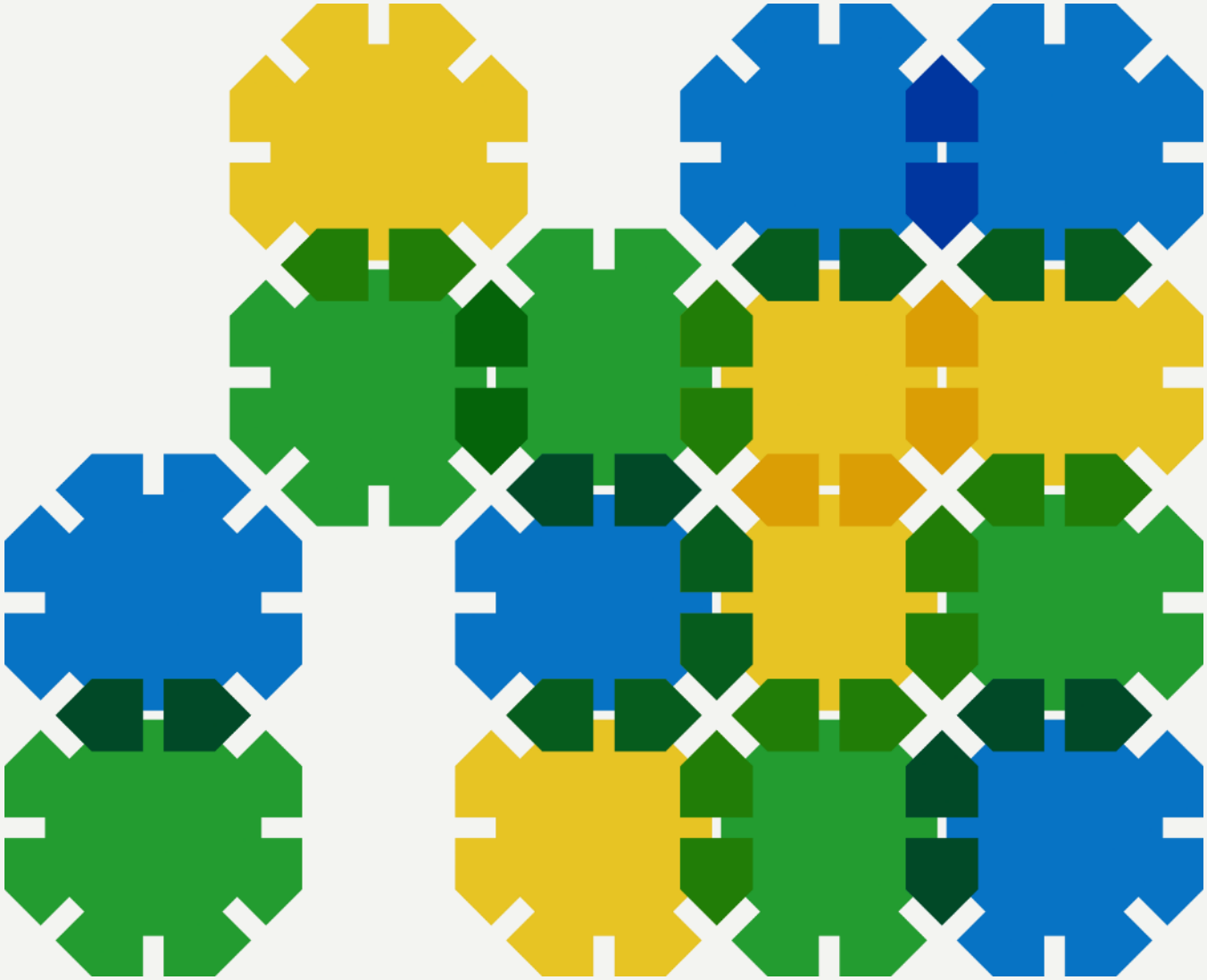
ITP Renewables

REnew Pacific

PV/BESS Technical Specification
Apolima Island, Samoa



July 2026

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We acknowledge the First Peoples of Australia, and their Elders past, present and emerging. We pay our respects to the traditional storytellers, designers, artists and custodians of the land on which we live and work.

About this report

This document contains the technical specifications for the design and construction of a solar PV array, battery energy storage system, and back-up diesel generator on Apolima Island, Samoa. This system will replace the existing assets that have reached end-of-life and will integrate with the existing low voltage distribution network. These specifications were commissioned by Palladium International on behalf of the Electric Power Corporation of Samoa.

