowerFactory library so a metric equivalent has been chosen.

The cable selected in PowerFactory had a nominal frequency of 50 Hz, the cables were re-rated to 60 Hz ratings. The direct buried rating was used for all cables to assess their thermal rating.

A tower model was created for the overhead lines, the line geometry and conductor characteristics were taken from the file "mec_cables_and_lines" and are detailed in Appendix B.

A summary of overhead conductors and under ground cable ratings is shown in Table 7.

Table 7 - Line Parameters

Line Type	Rating (A)	AC Resistance 20°C (Ω/kft)	Inductance (mH/kft)	Capacitance (uF/kft)
U/G 3c 15 kV Cu 70 mm^2 (2/0)	241	0.0824	0.1128	0.0701
U/G 3c 15 kV Cu 35 mm^2 (#2)	165	0.1602	0.1128	0.0701
U/G 3c 6 kV Cu 35 mm^2 (#2)	165	0.1602	0.1106	0.1463
O/H 15kV Cu 2/0	245	0.0797	0.3315	0.0034
O/H 6kV Cu #2	155	0.1563	0.3527	0.0031

3.1.9 Feeder Lengths

Cable lengths were determined by the "MEC Data handbook". The distance has been quoted in feet so the PowerFactory distance parameter has been set to feet (ft). The distance from the MEC data handbook is for a single run of wire along the line of the primary poles. An assumption was made for radial loads off the primary poles of 500 ft.

The distances between loads have been evenly spaced along the feeder. Feeder lengths were determined from the "MEC data Handbook, Table 4".

Table 8 – Feeder Lengths

Cable	Length (ft)	Distance between loads (ft)
Feeder One		
Power Plant to Fishbase	1000	500
Power Plant to Kessai VCB	19477	2164
Kessai VCB to Airport VCB	8520	2840
Airport VCB to Airport	6000	3000
Airport to Laura	98657	4484
Laura to end	8366	836
Feeder Two		
Power Plant to Momotaro	9295	663
Momotaro to Uliga	3736	934
Uliga to Jenrok	3175	453
Uliga to Houses	3916	929 (tee-off is 200)
Jenrok to MIHS	3369	790
MIHS to Rita End	3954	499
Rita End to Ejit	2998	2998
Feeder Three		
Power Plant to Hospital	7122	791
Branch line to BNJ Church	1492	373

3.2 Methodology

3.2.1 Simulation Method

PowerFactory's built-in quasi-dynamic simulation tool was used to undertake load-flows at 15 minutes intervals throughout the day based on the maximum and minimum peak scenarios discussed in section 3.1.4.

Thermal loading was investigated with the maximum September load. The effects of the existing PV are compared to the new PV to determine if feeder loading is reduced.

Voltages are investigated by using the maximum and minimum loads to check for voltage sags and swells.

An N-1 study has been conducted in the load flow analysis to determine if a failure of one of the diesel generators will result in the overloading and subsequent blackout of the Majuro power system. Load shedding has not been considered for this study.

4 Study Results

4.1 Thermal Loading on Components

4.1.1 Feeder Loadings

The maximum September load profile was used to determine feeder loadings. Figure 6 And Figure 7 show the feeder loadings across a day with the existing PV and new PV. All components remain within their capability throughout the day. The highest loaded component is the initial overhead line section from the MEC power station to the fish loining plant on feeder two at over 82%, this occurs at 1700. The majority of the new PV is on feeder one, this can be seen as the loading decreases on feeder 1 during the middle of the day.

The new PV does not reduce the maximum loading of the feeders because the maximum load occurs outside of daylight hours.

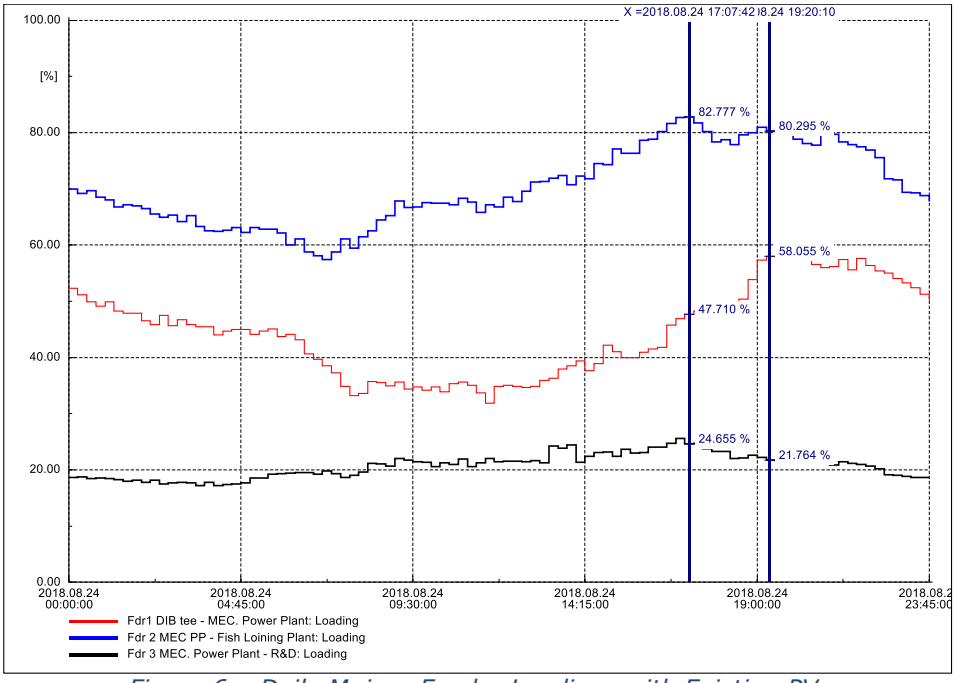


Figure 6 – Daily Majuro Feeder Loadings with Existing PV.

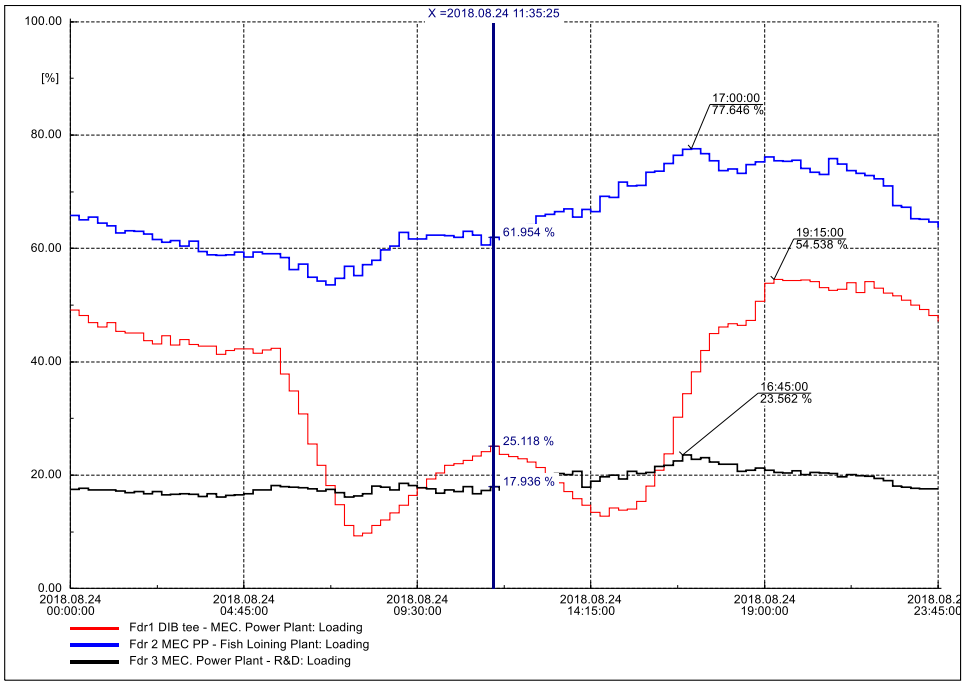


*Figure 7 – Daily Majuro Feeder Loadings with **New** PV.*

The real power flow on feeder one changes direction during the middle of the day. This is not easy to identify in the loading graphs because feeder one is supplying 1 Mvar throughout most of the day. For interest, the MW loadings are shown in Figure 8 and Figure 9.

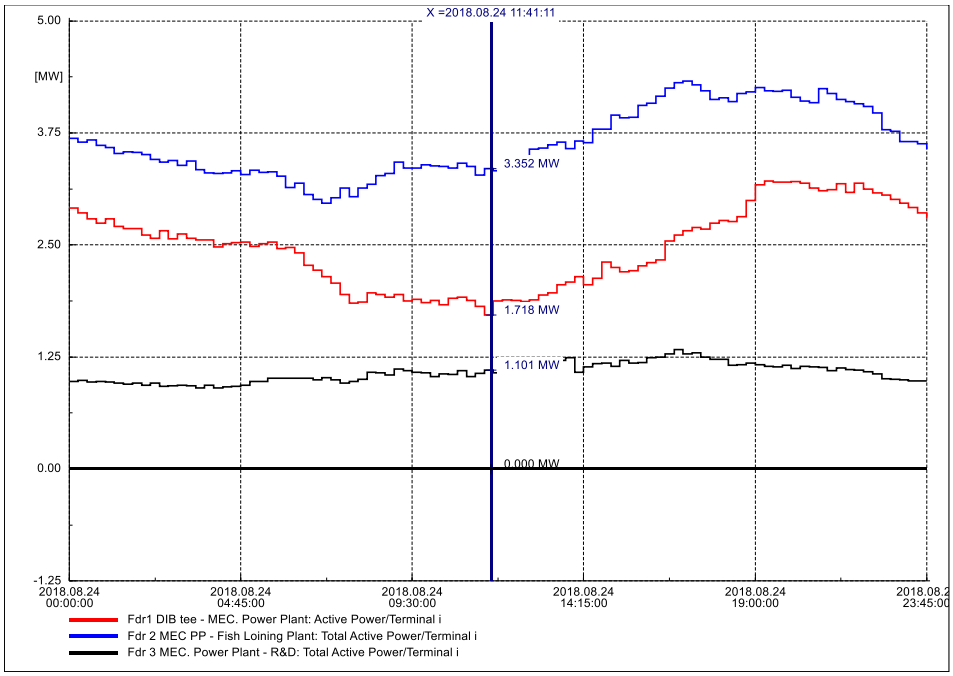


Figure 8 – Daily Majuro Feeder MW with Existing PV.

