Employer's Requirements

General Requirements

Project: Engineering, Procurement and Construction of Hybrid PV-Diesel-Battery Energy Storage System

Location: Pulau Tiga, Maluku, Indonesia

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Acronyms

PV	**Photovoltaic**
BESS	Battery energy storage system
ERQ	Employer's Requirement
AC	Alternating Current
DC	Direct Current
BMS	Battery Management System

1 BACKGROUND and PURPOSE

A **three-phase hybrid** PV + Diesel + Battery Energy Storage System (BESS) power plant is to be installed at Pulau Tiga and connected to the existing electricity distribution system. The proposed new system is to meet the electricity generation needs for the island community at Pulau Tiga, Maluku Province, Indonesia.

The Employer, NZMATES, is requesting bid proposals for the design, supply, delivery, installation, testing and commissioning of such a system, designed such that a **renewable energy fraction of at least 95% (average over 20 years)** is achieved with the BESS design. Information on NZMATES can be found here: https://www.nzmates.org/about/what-nzmates.

There is an existing Hybrid PV-Diesel-BESS plant on Pulau Tiga which is now defunct. Currently a 20kW diesel generator is supplying electricity to the island through the existing electrical distribution network.

The intention is to dismantle and replace all major system components of the defunct system (i.e. solar arrays, battery banks, power conditioning gear and diesel generators) with new state-of-the-art equipment. In addition, the existing powerhouse and security fencing will have to be refurbished.

The scope of this tender does **not** include the existing electrical distribution network. Any repair, improvements and extension remain the responsibility of PLN.

These Employer's Requirements (ERQ) provide all the necessary information for the submission of the requested proposal.

2 SCOPE

2.1 System components

The following main system components are the minimum to be provided:

- Ground-mounted solar PV arrays.
- Power-conditioning equipment, aka inverters.
- Lithium-ion BESS.
- Remote online and local Monitoring and Control system (optional).
- New back-up diesel generator.
- Master controller to manage the system operation and integration.
- Electrical connections to the existing grid.
- Electrical equipment including cabinets, switchgear, and control panels.
- Electrical protections, earthing, and lightning arrestor
- Meteorological station.
- All civil works related to the installation of the new hybrid powerplant including site preparation, installation of footings and mounting structures, trenching and remediation, and any foundations/slabs required for BESS or other equipment.
- Civil works for remediation of security fencing.
- Civil works for remediation of existing power station.
- Mobilization, relocation, recycling and/or disposal of defunct equipment related to the existing PV and storage system.

2.2 Services

The following services are the minimum to be provided:

- Co-ordination and liaison with the Employer's Representative at the outset and throughout the entire project.
- Submission of a project programme including witness and hold points for review and approval prior to commencing works onsite.
- Engineering design for the whole system, including a PVSyst and Homer Energy simulation modelling,
- DraftSight, AutoCad, or equivalent for construction drawings for review.
- Submission of provision of drawings, specifications, datasheets, vendor data and standards of compliance, and including submitting the design for review and approval by the Employer's Engineer prior to any equipment procurement or commencing works on site.
- Submission of a testing and commissioning plan for review and approval within four weeks of detailed design approval.
- Construction and commissioning of the full system (including mobilisation and de-mobilisation, and all associated transport and personnel).
- Provide training and capacity building of local staff in the operation, maintenance, and safety of the system.

- Submission of Operations and Maintenance Manuals for review and approval prior to practical completion, and its delivery is subject to practical completion certificate when approved.
- Submission of Health and Safety standard operating protocols for site.
- Submission of Community Engagement plan and feedback channels.
- Warranties of performance and component life.
- Submission of As-Built Drawings for approval and verification prior to practical completion.
- Provide a 12-month Defects Liability Period for the works from the date that practical completion is awarded.
- Supply of spares to be defined by Bidders.
- Supply of a full set of tools, personal protection equipment (PPE), and equipment required for the maintenance and operation of the system.