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Table of Contents

1 Introduction 3

1.1 Project context 3
1.2 Project scope summary 4
1.3 Design objectives 6
1.4 Applicable standards 6
1.5 Site overview 7
1.6 Site access 9
1.7 Environmental conditions 11
1.8 Terminology 11

2 General Requirements 12

3 Generation Assets 14

3.1 Solar PV system 14
3.2 DC balance of system 16
3.3 Battery modules 17
3.4 Inverters 18
3.5 LV balance of system 19

4 Other Works 21

4.1 Earthing and lightning protection 21
4.2 Control and monitoring 21
4.3 Signage and labelling 22

5 Commissioning and Handover 23

5.1 Commissioning 23
5.2 Training 23
5.3 Handover package 24
5.4 Spare parts and tools 25

Appendix A. Abbreviations 26

1 Introduction

The Apolima Tai Mini-Grid is located on Apolima Island, a remote volcanic island situated between Upolu and Savai'i, Samoa (Figure 1). Originally installed in 2006, the system supplies electricity to the entire Apolima Tai community through a standalone low-voltage distribution network independent of the national electricity grid.



Figure 1: Location of Apolima Island

Although the system has been maintained by the Electric Power Corporation of Samoa (EPC Samoa) over its operational life, several components have reached the end of their economic and technical service lives. Battery performance has deteriorated, generation capacity is insufficient to reliably meet current demand during prolonged periods of cloud cover, and critical infrastructure requires replacement or refurbishment. Community feedback and EPC Samoa operational records indicate increasing reliance on diesel backup generation and periods of reduced service availability during adverse weather conditions.

In response, EPC secured support through the REnew Pacific Program to undertake a comprehensive upgrade and replacement of the existing mini-grid infrastructure.

1.1 Project context

The existing system comprises:

- Approximately 13 kWp solar photovoltaic modules
- Lead-acid battery energy storage system

- Inverters and control equipment
- Standby diesel generator
- Equipment housing structures
- Security fencing
- Ancillary control and protection systems
- Low-voltage (415 V/240 V) single-phase radial distribution network.

The location of these assets (the Site) and the distribution network map are shown in Figure 2 below.

1.2 Project scope summary

EPC Samoa is seeking a design and construction contractor to design, supply, install, and commission a solar PV system, a BESS, a standby diesel generator set, and necessary balance-of-system equipment to replace the existing generation infrastructure on the Apolima Tai mini-grid. The new equipment will be integrated with the existing low voltage distribution network.

The responsibilities of each party under this contract are summarised in Table 1.

Table 1: Division of responsibilities

Stakeholder	Responsibilities
EPC Samoa (Owner)	• Contract management • Land acquisition • Liaison with all stakeholders • Decommissioning and removal of existing assets • Transport of materials from Upolu to Apolima • Geotechnical study • Enabling civil works and earth works • Refurbishment of existing structures • Supply, installation, and commissioning of new diesel genset • Design review and approvals • Commissioning supervision • Attend training
PV/BESS contractor (Contractor)	• Delivering materials CIF to Upolu • All other works required to deliver the project as described in this specification



Figure 2: Site and distribution network map

1.3 Design objectives

The new generation assets will provide continuous electricity supply to all connected customers under normal operation conditions. The system will maximise utilisation of solar generation and minimise diesel generator runtime and fuel consumption. The Contractor will be design for operational simplicity and provide a system that can be safely operated and maintained by EPC Samoa personnel and trained local operators. The design will provide robust operation in the local environmental conditions, including: a corrosive marine environment, high humidity, salt spray exposure, cyclonic wind events, and prolonged cloudy weather periods.

1.4 Applicable standards

The PV array, BESS, and associated infrastructure shall be installed in accordance with the current version of relevant Australian/New Zealand standards. Where none exist, an appropriate international standard shall instead be applied. These standards include, but are not limited to, those listed in Table 2, along with all standards they call upon.

Table 2: Applicable standards

Standard	Title
AS 1012	Methods of testing concrete
AS/NZS 1125:2001	Conductors in insulated electric cables and flexible cords
AS/NZS 1170.0:2002	Structural design actions part 0: General principles
AS/NZS 1170.2:2021	Structural design actions part 2: Wind actions
AS/NZS 1170.4:2007	Structural design actions part 4: Earthquake actions in Australia
AS 1379:2007	Supply of concrete
AS/NZS 1768:2021	Lightning Protection
AS/NZS 2312.2	Guide to the protection of structural steel against atmospheric corrosion by the use of protective coatings
AS/NZS 3000:2018	Australian/New Zealand Wiring Rules
AS/NZS 3008.1.1:2017	Selection of cables
AS/NZS 3017:2022	Electrical installations – Verification by inspection and testing
AS 4100:2020	Steel structures
AS/NZS 4600:2018	Cold-formed steel structures
AS/NZS 4777.1	Grid connection of energy systems via inverters. Part 1: Installation requirements
AS/NZS 4777.2	Grid connection of energy systems via inverters. Part 2: Inverter requirements
AS/NSS 5033:2021	Installation and safety requirements for photovoltaic (PV) arrays
AS/NZS 5139:2019	Safety of battery systems for use with power conversion equipment