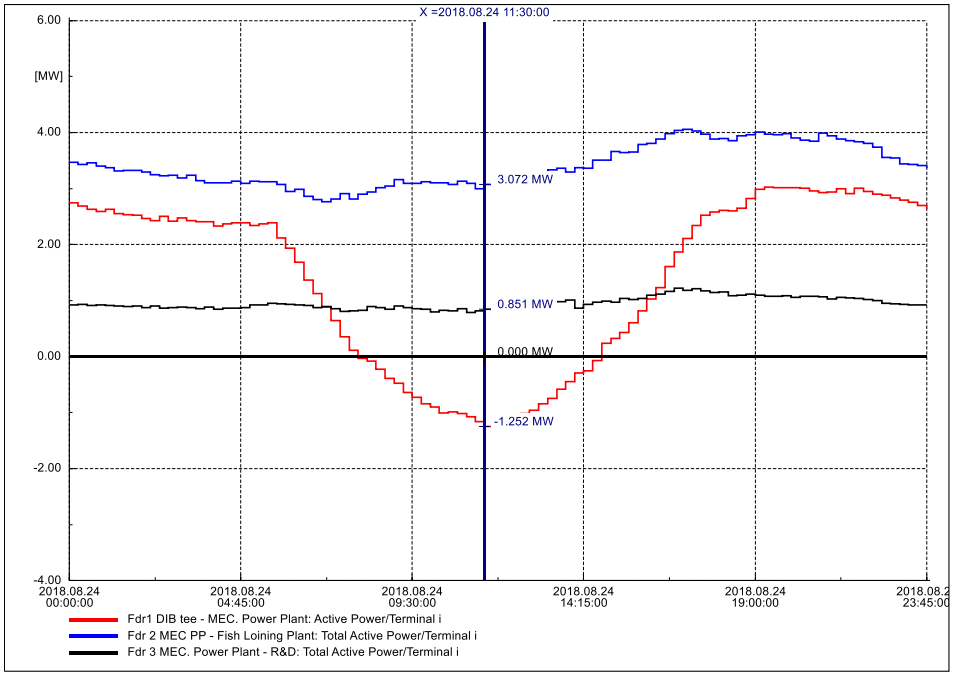


Figure 9 – Daily Majuro Feeder MW with New PV.

A summary of the maximum loadings on each feeder are shown in Table 9.

Table 9 –Maximum Feeder Loading

Feeder	Loading	Current	Time
One	58.202 %	142.59 A	1915
Two	82.723 %	202.67 A	1700
Three	25.124 %	60.55 A	1645

Table 9 shows the maximum feeder loadings, however it must be noted that these maximums occur outside daylight hours. It's important to refer to Figure 9 when considering more PV penetration on feeders one and two. The PV generation on Feeder one already exceeds the

loading of the feeder, thus supplying the surplus generation to feeders two and three. Generators MPS1G4, MPS1G5 and MPS2G1 are all running at 30.3 % loading, should more PV be installed the generator loading will further decrease. Operating diesel generators at loadings less than 30 % of its rated output for extended periods of time can impact the generator negatively. With the new BESS installed the number of generators may be reduced to two during midday PV peak.

4.1.2 Transformer Loadings

The loading on the Jenrok and Laura transformers were checked and are operating well below their ratings. Figure 10 shows the loading profile over the day with the new PV generation. It can be seen in Figure 11 that the power flow reverses through the Jenrok transformer during the middle of the day due to the amount of PV generation on the 4.16 kV side.

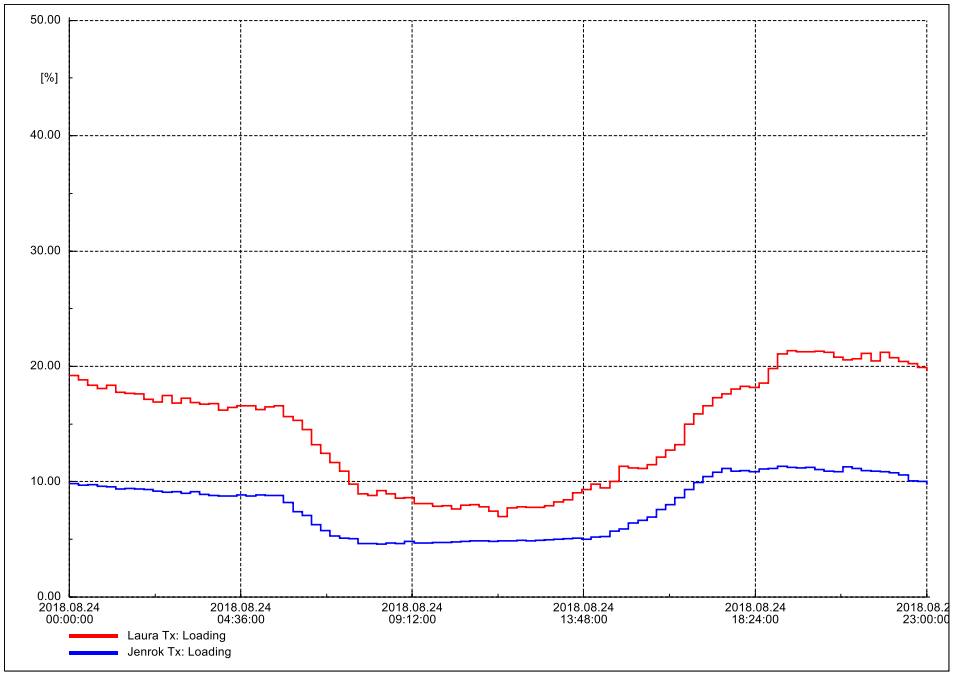


Figure 10 – Daily Loading of Laura and Jenrok Transformers.

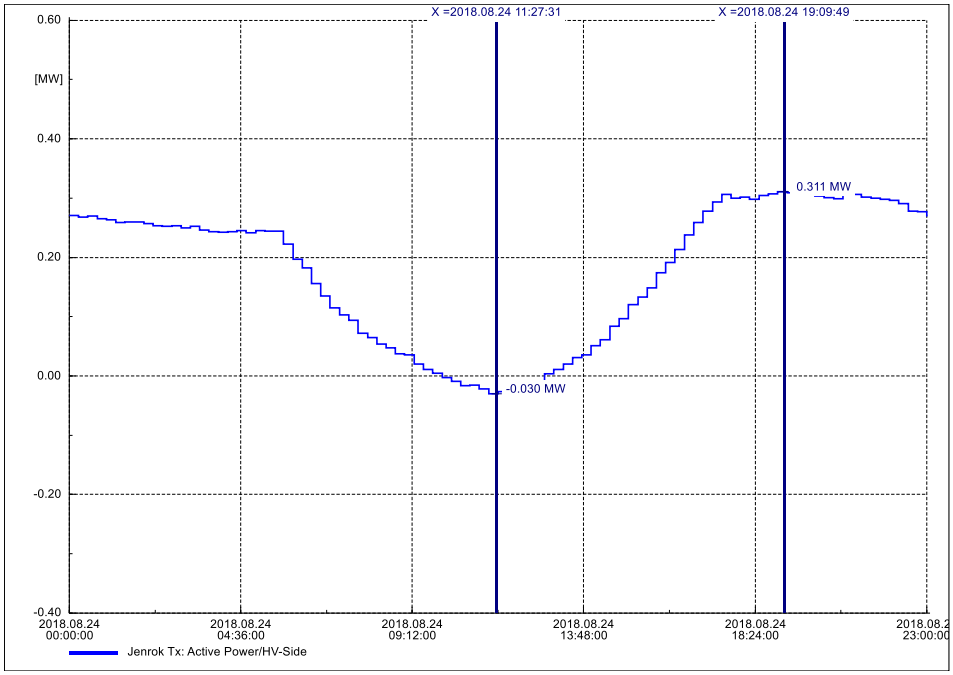


Figure 11 – Daily Power Flow of Jenrok Transformer.

4.2 Voltages

The load flow was carried out with the new PV. The minimum January load profile was studied to determine the maximum voltage swell and the maximum September load profile was studied to determine the maximum voltage sag.

The largest voltage swells will occur throughout the network when PV generation is maximum, and may also occur on the LV side of the 13.8/4.16 kV transformers depending on the tap position.

The largest voltage sags will occur near the end of the feeders during the evening peak.

The maximum voltage swell and sag for each feeder occur around the midday PV peak and are shown in Table 10 and Table 11 below:

Table 10 – Maximum Feeder Voltage Swell

Terminal	Feeder	Voltage	Time
Laura 4.16 kV	One	1.075	1130
Mihs High School	Two	1.021	1115
R&D	Three	1.000	1100

Table 11 – Maximum Feeder Voltage Sag

Terminal	Feeder	Voltage	Time
Laura 13.8 kV Substation	One	0.940	1915
Jenrok 13.8 kV Substation	Two	0.966	1700
Co-op School	Three	0.996	1645

Feeder 3 has very minimal voltage sag or swell as it is a short feeder connected close to the MEC power stations. The most severe voltage sag is on the longest feeder; feeder 1. Minimum voltages were measured at the 13.8 kV/4.16 kV Laura Substation. Figure 12 and Figure 13 show the voltage across the day with the existing PV and new PV respectively. The Laura 13.8/4.16 kV transformer is set to tap 5 (12.825 kV) to support voltage on the 4.16 kV side. The minimum voltage of 0.940 pu (12.97 kV) occurs during the 1930 evening peak, which is outside the +/- 5% voltage range and is not acceptable.