AS 60529:2004	Degrees of Protection Provided by Enclosures (IP Code)
AS 60947.3:2018	Low voltage switchgear and controlgear, Part 3: Switches, disconnectors, switch-disconnectors, and fuse combination units
AS/NZS 61439	Low-voltage switchgear and controlgear assemblies
AS/NZS 61724.1	Photovoltaic system performance, Part 1: Monitoring (IEC 61724-1:2021, (ED.2.0) MOD)
EN 50521:2008	Connectors for photovoltaic systems
IEC 60255	Measuring relays and protection equipment
IEC 61625	Crystalline silicon terrestrial photovoltaic (PV) modules –Design qualification and type approval
IEC 61701	Photovoltaic (PV) modules – Salt mist corrosion testing
IEC 61730	Photovoltaic (PV) modules – Safety qualification
IEC 62109	Safety of power converters for use in photovoltaic power systems
EN 50521:2008	Connectors for photovoltaic system

Works shall account for the following codes and standards:

- Samoa National Building Code 2017
- EPC Technical Standards and Specifications
- Samoa variations of AS/NZS standards – in particular the standard LV AC voltages in Samoa are 415 V/240 V.

1.5 Site overview

The Site, shown in Figure 3, occupies customary land for which community approval and land access arrangements have been secured through consultation with village leadership and land custodians. The project incorporates an expanded lease area totalling approximately 951 m² to accommodate the upgraded renewable energy infrastructure as shown in Figure 4.



Figure 3: Site location on Apolima Island

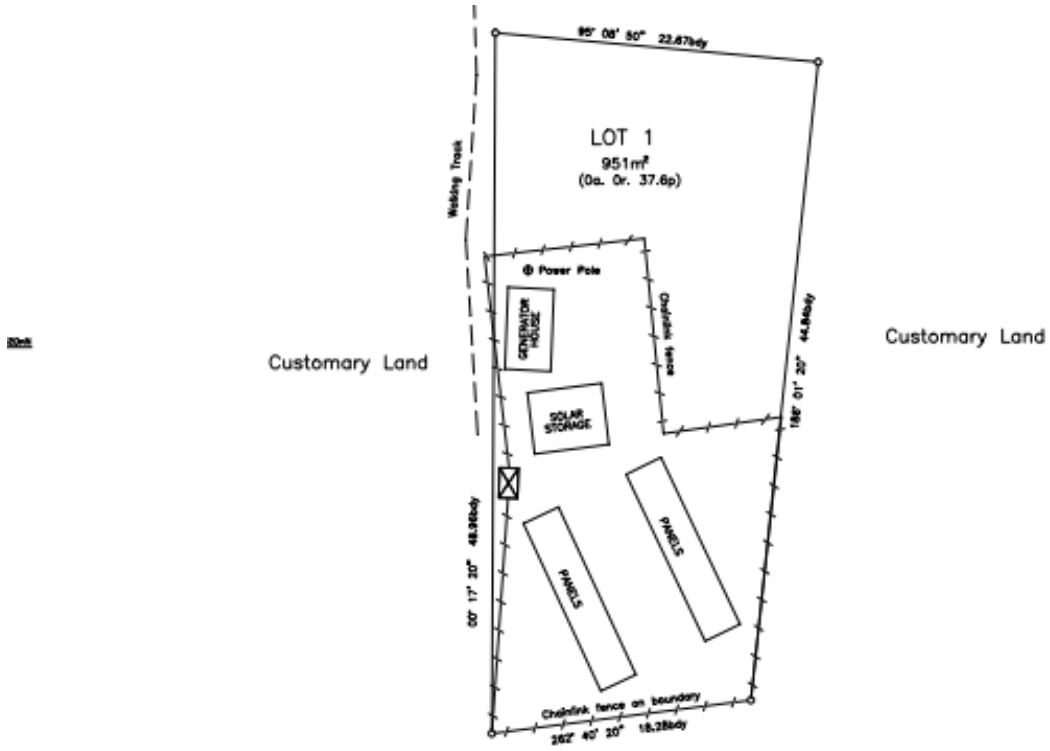


Figure 4: Cadastral survey of the site

The upgraded system will continue to utilize the existing site due to:

- Proven operational history
- Existing distribution network connection
- Existing community acceptance
- Existing access tracks and logistics arrangements
- Existing building infrastructure suitable for refurbishment.

1.6 Site access

The materials will be transported to Apolima in a small boat as there is no wharf or unloading facilities Figure 5. The Site is accessible via a narrow footpath (Figure 6) that leads through the village. The design shall account for these limitations, particularly regarding the batteries.



Figure 5: Boat access to Apolima Island



Figure 6: Access track leading to the site

1.7 Environmental conditions

The Apolima Tai Renewable Energy Mini-Grid is located within a tropical marine environment and is subject to elevated humidity, salt-laden winds, high rainfall, cyclonic weather events and remote-island operating conditions. Equipment selection, design, and installation shall account for these environmental conditions, particularly:

- Maximum windspeed up to 220 km/h (per Samoa National Building Code 2017)
- C5M corrosivity environment (per ISO 12944-5)
- Seismically active region
- Ambient temperatures of 24–32°C
- Operational temperatures of 50°C
- Relative humidity frequently exceeding 80%
- High annual rainfall

No geotechnical study is currently available. EPC Samoa will carry out a geotechnical study following Contract Award and provide the results to the Contractor. Tenderers shall clearly state any geotechnical design assumptions made in their tender design. If reasonable assumptions are made, and actual conditions differ materially from these assumptions, the EPC Samoa will consider a price variation for additional costs incurred.