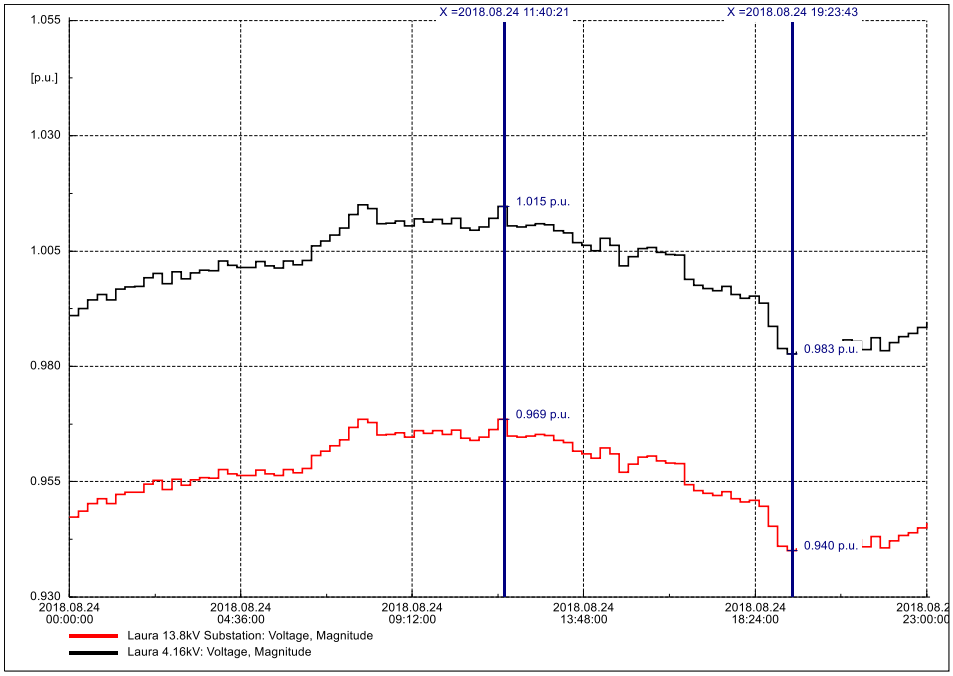


Figure 12 – Daily Voltage Profile of Laura Substation with Existing PV

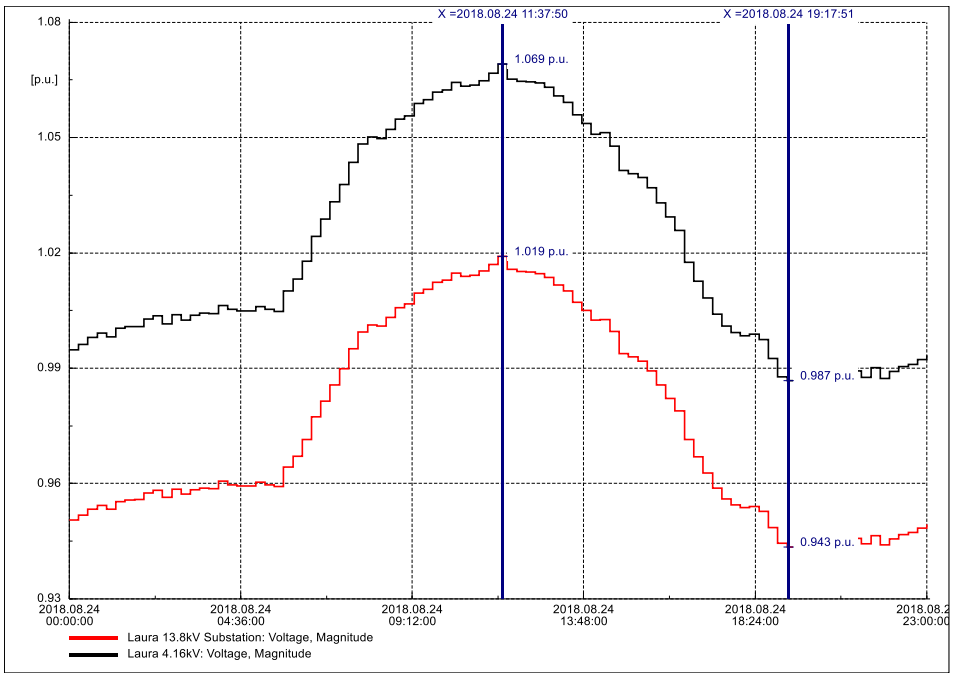


Figure 13 – Daily Voltage Profile of Laura Substation with New PV

The new PV installed on feeder one at the Airport reservoir helps with voltage support at the Laura substation. The PV is unable to support voltage outside of sunlight hours and the maximum voltage sag occurs during this time.

Possible mitigation options to reduce this voltage sag are:

1. Increase Majuro power station voltage set point to 14.2 kV
2. Install a 1 Mvar capacitor bank at Laura substation
3. Install battery storage system on Feeder one that will run during the evening peak.

The options above are explained below.

4.2.1 Option 1: Increase Majuro Power Station Voltage Setpoint to 14.2 kV

Increasing the Majuro Power Station voltage setpoint to 14.2 kV will require changing the AVR setpoint on all diesel generators. A tap change is required at both the Laura and Jenrok transformers as the voltage gets up to 1.07 pu during the midday PV peak.

- Set Majuro Power station 1 and 2 voltage setpoint to 14.2 kV
- Set Laura transformer tap position to tap 3 (13.8 kV)
- Set Jenrok transformer tap position to tap 2 (13.8 kV).

This is the most cost effective solution as there is no capital requirement. A load flow of the Laura voltage is shown in Figure 14. The minimum voltage is now 0.971 pu at the 13.8 kV substation.

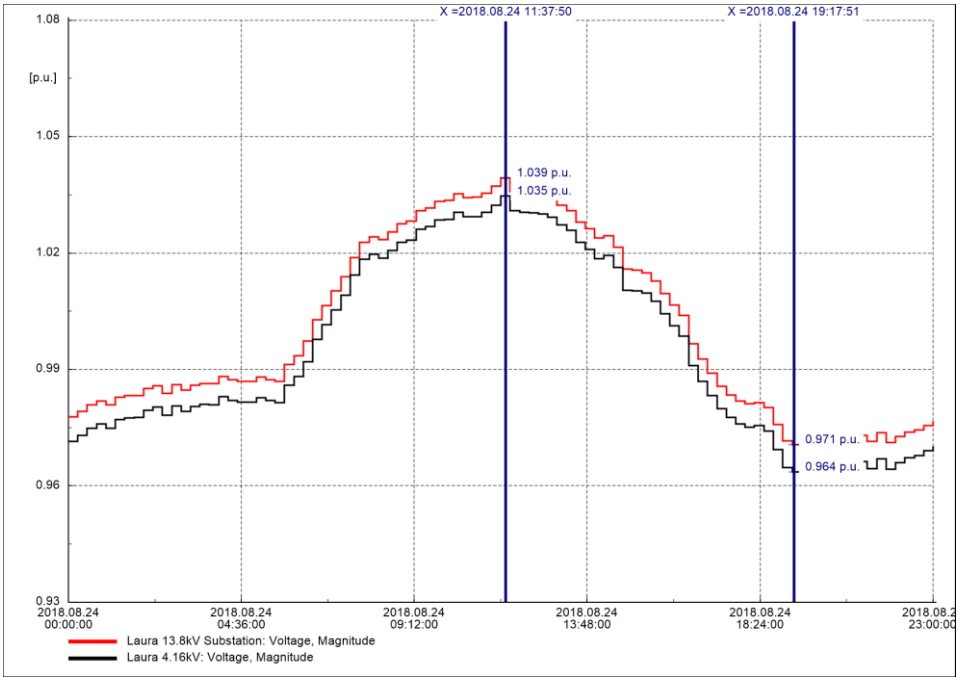


Figure 14 – Daily Voltage Profile of Laura Substation with MEC Power Station set to 14.2 kV.

A check was carried out with the January minimal load at the same voltage setpoint. The Airport PV voltages exceeded 1.05 pu These voltages only occur around the PV peak and are shown in Table 12.

Table 12 – Voltage Swells from Majuro 14.2 kV voltage setpoint change

Terminal	Voltage (pu)	Time
Airport existing PV	1.062	1130
RES 2	1.062	1130
RES 3	1.062	1130
RES 6 & 7	1.061	1130
RES 1	1.059	1130
Pump House Resevoir	1.053	1130
Airport	1.053	1130

Depending on Marshalls Islands power system operating practices, the power station voltage setpoint could be adjusted between seasons to reduce the voltage swells experienced in January or adjusted throughout the day.

It should be noted that this operating condition may only be viable with the new PV generation. Further PV generation, especially at the airport where PV generation is already focused will result in much higher voltage swells at those locations. The power station voltage setpoint may have to be reduced during this time.

4.2.2 Option 2: Install a 1 Mvar Capacitor Bank at Laura Substation

Installing a 1 Mvar capacitor bank at the 13.8 kV Laura substation will support the voltage at the end of feeder one. The tap position on the Laura substation transformer will need to be changed as the voltage will be too high on the 4.16 kV side.

- Install 1 Mvar capacitor bank at Laura 13.8 kV substation
- Change Laura transformer to tap position 3 (13.8 kV).

The Laura transformer tap position must be changed or 1.07 pu will be seen during the midday PV peak. The effect of the capacitor bank will bring the Laura 4.16 kV minimum voltage up to 0.97 pu. The maximum voltage is 1.05 pu during the midday PV peak.

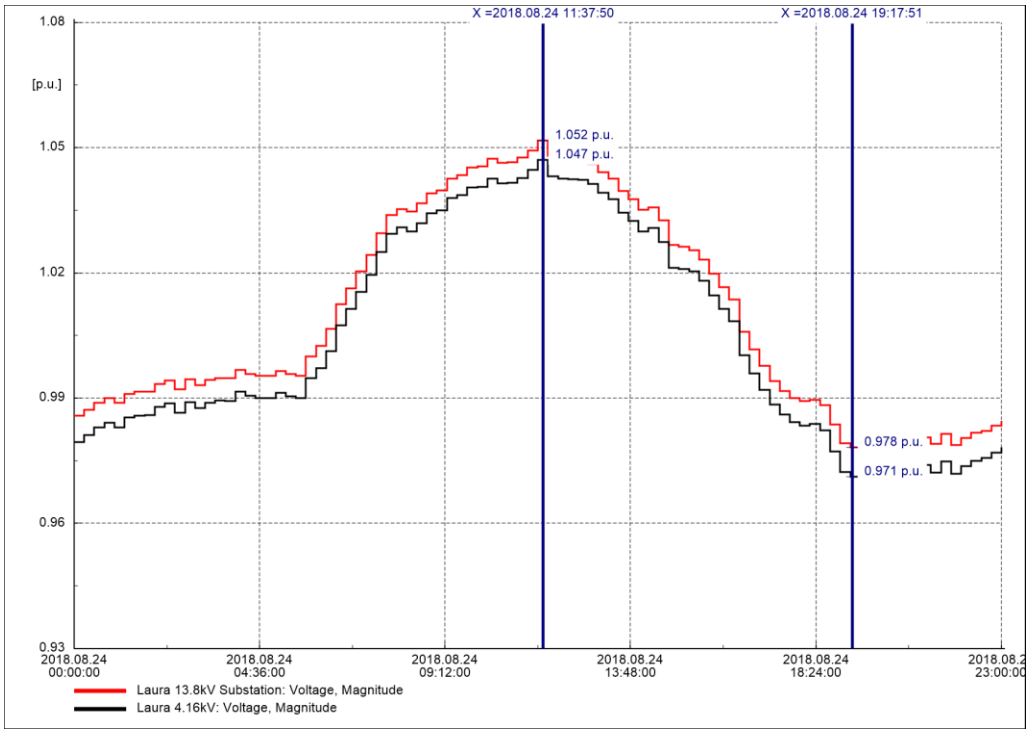


Figure 15 – Daily Voltage Profile of Laura Substation with 1 Mvar Capacitor Bank.

4.2.3 Option 3: Install a Battery Storage System on Feeder 1

A battery energy storage system could be installed either at the airport reservoir where there is high PV penetration or at Laura substation. The BESS could be charged during the midday PV peak and discharged during the evening peak, smoothing out the voltage profile.

A 0.5MWh, 1MWh, 2 MWh, 3MWh and 4MWh battery have been considered. The battery should be located at the Laura substation as that will have the greatest influence on the bus voltage.

The battery could be charged from 0900 – 1500 at 86.7 kW and discharged from 1800 – 2300 at 100 kW, the larger 1 MWh battery will have twice the input/output.

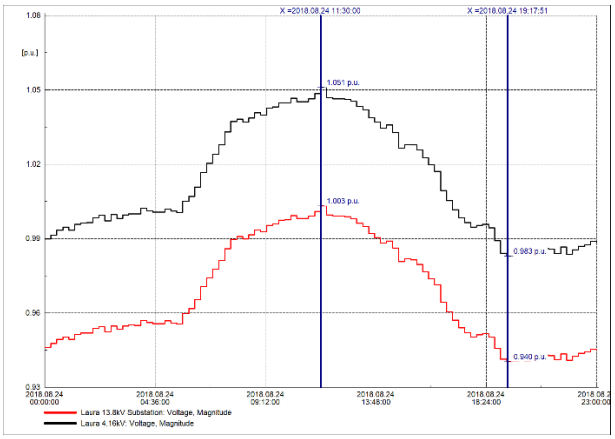


Figure 16 – Voltage Profile of 0.5 MWh Battery at Laura Substation

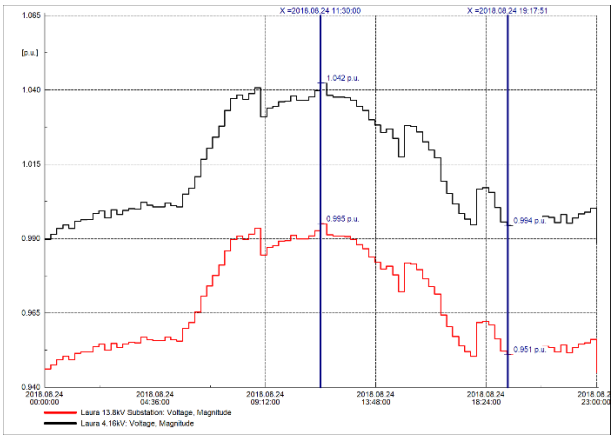


Figure 17 – Voltage Profile of 4 MWh Battery at Laura Substation

The 0.5 MWh battery will bring the minimum voltage up to 0.940 pu still outside the minimum voltage limit. The 4 MWh battery will bring the minimum voltage up to 0.951 pu just inside the minimum voltage limit.

Installation of a BESS at the Laura substation is not likely to be justified based on voltage as it provides limited benefits here. However, a BESS may be considered to assist in frequency management, or to allow diesel generation to remain online if there is a requirement to maintain inertia.

4.3 PV Penetration and System Stability

Figure 18 shows a graph of the photo-voltaic generation as a percentage of total network load. A second study was carried out to see the effect of PV penetration when the load is at a minimum; this is based on the month of January 2017 where the average load was 6.66 MW and is shown in Figure 19.

There is a lot of PV on Feeder one, during the midday PV peak 1.6 MW is fed back into the MEC power station bus.

During September there are a few hourly periods where the penetration is greater than 50% as shown in Figure 18. Figure 19 shows that during January the maximum penetration is greater than 70% during the midday peak, for a period of approximately 30 minutes.

A good summary of some of the problems that can occur can be found in a study conducted on the Greek Island system of Kythos [1]. The key finding was that an islanded system can become unstable when PV penetation exceeds 50%. These concerns can be overcome with appropriate control systems, such as battery storage or smart dispatch of diesel generation prior to cloud cover.

For a system without any significant dynamic storage it means that the diesel generators will be subject to more ramping activity and operate at less efficient areas of their operating range; diesel machines usually operate optimally at close to the nominal load. Consequently, more ramping activity and operation at lower utilisation increases the wear and tear on the machines and may result in increased maintenance requirements.

Furthermore, there are additional concerns regarding frequency stability and observed rates of change of system frequency for systems with a high penetration of voltage source converters. Over 60% of the Majuro system PV (3.24 MW) is concentrated around the airport resevoirs, an event such as cloud cover of this area is could cause a frequency event, which the diesel generators may not ride through.

The dynamic stability of the system has not been investigated as part of this analysis, but should be investigated in a further study.

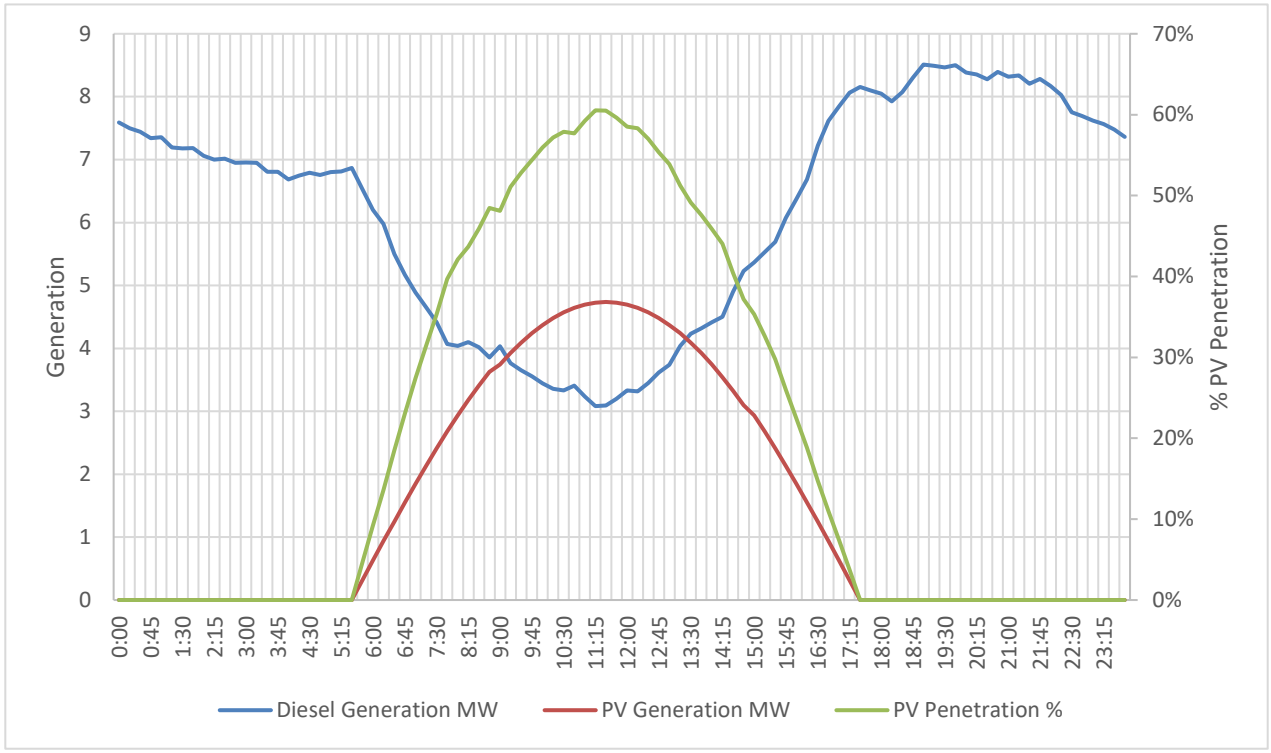


Figure 18 – PV penetration during September

Figure 19 – PV penetration during January

4.4 N-1 Study

An N-1 study was carried out for the September load profile with the new PV installed. Two scenarios were developed, one for the midday PV peak and one for the evening load peak. One caveat: this study is not a frequency stability study, rather it is determining if there is enough MW capacity reserve if one of the diesel generators fails or trips. It is possible that even if there is enough reserve, the remaining diesel machines may not be able to ramp quickly enough to prevent system instability. However, such an analysis is outside the scope of this study. It could be investigated as part of a dynamic stability study.

The maximum demand occurs during the evening peak at 8.6 MW. If the combined generator capacity is less than 8.6 MW after a single event, the generators will become overloaded and may potentially trip causing a blackout of the system.

4.4.1 Normal operating mode with Deutz, Caterpillar and New 2.5 MW generator

The normal operating mode of the power station is to have 1 Deutz (6.4 MW) and a combination of 2 new generators (2.5 MW) or a new generator (2.5 MW) and the Caterpillar (3.36 MW) operating.
In this operating mode, a failure of the Deutz outside of the PV hours (0700 – 1600) will result in an overload and likely blackout of the Majuro power system, assuming no load shedding, as shown in Figure 20.

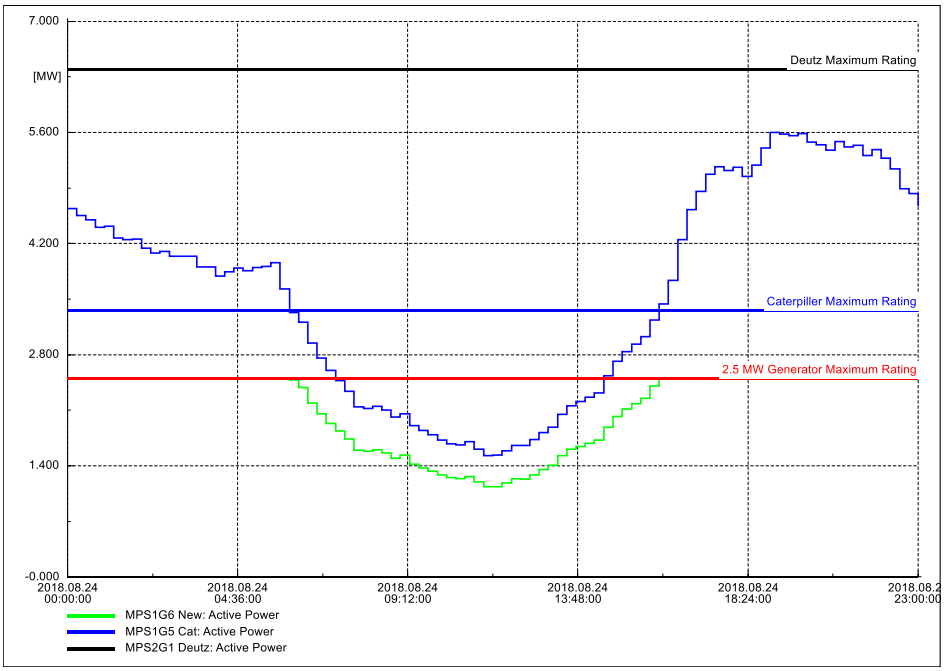


Figure 20 – Generator output from failure of Deutz.