1.8 Terminology

In this specification the following terms have the meanings defined below:

- **Shall** indicates a mandatory requirement; tenderers cannot deviate from these requirements without strong justification and explicit, written agreement from the Owner
- **Must** has the same meaning as shall
- **Should** indicates a recommendation, tenderers may deviate from the requirement with appropriate justification.
- **May** indicates an optional requirement or alternative. Typically used in conjunction with should.
- **Will** indicates a statement of fact or intent.

2 General Requirements

(a) The PV array, BESS and associated equipment shall be located on the Site as described in Section •.

(b) The Contractor shall conduct appropriate geotechnical investigations to inform foundation design.

(c) Unless otherwise specified, all equipment installed according to this specification shall be new, unused, and free from defects.

(d) All equipment installed according to this specification shall be commercially proven and suitable for the prevailing environmental conditions as described in Section 1.6.

Continuity of supply and disruptions

(e) The Contractor should endeavour to minimise disruption to normal operation (e.g. site shutdown, electricity supply interruptions, evacuation of personnel from a key work area, blocking of road routes, etc.) of the site during installation. If disruption to normal operation is unavoidable, the Contractor shall provide at least 1-week of notice to EPC Samoa and coordinate with EPC Samoa to minimise the impact of the disruption, where possible.

(f) The Contractor shall prepare and implement a plan to ensure power supply continuity during the works (e.g. installing and commissioning the new genset with a temporary connection to the distribution network at the start of works).

Site control, access, and management

(g) Electricity and water access for site works will be provided by EPC Samoa.

(h) The Contractor shall prepare, manage, and clean-up the site during construction and the Defects Correction Period (DCP). During this period, the Contractor shall provide site access to EPC Samoa's personnel during the works for the purpose of oversight and progress monitoring.

(i) Prior to demobilising at the end of the works, the Contractor shall:

  (i) remove all surplus plant, materials, temporary buildings, equipment, and temporary works from the site

  (ii) stabilise any ground disturbed by the works to negate erosion and sedimentation.

  For the avoidance of doubt, this clause does not refer to decommissioning works on the existing assets, which will be completed by EPC Samoa before the Contractor begins work on the new assets.

Design life

(j) Unless otherwise specified, the minimum design life of major components shall be:

(i) 25-years for PV modules, PV structure, cables, and associated enclosures

(ii) 25-years for switchboards and building renovations

(iii) 15-years for inverters, batteries, and associated enclosures.

3 Generation Assets

3.1 Solar PV system

(a) The target PV module capacity (at STC[1]) of the PV system is 24 kWp and the capacity must be in the range 23–26 kWp.

(b) The Watt-peak (Wp) capacity under STC of the individual modules and their quantities is left to the Contractor to propose provided clause (a) above is met and the system can be installed in the allocated area.

Product requirements

(c) All modules provided under this tender must be of identical make and model and must be from a recognised Tier 1 module manufacturer.

(d) PV modules should be bifacial, with a minimum bifaciality factor of 80%.

(e) Modules must be certified to the international standards IEC 61215 and IEC 61730, and have been tested at a qualified testing institution (e.g. ESTI, TUV Rheinland, or equivalent).

(f) Modules must be certified to IEC 61701 as they will be installed in a tropical environment.

(g) Standard locking connectors (e.g. MC-4 or equivalent) certified to EN 50521 shall be included with the modules. Non-locking connectors (e.g. MC-3 or equivalent) must not be used.

(h) Each module must be fitted with a manufacturer's sticker on the back, providing the following information:

- (i) Name of manufacturer
- (ii) Date of manufacture
- (iii) Country of manufacture
- (iv) Model number
- (v) Serial number
- (vi) Rated power at STC
- (vii) Open-circuit voltage (V_{OC})
- (viii) Short-circuit current (I_{SC})
- (ix) Voltage at maximum power (V_{MP})
- (x) Current at maximum power (I_{MP}).

[1] G=1000 w/m^2, T=25°C, AM=1.5

Warranties

(i) Modules must be warranted to produce at least 90% of their nominal output (at STC) after 10 years, and 80% of their nominal output after 25 years.

(j) Modules must have a product warranty period of at least 10 years. The warranty must be valid in the local conditions and jurisdiction. The warranty statement must define when the warranty period starts, what remedial action the manufacturer will take upon a successful warranty claim, who underwrites the warranty, and how to lodge a warranty claim.

Layout and design

(k) The array layout shall fit within the area shown in Figure 4, Section • while allowing for:

- (i) A minimum set back of 2 metres between the array and perimeter security fence
- (ii) A minimum set back of 2 metres between the array and existing structures
- (iii) Underground services which must be relocated if Contractor identifies any that are within the extents of the PV array and in service.