In the normal configuration there is no N-1 security for a failure of the Deutz generator.

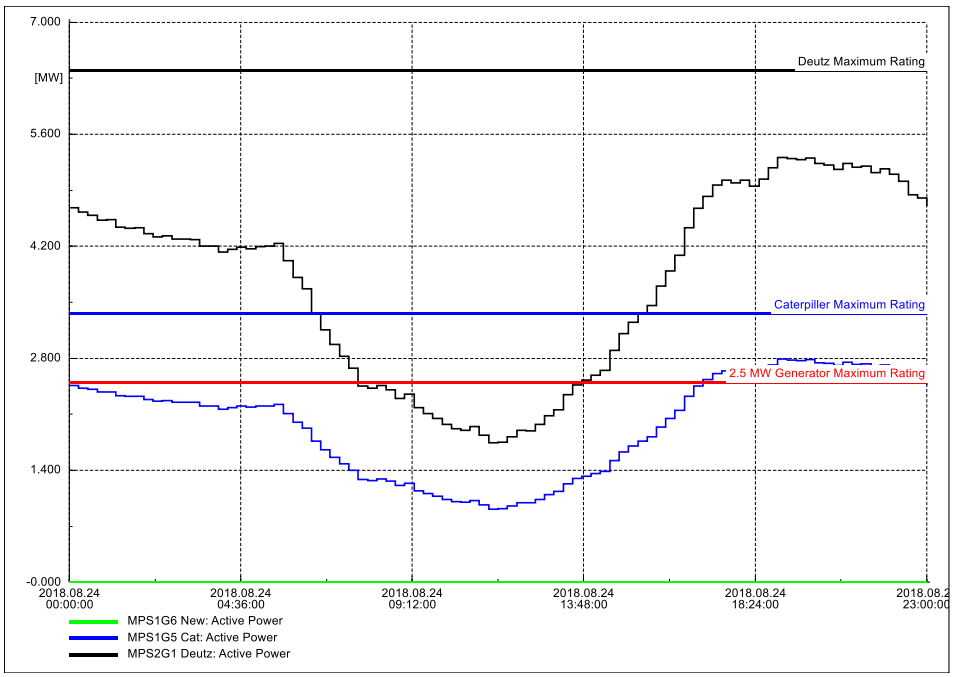


Figure 21 – Generator Output from Failure of New Generator

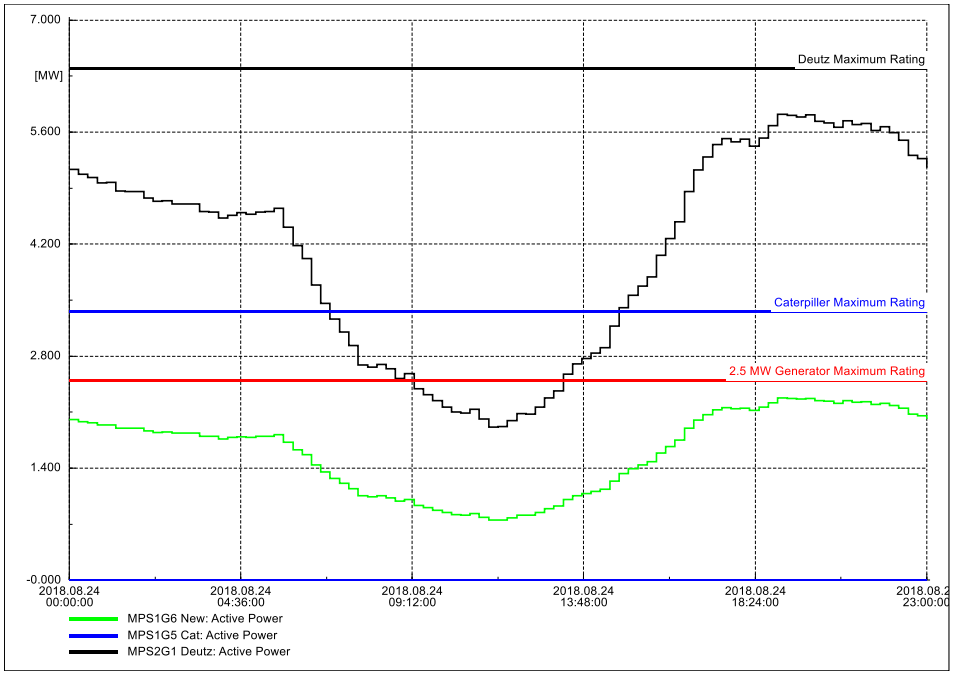


Figure 22 – Generator Output from Failure of Caterpillar

Table 13 shows the results of the N-1 study for normal operation, the power system status is provided with the generation capacity after the N-1 event. The system will remain stable with no generator overload following a failure of either the Caterpillar or new generator, provided the excess load is picked up in time by the remaining two generators. This is also shown in Figure 21 and Figure 22.

Table 13 – Results from N-1 Study in Normal Operation

Deutz	Caterpillar	New Gen	Post-Contingency Generator Capacity
Failed	Overloaded	Overloaded	5.86 MW; Likely Blackout
Online 84.2% loaded	Failed	Online 84.2% loaded	8.9 MW; Stable
Online 76.8% loaded	Online 76.8% loaded	Failed	9.76 MW; Stable

4.4.2 N-1 with Existing Available Generators

A further N-1 study was carried out with the existing generators to see if the system would remain stable after a Deutz generator failure. As can be seen in Table 14 any combination of both Deutz generators and one smaller generator will result in the system remaining stable after a single Deutz failure.

Table 14 – Results from N-1 study of a Deutz Generator Failure

Case	P1 G3 New Gen 2.5 MW	P1 G4 New Gen 2.5 MW	P1 G6 New Gen 2.5 MW	P1 G5 Caterpillar 3.36 MW	P2 G1 Deutz 6.4 MW	P2 G2 Deutz 6.4 MW	Post-Contingency Generator Capacity
1	Online	Online	Online	Off	Online	Failed	13.9 MW; Stable
2	Online	Off	Off	Online	Online	Failed	12.26 MW; Stable
3	Online	Off	Off	Off	Online	Failed	8.9 MW; Stable
4	Off	Off	Off	Online	Online	Failed	9.76 MW; Stable
5	Online	Online	Online	Online	Off	Failed	10.86 MW; Stable
6	Online	Online	Off	Online	Off	Failed	8.36 MW; likely blackout during peak
7	Overloaded	Overloaded	Overloaded	Off	Off	Failed	7.5 MW; Blackout
8	Off	Overloaded	Off	Overloaded	Off	Failed	5.86 MW; Blackout
9	Overloaded	Overloaded	Off	Off	Off	Failed	5.00 MW; Blackout

For case 6 with two the smaller generators in service, a Cat generator and no Deutz generator, the system is stable except during the evening peak, all three of the smaller generators go into a light overload, during the evening from 1900. Depending on how the machines react and if the second Deutz can be started up, then the system should remain stable. Figure 23 shows the extent of the system running on two smaller generators, a Cat generator and no Deutz generators.

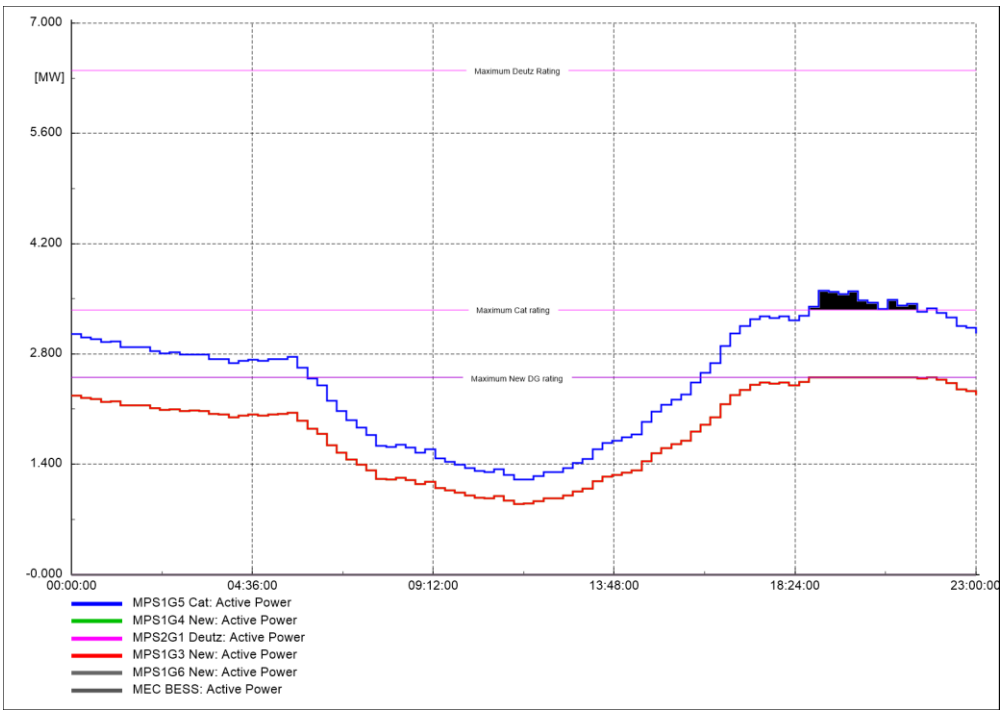


Figure 23 – N-1 of 3 Existing Smaller Generators with a Deutz Failure

The installation of a BESS at the Majuro Power Station may provide some contingency in the event of a Deutz failure, which could reduce the risk of a system blackout if the Deutz failed during the evening.

Figure 24 shows case 6 with the installation of a 2MWh BESS at Majuro Power Station.

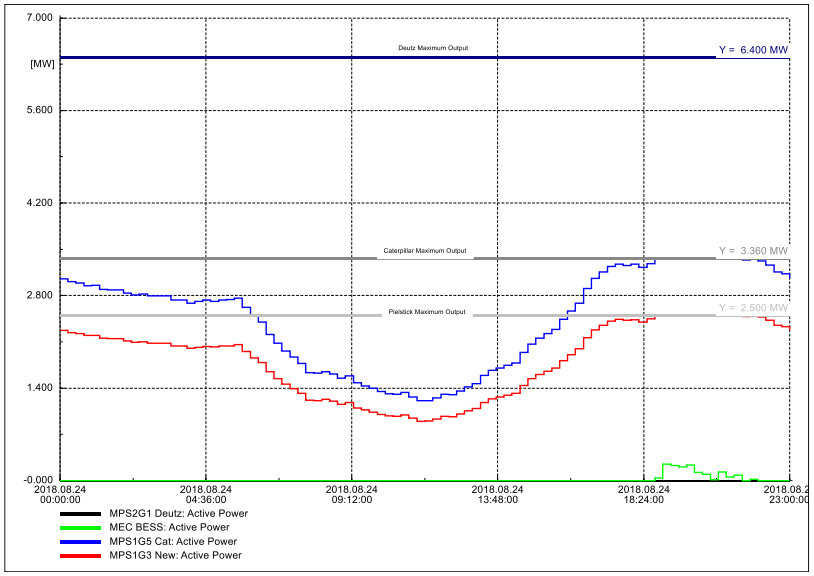


Figure 24 – N-1 of 3 Existing Smaller Generators with a Deutz Failure and BESS installed

4.4.3 N-1 with new 2.5 MW Generators

ITP Renewables are planning on replacing G1, G2, G3 and G4 generators and installing three new 2.5 MW diesel generators at Power Station 1.

With the new installation of three new 2.5 MW generators there is an opportunity to carry out work on the Deutz generators while running on a combination of the 3 new generators and the Catepillar.

Table 15 shows the results of N-1 study for power station 1.

Table 15 – Majuro Power Station 1 N-1

Case	G3 New 2.5 MW	G4 New 2.5 MW	G5 Cat 3.36 MW	G6 New 2.5 MW	Post-Contingency Generator Capacity
1	Online	Online	Online	Online	10.86 MW; Stable
2	Failed	Overloaded	Overloaded	Overloaded	8.36; likely blackout during peak
3	Overloaded	Overloaded	Failed	Overloaded	7.5 MW; Blackout during peak
4	Off	Online	Failed	Online	5MW; Blackout
5	Off	Failed	Online	Online	5.86 MW; Blackout

For case 2, the generators will become overloaded during the evening peak as shown in Figure 23. Depending on the standby capacity of the diesel generators, there may be enough reserve to ride though the event and prevent a blackout.

This N-1 study proves that only a combination of all the new generators and Cat generator can provide a stable power system status while work is carried out on the Deutz generators. shows N-1 security can be achieved with the failure of one of the new generators, however, a blackout likely to occur during peak loading. The installation of a 2MWh BESS at Majuro Power Station could reduce the risk of system blackout during the evening peak, as seen in Figure 24.

4.5 Maximum PV Capacity for Feeders 1 & 2

MEC have requested investigation into the maximum amount of PV that can be put onto feeders 1 & 2 before the lines require uprating. This is dependent on what section of the feeder the PV is installed on as it will first offset the load then start supplying the rest of the network. In order to carry out an analysis a fixed location has been selected for each feeder. For Feeder 1 we have chosen to model the airport reservoirs, for feeder 2 the Jenrok substation has been chosen.

For feeder 1 the limitation is the 13.8 kV line from the Pump house Reservoir to the Airport VCB then via the NTA Telecoms switch line. Analysis shows that an additional 3.1 MW of PV to be installed at the Airport reservoirs on Feeder 1 can be accommodated. This will load the line to 99.3% with the power system fully supplied from PV generation and the diesel generators only supplying the system Mvar.

Having the diesel generators providing only Mvars is not a practical solution, the new inverters should be specified with the ability to provide reactive power support, the inverters should have a kVA rating larger than the PV so they provide voltage support at maximum PV output.

Table 16 – Feeder 1 Maximum PV Capacity with line loadings at Airport Reservoirs

New PV (kW)	Total Feeder PV Capacity (kW)	Line Loading	Bus Voltage (p.u.)
3100	6791	99.3%	1.05
2500	6191	90.0%	1.04
1900	5591	80.6%	1.04
0	3691	50.2%	1.02

Table 17 – Feeder 2 Maximum PV Capacity with line loadings at Jenrok Sub

New PV (kW)	Total Feeder PV Capacity (kW)	Line Loading	Bus Voltage (p.u.)
3950	4807	99.6%	1.00
3300	4157	83.7%	1.00
2500	3357	63.9%	0.99
1900	2757	48.9%	0.99
0	857	4.1%	0.97

For feeder 2, the limitation is the 13.8 kV line from MBC to Jenrok substation. The additional 3.3 MW of PV installed and concentrated at Jenrok substation will result in the power system being fully supplied from PV generation at 1130 with the diesel generators only supplying the system Mvar.

PV can be increased further, as long as it is supplemented by battery storage at the same location as this will not affect transmission line loading. The installed PV can exceed the system demand, this is shown in Table 17 with the additional 3.95 MW PV installed on feeder 2, the excess power of 900 kW is absorbed by the power station BESS, however, the PV will require curtailment once the BESS is fully charged.

It should be noted that the voltage on the LV side of the Jenrok transformer will start to swell during the midday PV peak, simulations show the 4.16 kV voltage getting to 1.05 p.u. with 3.95 MW of PV. This is acceptable as the voltage will reduce as the PV ramps down.

It should also be noted that the bus or line voltage will determine the maximum power that can be transmitted down the line as the current rating of the line should not be exceeded. The cable at the airport VCB to pump house reservoir has a rating of 241 A, at 1.05 p.u. its maximum loading is 6050 kW (the total capacity of 6340 kW accounts for losses). If the voltage at the airport was instead to be maintained at 1 p.u. the maximum loading for the line would be 5760 kW, a reduction of approximately 300 kW (~5 %).

5 Conclusions

No thermal loading issues were found on any equipment in the network. The feeder two line from the Majuro power station becomes 80% loaded during the evening peak. If future load growth is expected on this feeder, then consideration should be made on upgrading to a larger conductor size or installation of PV and a BESS to reduce the feeder two loading from the Majuro power station during the evening peak.

A voltage sag was identified at the Laura 13.8 kV substation, the voltage dips below the ANSI C84.1 minimum service voltage of 0.95 pu during the evening peak.

Reasonable solutions to this problem, which require a cost-benefit analysis would be:

1. Changing the Majuro Power station voltage setpoint to 14.2 kV
2. Installation of a 1 Mvar capacitor bank at the Laura 13.8 kV substation.

Results showed that the PV penetration as a percentage of the load will increase above 60% during some peak daylight periods with the new 2,500 kW PV arrays. With penetration this high, system stability may be compromised in the event of a sudden loss of PV generation caused by fast moving clouds. A case study example has been discussed in a conference paper on an islanded system in the Greek Isles [1]. This paper indicates that practical maximum levels of PV penetration, without additional measures to ensure system stability, are about 50 %.

When the planned network configuration is finalised, it is recommended that a dynamic stability study should be undertaken to assess voltage and frequency stability of the system with high PV penetration. The installation of battery storage should be considered to assist with system frequency and voltage stability should these prove to be issues. The battery could be charged during the solar peak and discharged at night, smoothing out the ramp rate and fluctuation of the diesel generators. It should be noted that as PV generation starts to replace diesel generation, reactive power support will be required from the new inverters. With new PV and BESS installations, inverters with reactive power capability should be considered.

An N-1 study identified a supply security issue with the two Deutz, one Cat and three new generators operating. The normal service condition is to run one Deutz, and a combination of the two other generators from the Cat and new generators. A failure or inadvertent trip of the Deutz generator will likely result in a blackout of the Majuro system. With the existing situation, the security of the system can be increased by running a single Deutz, the Cat and two new generators, although a risk of overload may still occur if the failure was to happen during the evening peak. Alternatively, one Deutz generators, the Cat and three new generators could be run but the fuel usage would be much higher in this configuration due to the reduced efficiency of the machines when operating at a lower average output.

Ultimately, a determination of the optimal operating scenario, depends on the trade-off that the power utility is willing to make between additional security and the cost of additional fuel consumption and maintenance on the diesel generators. Such work could be completed as an addendum to this study, if desired.

The installation of three new 2.5 MW diesel generators will increase the availability and flexibility of generators allowing planned maintenance to be carried out. An N-1 study for the smaller generators determined that the system could be run without the larger Deutz generators. N-1 security is only achieved with two new generators and the Cat generator in service, however, a blackout is likely to occur during evening peak loading when the generators may be slightly overloaded. However, the installation of a BESS at the Majuro

Power Station may provide some contingency in the N-1 scenarios, which could reduce the risk of a system blackout if a Deutz generator failed during evening peak, also, during midday with fast moving clouds.

In terms of line capacity, feeder 1 has capacity for an additional 3,100 kW of PV resulting in a 14.49 kV line voltage and conductor current of 240 A. Feeder 2 has capacity for an additional 3,950 kW of PV resulting in a line voltage of 13.8 kV and conductor current of 165 A if installed at the Jenrok Substation, installation to these maximum amounts would result in the system being fully renewable during midday.

6 References

[1] E. Rikos, S. Tselepis and A. Neris, "Stability in Mini-Grids with Large PV Penetration under Weather Disturbances - Implementation to the power system of Kythnos," 2008.

[2] KEMA Inc, *Quantification of Energy Efficiency in the Utilities of the U.S. Affliate States (Excluding US Virgin Islands), Data Handbook,* 2010.

[3] Saipan International, "Weather Underground: Delap, Marshall Islands," 28 August 2018. [Online]. Available: wunderground.com/history/daily/us/mp/saipan/PGSN/date/2018-8-28.