(l) The Contractor will specify the azimuth, tilt, and arrangement of the array to maximise yield. The tilt angle shall be at least 10° to enable sufficient drainage.

(m) Modules shall be installed in strings only with modules of the same power class.

(n) The input power, current, and voltage to the inverter shall not exceed manufacturer-specified limits without confirmation from the manufacturer that this will not impact the warranty or service life.

(o) Clearance at the lowest point of each panel shall be between 750 mm and 1,250 mm from the ground. No live components of the PV array (e.g. circuit breakers, fuses, cables not in conduit) shall be installed below 750 mm.

Mounting structure

(p) The PV array shall utilise a fixed-tilt mounting system.

(q) Corrosion protection of structural members, plates, and fasteners shall be adequate for a 25-year design life in:

- (i) a C5M corrosivity environment (per ISO 12944-5)
- (ii) the local geotechnical conditions.

(r) PV modules shall be attached to the mounting frames using either the existing mounting holes on the frame or clamps, in line with the manufacturer's instructions.

(s) Interfaces between dissimilar metals that are likely to cause galvanic corrosion shall be minimised by use of EPDM washers/bushings or similar.

(t) The array mounting structure, when built and with the modules installed, must withstand maximum windspeeds of 220 km/h. For the purposes of wind loading calculations, the facility shall be considered to be Building Group 1 in accordance with the Samoa National Building Code 2017, with a minimum design life of 30 years.

3.2 DC balance of system

DC cables

(a) The maximum open-circuit voltage of each PV string shall not exceed 1,000V_{DC} at the rated voltage of the PV panels.

(b) All cabling shall be sized and installed in accordance with AS/NZS 3008.1 or IEC 60287, AS/NZS 5033, AS/NZS 4777.1 and AS/NZS 4777.2.

(c) PV cabling at the array must be installed such that inductive loops are minimised, to minimise voltage surges caused by inter-cloud lightning strikes.

(d) Cabling shall not be exposed to direct sunlight, even if sheathing is marked as being UV-stabilized. All cabling that may be exposed must be routed through UV- stabilized conduit.

(e) Plastic cable ties, where used, must be protected from both direct and reflected UV radiation. Any cable ties used in UV-exposed locations or as primary means of cable support must be stainless steel.

(f) All cable terminations shall be crimped or use a solar connector.

(g) Any 4–10mm^2 underground solar cable shall be enclosed in conduit. Larger cables may be direct buried provided the insulation is adequate for a 25-year design life in the local geotechnical conditions.

(h) Conduit buried in trenches must include appropriate trench markings and be buried in accordance with AS/NZS 3000. If any communications conduit is used, it must be physically separated from power conduit by a minimum of 150 mm.

(i) Where flexible conduit is used, conduit entries shall face downwards to prevent water ingress. Plugging the conduit entry with silicone is not an acceptable long-term solution.

Isolators

(j) DC switchgear shall be selected and installed in accordance with AS/NZS 5033, AS/NZS 4777.1, and AS/NZS 3000.

(k) Any outdoor isolator enclosures or junction boxes shall:

(i) Have an ingress protection rating of at least IP65
(ii) Be sheltered from direct sun and rain by the array or an awning
(iii) Be constructed from UV-resistant materials.

(iv) Be vermin-proof
(v) Be highly corrosion resistant. Any metallic parts must be 316 stainless steel. Galvanised steel is not acceptable

(l) All cable entries into outdoor enclosures shall be through the bottom of the enclosure to prevent water ingress.

3.3 Battery modules

(a) The battery modules shall have an aggregate, usable energy capacity at beginning-of-life of 90 kWh. Usable capacity is the energy available within the State of Charge (SoC) constraints indicated in the warranty conditions (if any).

(b) Inverter and battery management modules must have been integrated together on previous projects, or else be supplied with a written statement from the inverter manufacturer indicating that compatibility has been confirmed via real-world testing.

(c) Battery equipment selection shall consider the limited local logistics capability.

Product requirements

(d) Battery cells shall be lithium iron phosphate (LFP) prismatic cells.

(e) All battery cells/modules/racks must be new, unused, and of the same make and model.

(f) Each cell/module/rack shall be manufactured and tested within 6 months preceding delivery to site.

(g) Battery management functionality shall include, at a minimum:

(i) Over-voltage protection
(ii) Under-voltage protection
(iii) Over-temperature protection
(iv) Cell balancing.

(h) At an ambient temperature of 25±3°C, and rated charge/discharge power, each battery cabinet shall have a round-trip efficiency of >85%.

(i) The batteries shall be selected in accordance with AS 5139.

(j) Battery cells/modules shall be certified to UN 38.3.

(k) The battery product shall be compliant with at least one of the following:

(i) UL 1973

(ii) IEC 62619.

(l) No part of the battery shall exceed a maximum open-circuit voltage of 600 V_{DC}.

Warranties

(m) The battery modules/racks shall have a product warranty of at least 5 years.

Battery installation

(n) Battery modules (energy and control/management) and cabinets shall be transported to, and around, the site in accordance with the manufacturer's instructions and warranty conditions.