7 Appendix A

Table 18 – Majuro Quasi-Dynamic Characteristics

Time	Feeder 1 pu	Feeder 2 pu	Feeder 3 pu	PV pu
0:00	1.0665	0.9356	0.8462	0.0000
0:15	1.0456	0.9248	0.8528	0.0000
0:30	1.0209	0.9319	0.8399	0.0000
0:45	1.0057	0.9165	0.8433	0.0000
1:00	1.0207	0.9099	0.8403	0.0000
1:15	0.9904	0.8934	0.8315	0.0000
1:30	0.9834	0.8981	0.8180	0.0000
1:45	0.9829	0.8970	0.8270	0.0000
2:00	0.9570	0.8900	0.8089	0.0000
2:15	0.9449	0.8770	0.8278	0.0000
2:30	0.9743	0.8700	0.7979	0.0000
2:45	0.9412	0.8748	0.8042	0.0000
3:00	0.9612	0.8602	0.8098	0.0000
3:15	0.9431	0.8733	0.8035	0.0000
3:30	0.9365	0.8477	0.7839	0.0000
3:45	0.9376	0.8390	0.8100	0.0000
4:00	0.9085	0.8375	0.7820	0.0000
4:15	0.9219	0.8392	0.7940	0.0000
4:30	0.9277	0.8461	0.7981	0.0000
4:45	0.9280	0.8345	0.8068	0.0000
5:00	0.9112	0.8468	0.8439	0.0000
5:15	0.9226	0.8418	0.8432	0.0000
5:30	0.9289	0.8422	0.8755	0.0000
5:45	0.9219	0.8457	0.8913	0.0654
6:00	0.9448	0.8301	0.9074	0.1305
6:15	0.9432	0.8571	0.9239	0.1951
6:30	0.9130	0.8392	0.9368	0.2588
6:45	0.9094	0.8419	0.9354	0.3214
7:00	0.9029	0.8457	0.9713	0.3827
7:15	0.8938	0.8748	0.9619	0.4423
7:30	0.8634	0.9159	0.9429	0.5000
7:45	0.8451	0.9047	0.9716	0.5556
8:00	0.8663	0.9415	1.0065	0.6088
8:15	0.9190	0.9635	1.0839	0.6593
8:30	0.9263	0.9988	1.0889	0.7071
8:45	0.9271	1.0165	1.0807	0.7518
9:00	0.9493	1.0583	1.1500	0.7934
9:15	0.9351	1.0502	1.1423	0.8315
9:30	0.9510	1.0577	1.1371	0.8660
9:45	0.9476	1.0736	1.1378	0.8969
10:00	0.9643	1.0776	1.1060	0.9239
10:15	0.9538	1.0820	1.1405	0.9469
10:30	0.9847	1.0807	1.1346	0.9659
10:45	0.9941	1.0994	1.1790	0.9808
11:00	0.9851	1.0917	1.1220	0.9914
11:15	0.9612	1.0688	1.1525	0.9979
11:30	0.9267	1.0879	1.1843	1.0000
11:45	0.9837	1.0819	1.1580	0.9979

12:00	0.9865	1.1032	1.1631	0.9914
12:15	0.9799	1.0913	1.1625	0.9808
12:30	0.9727	1.1124	1.1565	0.9659
12:45	0.9725	1.1300	1.1575	0.9469
13:00	0.9856	1.1284	1.1388	0.9239
13:15	0.9880	1.1310	1.2670	0.8969
13:30	1.0113	1.1312	1.2458	0.8660
13:45	1.0132	1.1033	1.2634	0.8315
14:00	1.0217	1.1156	1.1171	0.7934
14:15	0.9785	1.1018	1.1568	0.7518
14:30	0.9907	1.1296	1.1791	0.7071
14:45	1.0426	1.1175	1.1758	0.6593
15:00	1.0064	1.1445	1.1320	0.6088
15:15	0.9734	1.1249	1.1786	0.5556
15:30	0.9606	1.1141	1.1384	0.5000
15:45	0.9642	1.1340	1.1300	0.4423
16:00	0.9604	1.1249	1.1615	0.3827
16:15	0.9510	1.1306	1.1513	0.3214
16:30	1.0093	1.1377	1.1695	0.2588
16:45	1.0154	1.1382	1.1982	0.1951
17:00	1.0134	1.1268	1.1418	0.1305
17:15	1.0066	1.1011	1.1331	0.0654
17:30	0.9819	1.0688	1.0766	0.0000
17:45	1.0050	1.0449	1.0559	0.0000
18:00	1.0163	1.0491	1.0564	0.0000
18:15	1.0107	1.0387	0.9990	0.0000
18:30	1.0297	1.0605	1.0041	0.0000
18:45	1.0961	1.0654	1.0235	0.0000
19:00	1.1590	1.0779	1.0084	0.0000
19:15	1.1732	1.0688	0.9878	0.0000
19:30	1.1690	1.0670	0.9838	0.0000
19:45	1.1689	1.0702	1.0010	0.0000
20:00	1.1704	1.0501	0.9694	0.0000
20:15	1.1649	1.0405	0.9869	0.0000
20:30	1.1455	1.0358	0.9842	0.0000
20:45	1.1342	1.0745	0.9781	0.0000
21:00	1.1386	1.0612	0.9491	0.0000
21:15	1.1613	1.0442	0.9718	0.0000
21:30	1.1274	1.0385	0.9604	0.0000
21:45	1.1647	1.0326	0.9544	0.0000
22:00	1.1416	1.0251	0.9376	0.0000
22:15	1.1245	1.0071	0.9186	0.0000
22:30	1.1163	0.9593	0.8700	0.0000
22:45	1.0994	0.9564	0.8656	0.0000
23:00	1.0836	0.9270	0.8574	0.0000
23:15	1.0684	0.9264	0.8487	0.0000
23:30	1.0467	0.9200	0.8495	0.0000
23:45	1.0254	0.9057	0.8491	0.0000

8 Appendix B

Table 19 - Tower Geometry

Voltage	X1 (ft)	X2 (ft)	X3 (ft)	Conductor Height (ft)
13.8 kV	-1.9685	0	2.6247	26.2467
4.16 kV	-1.9685	0	2.6247	26.2467

Table 20 - Conductor parameters

Size	Nominal Current (A)	Nominal Voltage (kV)	DC resistance 20°C (Ω/kft)	GMR (in)	Outer diameter (in)
2/0 Cu	245	13.8	0.0795	0.15	0.414
#2 Cu	155	4.16	0.1562	0.106	0.292

Marshalls Energy Company
Republic of the Marshall Islands

VOLUME 3
CONTRACT DATA

LOT 1 : Design, Supply & Installation of Power Station Upgrade and BESS

LOT 2 : Design, Supply & Installation of Solar PV System & Associated Controls

Part 3, Volume 3 Contract Data

Includes

Section VIII General Conditions of Contract

Section IX Particular Conditions of Contract

Section X Contract Forms

ISSUED 9th SEPTEMBER 2019

PART 3

Conditions of Contract and Contract Forms

Section VIII - General Conditions of Contract

Table of Clauses

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.

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 1er, 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. Communications

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

6.1 The Bank requires compliance with the Bank's Anti-Corruption Guidelines and its prevailing sanctions policies and procedures as set forth in the WBG's Sanctions Framework, 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.

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 Commence-ment 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 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, and shall designate one of such persons to act as a leader with authority to bind the JV. The composition or the constitution of the JV shall not be altered without the prior consent of the Employer.

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 sub consultants 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 sub consultants' 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.

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 arbitrage 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 Employer may by notice to the Contractor object to any representative or person employed by the Contractor in the execution of the Contract who, in the reasonable opinion of the Employer, may behave inappropriately, may be incompetent or negligent, or may commit a serious breach of the Site regulations provided under GCC Sub-Clause 22.4. The Employer shall provide evidence of the same, whereupon the Contractor shall remove such person from the Facilities.

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.

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.

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.

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 their liability to pay personal income taxes in the Country in respect of such of their salaries, wages and allowances as are chargeable under the Laws for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such Laws.

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. The Contractor shall also provide facilities for the Employer's Personnel as stated in the Specification.

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 Permanent Works.

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. In collaboration with local health authorities, the Contractor shall 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, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.

The Contractor shall 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.

The Contractor shall send to the Project Manager, details of any accident as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Project Manager may reasonably require.

The Contractor shall throughout the contract (including the Defects Notification Period): (i) conduct Information, Education and Consultation Communication (IEC) campaigns, at least every other month, addressed to all the Site staff and labor (including all the Contractor's employees, all Subcontractors and Employer's and Project Manager's' employees, and all truck drivers and crew making deliveries to Site for construction activities) and to the immediate local communities, concerning the risks, dangers and impact, and appropriate avoidance behavior with respect to of Sexually Transmitted Diseases (STD)—or Sexually Transmitted Infections (STI) in general and HIV/AIDS in particular; (ii) provide male or female condoms for all Site staff and labor as appropriate; and (iii) provide for STI and HIV/AIDS screening, diagnosis, counseling and referral to a dedicated national STI and HIV/AIDS program, (unless otherwise agreed) of all Site staff and labor.

The Contractor shall include in the program to be submitted for the execution of the Facilities under Sub-Clause 18.2 an alleviation program for Site staff and labor and their families in respect of Sexually Transmitted Infections (STI) and Sexually Transmitted Diseases (STD) including HIV/AIDS. The STI, STD and HIV/AIDS alleviation program shall indicate when, how and at what cost the Contractor plans to satisfy the requirements of this Sub-Clause and the related specification. For each component, the program shall detail the resources to be provided or utilized and any related sub-contracting proposed. The program shall also include provision of a detailed cost estimate with supporting documentation. Payment to the Contractor for preparation and

implementation this program shall not exceed the Provisional Sum dedicated for this purpose.

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 Prohibition of All Forms of Forced or Compulsory Labor

The contractor shall not employ "forced or compulsory labor" in any form. "Forced or compulsory labor" consists of all work or service, not voluntarily performed, that is extracted from an individual under threat of force or penalty.

22.2.16 Prohibition of Harmful Child Labor

The Contractor shall not employ any child to perform any work that is economically exploitative, or is likely to be hazardous to, 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.

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, rules in respect of security, safety of the Facilities, gate control, sanitation, medical care, and fire prevention.

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 Watching and Lighting

The Contractor shall provide and maintain 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.

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.

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; Indemnification

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 paragrpah 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:

(i) international arbitration with proceedings administered by the international arbitration institution **appointed in the PCC,** in accordance with the rules of arbitration of the appointed institution,

(ii) the place of arbitration shall be the city where the headquarters of the appointed arbitration institution is located or such other place selected in accordance with the applicable arbitration rules; and

(iii) the arbitration shall be conducted in the language for communications defined in Sub-Clause 5.3; 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 Works. 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 Works.

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 sub-paragraphs (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 Works.

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 Works, 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 Works 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 Anti-Corruption Guidelines 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/proposers), 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 Anti- Corruption Guidelines 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/request for proposals documents and in contracts financed by a Bank loan, requiring (i) bidders (applicants/proposers), 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.

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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.

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.

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.

The clause number of the PCC is the corresponding clause number of the GCC.

Note that this is a draft Contract

PCC 1. Definitions	The Employer is: **Marshalls Energy Company MEC)** The Project Manager is: **Kamalesh Doshi** The Bank is: **International Development Association (World Bank)** Country of Origin: **all countries and territories as indicated in Section V of the bidding document, Eligible Countries.**
PCC 5. Law and Language	PCC 5.1, The Contract shall be interpreted in accordance with the laws of: **Republic of the Marshall Islands** PCC 5.2, The ruling language is: **English** PCC 5.3, The language for communications is: **English**
PCC 7. Scope of Facilities [Spare Parts] (GCC Clause 7)	PCC 7.3: The Contractor agrees to supply spare parts for a period of years: **5 years** 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 **four (4) 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.
PCC 8. Time for Commencement and Completion	PCC 8.1: **For Lot 1:** The Contractor shall commence work on the Facilities within **Fourteen (14) days** from the Effective Date for determining Time for Completion as specified in the Contract Agreement. **For Lot 2**: The Contractor shall commence work on the Facilities within **Fourteen (14) days** from the Effective Date for determining Time for Completion as specified in the Contract Agreement. PCC 8.2: **For Lot 1:** The Time for Completion of the whole of the Facilities shall be **365 days** from the Effective Date as described in the Contract Agreement. **For Lot 2:** The Time for Completion of the whole of the Facilities shall be **300 days** from the Effective Date as described in the Contract Agreement.
PCC 9. Contractor's Responsibilities	PCC 9.9 **Protection of the Environment** - Pursuant to Clause 9.4 and Clause 22.4 the Contractor shall comply with all national, provincial and local environmental laws and regulations. The Contractor shall; a. establish an operational system for managing environmental impacts: b. carry out all of the mitigation measures set forth in the Initial Environmental Impact Assessment and Environmental Management Plan: and c. allocate the budget required to ensure that such measures are carried out. The Contractor shall submit monthly reports on the carrying out of such measures to the engineer For EMP infringements the Contractor will be given a Notice by the Project Manager to initiate action to remedy the problem within 48 hours. If remediation and restoration has been satisfactorily initiated but could not be completed during this period, the Project Manager shall determine a reasonable extended period to complete the remediation in consultation with the contractor,

	If within the 48-hour period, in the judgment of the Project Manager, contractor has not initiated any action or the restoration is not being done properly or in a timely manner during the extended period, the Employer shall be entitled to employ and pay others to carry out the work. The Contractor shall pay to the Employer all costs reasonably incurred by the Employer in remedying the problem. **Clearance of Site and Disposal of Solid Waste -** At all times, the Contractor is responsible for the safe and sound disposal of all solid waste generated by the Works; Solid waste includes; • Inorganic non-recyclable waste = waste that cannot decompose / break down and which cannot be recycled • Hazardous waste: examples such as asbestos, waste oil etc. The export of such waste must be in compliance with the Waigani Convention and any relevant laws enacted by the recipient country. • Recyclable waste: waste that can be recycled, i.e. plastics, metals, rubber etc. All waste is to be disposed of OFFSHORE, preferably to New Zealand or Fiji and in permitted or licensed facilities at all times. It is the Contractor's responsibility to ascertain permissions for receipt of waste from The Republic of the Marshalls into another country. Evidence will need to be supplied to the employer or proper disposal of waste. The Contractor may dispose of aggregate in a designated location on island, agreed to by the Government. Biodegradable (organic) waste (i.e. waste that will decay / break down in a reasonable amount of time, such as green waste, food waste) maybe left on the island, (in designated dumping areas) in reasonable quantities.
PCC 11. Contract Price	Not Applicable
PCC 13. Securities	**PCC 13.3.1:** **For Lot 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%** **For Lot 2:** 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%**

	PCC 13.3.2: Both Lots The Performance Security shall be in the form of the Demand Guarantee attached hereto in Section X, Contract Forms. **PCC 13.3.3: Both Lots** The Performance Security shall not be reduced on the date of the Operational Acceptance. **PCC 13.3.3: Both Lots** 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.
PCC 22 **Installation**	**PCC22.2.5:** Working Hours Normal working hours are: **Between 8-00am and 6-00pm Monday to Saturday** **PCC 22.2.8:** Funeral Arrangements: Not Applicable
PCC 25. Commissioning and Operational Acceptance	**PCC 25.2.2:** **For Lot 1:** The Guarantee Test of the Facilities shall be successfully completed within **30 days** from the date of Completion. **For Lot 2:** The Guarantee Test of the Facilities shall be successfully completed within **30 days** from the date of Completion.
PCC 26. Completion Time Guarantee	**PCC 26.2:** Applicable rate for liquidated damages: **0.2% of the value of the Contract** 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. Maximum deduction for liquidated damages: **10% of the value of the Contract** **PCC 26.3**, No bonus will be given for earlier Completion of the Facilities or part thereof.
PCC 27. Defect Liability	**PCC 27.10** Not Applicable

PCC 30. Limitation of Liability	**PCC 30.1 (b)** The multiplier of the Contract Price is: **One times the Contract Price**
PCC 39. Value Engineering	**PCC 39.1.2** Not applicable
PCC46. Disputes and Arbitration	**PCC 46.1:** The DB shall be appointed within [28 days] after the Effective Date. **PCC 46.1:** The DB shall be: **One member** **PCC 46.1:** List of potential DB members is: *http://fidic.org/about-fidic/adjudicators or* from As available from the Singapore International Arbitration Centre (SIAC), or President Institute of Arbitrators and Mediators, Australia **PCC 46.2**: Appointment (if not agreed) to be made by: The Singapore International Arbitration Centre (SIAC). **PCC 46.5:** Procedure to settle disputes in respect of DB's decisions: *(a) Contracts with foreign contractors:* International arbitration shall be conducted in accordance with the rules of the Singapore International Arbitration Centre (SIAC). Arbitration shall be administered by SIAC The place of arbitration shall be the place of the institution administering the arbitration. (b) Contracts with contractors being nationals of the Republic of the Marshall Islands; Any dispute between the employer and a contractor who is a national of the employer's country arising in connection with the present contract shall be referred to arbitration in accordance with the laws of the Republic of the Marshall Islands.

Section X - Contract Forms

Table of Forms

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 RFB is issued]*

Loan No. /Credit No. / Grant No.: *[insert reference number for loan/credit/grant]*

RFB No: *[insert RFB 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:	[*insert name of successful Bidder*]
Address:	[*insert address of the successful Bidder*]

Contract price:	[*insert contract price of the successful Bid*]

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
[*insert name*]	[*insert Bid price*]	[*insert evaluated* **cost**]
[*insert name*]	[*insert Bid price*]	[*insert evaluated cost*]
[*insert name*]	[*insert Bid price*]	[*insert evaluated cost*]
[*insert name*]	[*insert Bid price*]	[*insert evaluated cost*]
[*insert name*]	[*insert Bid price*]	[*insert evaluated cost*]

3. Reason/s why your Bid was unsuccessful

[INSTRUCTIONS: State the reason/s why <u>this</u> 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 the Procurement Regulations for IPF Borrowers (Procurement Regulations)[https://policies.worldbank.org/sites/ppf3/PPFDocuments/Forms/DispPage.aspx?docid=4005] (Annex III). You should read these provisions before preparing and submitting your complaint. In addition, the World Bank's Guidance "How to make a Procurement-related Complaint" [http://www.worldbank.org/en/projects-operations/products-and-services/brief/procurement-new-framework#framework] provides a useful explanation of the process, as well as a sample letter of complaint.

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 of the information required by the Procurement Regulations (as described in Annex III).

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*

RFB No.: [*insert number of RFB process*]

Request 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 (Yes / No)	Directly or indirectly holding 25 % or more of the Voting Rights (Yes / No)	Directly or indirectly having the right to appoint a majority of the board of the directors or an equivalent governing body of the Bidder (Yes / No)
[include full name (last, middle, first),			

nationality, country of residence]			

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 46.1, 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

Note! To be used for either Lot 1 or Lot 2. Separate contracts based on the forms below will be issued for each lot

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 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: Lot 1 (or Lot 2) 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 1 (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: _____.

4.2 The address of the Contractor for notice purposes, pursuant to GCC 4.1 is: _____.

Article 5. Appendices

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 (Not Applicable)

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:

Fifteen percent (15%) 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.

Seventy Five percent (75%) of the total or pro rata CIP amount upon Incoterm "CIP", upon delivery to the carrier within forty-five (45) days after receipt of original shipping documents, i.e. ***a non-negotiable sea waybill***. MEC will arrange standby Letter of credit issued by bank of Guam to the bankers of the contractor valid for 12 months, against which the original shipping documents will be issued by the contractor's bankers to MEC. MEC will receive and get the goods cleared at Majuro port using the original shipping documents. The payment will then be made by MEC to the contractors after receipt of goods at Majuro port.

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:

Fifteen percent (15%) 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.

Seventy Five percent (75%) 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 *zero point three percent (0.3%)* 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:

1. The Contractor submits all claims to the Employer via the Project Manager. The Contractor shall submit all associated documents as required by the Project Manager and as stipulated in the Terms of Payment.
2. The Project Manager reviews and verifies the claim as submitted for accuracy and compliance. This verification is provided after the Project Manager has reviewed the claim, the current work or delivery status and associated measurement requirements as defined in the Contract. The Project Manager may liaise with the Contractor if any anomalies are found during this process and adjust accordingly;
3. The Project Manager prepares and submits a Payment Certificate to the Employer Representative for review and authorization;
4. If the Payment Certificate is deemed incorrect or is disputed by the Employer, it is returned to the Project Manager for verification and notification to the Contractor accordingly.
5. Upon approval by the Employer Representative, the Project Manager formally notifies the Contractor.
6. The Contractor submits an invoice in the amount of the Payment Certificate for payment by the Employer.
7. The payment is processed by the Employer, directly to the Contractor, in accordance with the time stipulated in the Contract. Confirmation of payment is issued by the Employer to the Contractor.
8. The Contractor shall provide formal confirmation to the Employer and Project Manager that payment has been received.

Appendix 2. Price Adjustment

NOT APPLICABLE - PRICES ARE TO REMAIN FIRM AND FIXED FOR THE DURATION OF THE CONTRACT

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.

To be at least the value of the goods being sent to site

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]

(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.

To be the estimated value of the Contract

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]

(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.

To be at least USD20,000,000 million

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]

(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.

(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 [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]

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

The Employer shall at its expense take out and maintain in effect during the performance of the Contract the following insurances. Employer's Risk is limited to US$5,000 for all three insurances.

Details:

Amount [in currency(ies)]	Deductible limits [in currency(ies)]	Parties insured [names]	From [place]	To [place]

Appendix 4. Time Schedule

TBD

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

Appendix 6. Scope of Works and Supply by the Employer

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

TBD

B. Review

TBD

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 *1*% 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 1% 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 ten percent (10 %) of the Contract price.

Performance Security Form– Bank Guarantee[1]

[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

(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.

---

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*.

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.

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.

---

[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."

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 . (. . . . .) [5] 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

(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

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[5] *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.*

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 . . . . . , ...[6], 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.

[6]*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."*