(o) The battery modules and racks shall be installed inside the Solar Storage building according to the requirements of AS 5139 and the manufacturer's instructions.

(p) The batteries shall be installed on a secure and level surface.

(q) The Contractor shall visually inspect battery modules and racking upon arrival for the following:

- (i) Dents, penetrations, loose connections, or any other external damage
- (ii) Corrosion
- (iii) Leaks

(r) The Contractor shall check the voltage of all battery racks upon arrival at site to confirm they are within manufacturer's limits.

3.4 Inverters

(a) The Contractor may propose an AC-coupled or DC-coupled solution.

- (i) In an AC-coupled solution, the inverters shall meet the following requirements:
  - (1) the battery inverters shall have a continuous rating equal to that of the PV inverters for both import and export.
  - (2) the PV inverters shall have a maximum PV input power rating greater than the nameplate capacity of the solar array
- (ii) In a DC-coupled solution, the hybrid inverters shall have a maximum PV input/array power rating greater than the nameplate capacity of the solar array.

(b) The battery or hybrid inverters – whichever is used – must be capable of off-grid operation with and without a diesel generator.

(c) The capacity of individual inverters and their number is left to Contractor, provided there are at least two inverters to provide redundancy.

Product requirements

(d) Inverters shall be commercially proven and compliant with AS/NZS 4777.2:2020 and IEC 62109.

(e) All inverters must be new, unused, and of the same make and model, for each relevant inverter application (PV/battery/hybrid).

(f) Inverters shall be commercially proven and compliant with AS/NZS 4777.2:2020 and IEC 62109.

(g) The inverters' peak efficiency must be greater than 97% and greater than 95% at maximum output.

(h) Inverters must have an ingress protection rating of at least IP54.

(i) Inverters must be rated to 50 Hz for single phase power output.

(j) Inverter nominal AC output voltage shall be 415 V (phase-to-phase).

(k) Inverter electronic components must be sealed from contact with outside air and include external heat sinks for cooling. If fans are used for cooling, they shall not blow air directly over electronic components, but rather over a heat sink.

(l) Isolators integrated within the inverter are acceptable if they are certified to be compliant with both AS/NZS 4777.2:2020 and AS 60947.3:2018.

Warranties

(m) At a minimum, the inverters shall have a 5-year warranty from the manufacturer (in addition to any Contractor warranties). This warranty shall be between the manufacturer and the Owner.

Inverter installation

(n) Inverters shall be located inside the Solar Storage building with sufficient space for air circulation and heat dissipation, and in line with the manufacturer's instruction.

(o) The selection and installation of inverters shall be in accordance with AS/NZS 5033, AS/NZS 4777.1, and the inverter manufacturers' instructions.

(p) Inverters shall be readily accessible as described in AS/NZS 4777.1.

(q) Inverters shall have a minimum clearance of 1,200 mm from the front.

(r) Inverters shall be installed such that cables cannot be inadvertently unplugged.

3.5 LV balance of system

Low voltage AC cables

(a) All LV cabling between equipment shall be buried in accordance with AS/NZS 3000.

(b) All cables must be sized and installed in accordance with AS/NZS 3008.1 or IEC 60287, AS/NZS 5033, AS/NZS 4777.1, and AS/NZS 4777.2.

LV switchboards

(c) An LV switchboard shall be provided to connect all generating assets, supply site auxiliary loads, and interconnect with the existing LV distribution network.

(d) All LV switchboards shall be designed, manufactured, and tested in accordance with AS/NZS 61439.

(e) Any switchboard must have an ingress protection rating of at least IP42.

(f) Outdoor switchboard cabinets/enclosures shall have an ingress protection rating of at least IP54.

(g) Outdoor switchboard cabinets/enclosures shall be made of stainless steel.

(h) All LV cable terminations shall be crimped lugs, affixed with bolts.

4 Other Works

4.1 Earthing and lightning protection

(a) The Contractor shall undertake soil resistivity testing to inform earthing design.

(b) A Lightning Protection System (LPS) of at least Lightning Protection Level (LPL) II shall be installed (97% interception efficiency), for protection of the BESS, and control and monitoring equipment.

(c) Both primary and secondary surge protection devices (SPDs) shall be installed. Appropriate SPDs shall be selected according to AS 1768 and AS/NZS 5033. At a minimum, SPDs should be installed at each:

  (i) PV array combiner box

  (ii) LV switchboard.

(d) The Contractor shall complete a lightning risk assessment, in accordance with AS 1768 to determine whether greater protection is necessary.

4.2 Control and monitoring

(a) The control system shall dispatch the solar PV, batteries, and diesel genset in a manner that:

  (i) Maintains power quality

  (ii) Minimises diesel fuel consumption

  (iii) Avoids overloading inverters

  (iv) Avoids underloading the diesel generator.

(b) The solar PV and BESS must be capable of operating in, and transitioning between, the following modes without loss of power:

  (i) Diesel-Off – inverters setting and maintaining the voltage and frequency, with PV output maximised but controlled and diesel genset disconnected.

  (ii) Diesel Back-Up – genset setting and maintaining voltage and frequency to meet the load while maximising battery charge with PV output set to zero.

  (iii) Diesel-Only – genset setting and maintaining the voltage and frequency, with all inverters disconnected or set to zero power input/output.

(c) Solar system to have provision for SCADA monitoring such as Modbus/DNP capabilities to allow for connection to SCADA.

(d) The PV and BESS shall include a data portal that is accessible both remotely (via the internet) and locally (without an internet connection) in a manner that is accessible to the Owner and its staff.

(e) Providing an internet connection is not in the Contractor's scope as this will be provided by EPC Samoa.

(f) The data portal shall log the following data fields with a resolution not exceeding 15-minute periods, at a minimum:

(i) AC voltage and current for each the inverter

(ii) DC voltage and current from both the PV array and the BESS

(iii) DC voltage, current, and power into the BESS

(iv) Cumulative energy from PV, to battery, from battery, to inverter (if applicable), and from inverter, for each inverter.

(v) Battery state of charge

(vi) Frequency for each inverter

(vii) Power factor for each inverter phase

(viii) Alarms and warnings for each inverter

(g) The data portal shall allow the viewing and export of at least 1-year of historical data for the fields specified in 4.2(c). Data export shall be in an easily accessible spreadsheet format (CSV file format or similar).

4.3 Signage and labelling

(a) All major components shall be identified with a consistent labelling scheme that matches the drawings and design and is in accordance with AS/NZS 3000, 4777 and 5033. The Contractor will also affix equipment with all require signage for safety and operational standards. EPC Samoa will supply the necessary signage to meet the requirements of the National Building Code of Samoa 2017.

(b) All equipment labels and signage installed outside shall be constructed from UV and corrosion resistant materials, e.g. U3.

(c) All equipment labels and signage should be screw or rivet fixed unless this will compromise the IP rating of equipment; in which case an appropriate adhesive may be used.

(d) The following laminated drawings shall be mounted in, or adjacent to, the BESS enclosure to facilitate maintenance and troubleshooting:

(i) Colour-coded layout drawing that identifies each PV string

(ii) Layout drawing that identifies each battery string

(iii) DC and AC single-line diagram of the entire system.

(e) All signage shall use both English and Samoan.

5 Commissioning and Handover

5.1 Commissioning

(a) Commissioning procedures shall comply with AS/NZS 5033:2021.

(b) The Contractor shall record all commissioning tests and provide completed and signed commissioning test sheets and punch sheets to EPC Samoa upon completing commissioning.

(c) Commissioning shall include, but not be limited to:

(i) Torque testing

(ii) I-V tracing of all PV array strings

(iii) Confirmation that the inverter MPPT's are harvesting the expected current from the PV arrays to maximise energy yield

(iv) Confirmation that all battery racks are accepting the expected currents when solar energy yield exceeds site energy demand.

(v) Confirmation that all battery racks are delivering the expected currents when diesel generators are offline and the site energy demand exceeds the solar energy yield.

(vi) Measurement of battery voltage sag while under load.

(vii) Confirmation that the diesel generators are automatically dispatched when battery SOC reaches the minimum setpoint.

(viii) Confirmation that the Facility turns off diesel generators when sufficient energy is available from the battery or the PV to meet the site energy demand.

(ix) Confirmation that the Facility is capable of black-starting the site and maintaining voltage and frequency within the limits defined in clauses 3.4(i) and 3.4(j) above.

(x) Infrared scanning of all plant at, or near, maximum loading, ensuring it remains within 30°C of the ambient temperature.

5.2 Training

(a) The Contractor shall provide training to EPC Samoa personnel and local operators, as selected and nominated by EPC Samoa. Each participate shall be provided with a hardcopy of the O&M manual in addition to the copies required by clause 5.3(e) below.

(b) The Contractor shall take registrations for all training participants, including signing in and out at the beginning and end of each training session.

(c) The training will equip participants with sufficient skills to operate and maintain the system. It shall include, but is not limited to:

(i) Generation system architecture

(ii) HMI user interface, navigation, and functionality

(iii) Generation system settings/parameters

(iv) How to alter generation system settings/parameters

(v) Routine operation and maintenance (O&M)

(vi) Start-up and shut-down procedures for all new equipment installed under this contract

(vii) Basic troubleshooting for all major equipment installed under this contract.

(d) The Contractor shall provide sufficient access for trainees to witness commissioning procedures.

5.3 Handover package

(a) An As-Built design package including updated version of all drawings that reflect the system as-built, including any changes made to the designs during construction.

(b) Commissioning test sheets for:

(i) PV array (per AS/NZS 5033)

(ii) BESS

(iii) LV switchgear

(iv) Genset.

(c) Upon completion of commissioning, the Contractor will prepare and supply sufficient documentation and data to EPC Samoa to:

(i) Support operations and maintenance activities

(ii) Enable review and monitoring of the design and installation works and ongoing system performance.

(d) The Contractor shall provide at least 3 hardcopies and digital copies of all documentation including, but not limited to:

(i) All As-Built drawings laid out on A3 or A1 sheets

(ii) Operation and maintenance (O&M) manual in both English and Samoan

(iii) Training materials

(iv) Full parts list, including model numbers.

(e) The O&M manual shall include, but is not limited to:

(i) Frequency of inspections

(ii) Inspection procedures

(iii) Frequency of cleaning

(iv) Cleaning procedures

(v) Frequency of routine maintenance

(vi) Routine maintenance procedures

(vii) System monitoring, including detailing performance metrics and how to identify underperformance

(viii) Identification of faults, damage, or defects

(ix) Basic troubleshooting

(x) Contractor contact details

(xi) Where possible, documents should seek to use visual cues (e.g. pictures or diagrams).

5.4 Spare parts and tools

(a) The Contractor must supply the following spare parts. The number of spares shall be at least 5% of the total number of parts in each case.

(i) PV modules

(ii) DC isolator switches and enclosures

(iii) PV string fuses and fuse holders

(iv) DC contactors

(v) MC4 connectors

(vi) Diesel genset fuses.

(b) The Contractor shall supply at least two spare inverters comprising the following:

(i) Two hybrid inverters for a DC-coupled solution

(ii) One PV inverter and one battery inverter, in an AC-coupled solution.

(c) At least one year worth of supplies for the genset including:

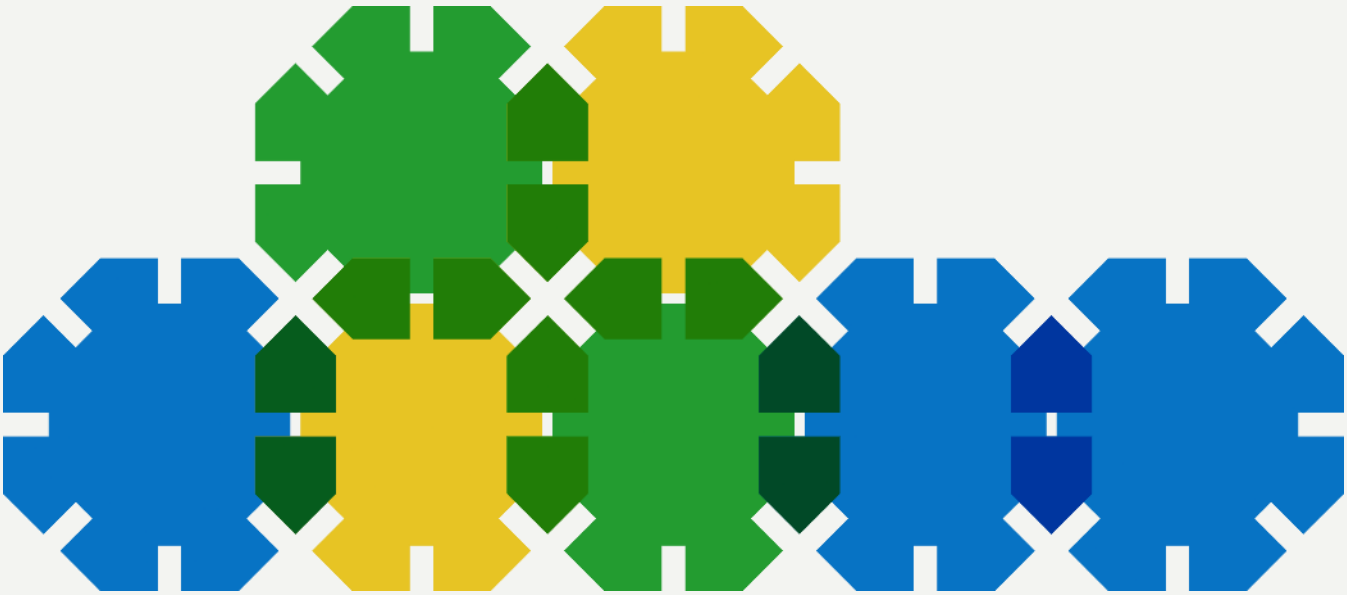
(i) Oil, air, and fuel filters

(ii) Spare belts and hoses

(iii) Consumables for 250-hr and 1,000-hr servicing

Appendix A. Abbreviations

AC	Alternating current
BESS	Battery energy storage system
DC	Direct current
DCP	Defect correction period
EPC	Electric Power Corporation
GGGI	Global Green Growth Institute
HMI	Human machine interface
IP	Ingress Protection
kW	Kilowatt, unit of power
kWh	Kilowatt-hour, unit of energy, 1 kW generated or consumed for 1 hour
kWp	Kilowatt-peak, capacity of PV modules tested at standard test conditions
LV	Low voltage
MPa	Megapascals, unit of mechanical stress
MPPT	Maximum power point tracking
O&M	Operation and maintenance
PV	Photovoltaic
SCADA	Supervisory control and data acquisition
SoC	State of charge, expressed as %
SPD	Surge protection device
UV	Ultraviolet



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