2.3 Operation and maintenance services (optional)

Provide a 24-month operations and maintenance (O&M) contract offer that includes site visits and inspections, defined by Bidder. The minimum requirements for the O&M tasks should include:

- PV Array Cleaning: 3-monthly
- Vegetation and Debris control: Monthly
- Civil Works Inspection: 6 monthly
- Mechanical works (racking) Inspection: 6 monthly
- Grid and battery Inverter Visual and detailed Inspection: 3 monthly
- BESS visual and detailed Inspection: 3 monthly
- Alerts, alarms, and events log: continuously
- Component Performance Remote monitoring: weekly

2.4 Common Design Principles

The approach taken in this specification has been selected for reasons of future applicability of *Common Design Principles* related to PLN's operations in Maluku. This approach allows for a standardised system configuration that is reliable, scalable, flexible, and serviceable; and yet can be adjusted for the specific site and current load conditions.

Common Design Principles refer to the attempt/objective to use similar or homogenized design considerations, system configuration, components selection, among other criteria that are meant to simplify and unify PLN Maluku and Maluku Utara (PLN MMU) ambitious targets of installing dozens of hybrid solar PV-Diesel-BESS systems.

The project in P. Tiga represents a new generation of off-grid solar PV hybrids for PLN MMU and hence the system is meant to serve as a model installation that its configuration, components, approach, and other implementation tasks might be replicated in future works.

2.5 TKDN (Optional)

To have a broader opportunity of component brands and in-line with potential regulatory requirements and future projects, all Bidders are requested to submit their preferred/optimal solution offers along with an alternative TKDN-compliant solution. Alternative offers are being requested that meet the TKDN component regulation No. 04//M-IND/PER/2/2017 and No. 05//M-IND/PER/2/2017 applicable to solar PV modules, batteries, and other components and services.

Annex A contains a copy of the most recent TKDN regulation in Indonesia. The main offer should present a rapid assessment of the non-TKDN and the TKDN solutions considering, impact on LCOE, capital cost, running and replacement costs, technological components specifications differences, et al.

2.6 Modular design

Bidders must provide details of system modularity for increasing size in the future, scalability and ease of expansion, and highlight any restrictions.

2.7 Base concept design parameters and specifications

The following table summarises the Employer's base concept **minimum design parameter requirements**:

Component	Minimum Specification
PV array	70 kWp – ground-mounted
PV inverters (AC-coupling)	Minimum 2 units – single phase
Grid-forming inverter/charger(s)	**Minimum 2 units** Output: 30 kW continuous – 50 kW peak Capable of accepting diesel generator input to charge the BESS and supply loads
BESS	Li-Ion technology Battery Management System (BMS) can communicate with Battery Inverter Modular Minimum 200 kWh usable capacity
Diesel generator	20 kW rated capacity
Monitoring & Control	Overall system remote online monitoring & control capability, visualized on an internet portal and accessible from anywhere in the world

Assumptions, details, and other technical and financial information is provided in **Attachment J Load Profile and HOMER Modelling Assumptions**.

More detailed Employer's requirements can be found in the following attachments:

Attachment A	**General electrical ERQ**
Attachment B	Remediation & Decommissioning ERQ
Attachment C	PV Generation System ERQ
Attachment D	BESS ERQ
Attachment E	Monitoring & Control ERQ
Attachment F	Diesel Generator ERQ

Attachment G	Testing & Commissioning
Attachment H	O&M Support and Training
Attachment I	Layout, photos and drawings
Attachment J	Load and modelling assumptions

Moreover, the following Annexes provide additional information:

Annex A	**TKDN Regulation Permenperin No.5 2017**
Annex B	NZMATES Cultural Guidelines
Annex C	Mercy Corps' Child Safeguarding Policy
Annex D	List of companies available in Ambon
Annex E.	Bid Documentation Checklist
Annex F.	Existing PV Plant Layout
Annex G.	PLTS Waste and Asset Management Plant
Annex H.	Prevention of Sexual Exploitation and Abuse (PSEA) of Program Participants & Community Members Policy

2.8 Summary of Bid request and options

Bids for system:

- **Main Bid**
- TKDN-compliant bid (Alternative 1)

Optional additions:

- Operation and Maintenance contract for 2 years
- Independent Remote Monitoring Platform
- Operation and Maintenance Platform software/tool for PLN staff operators

3 SITE DETAILS

The physical limits of the hybrid PV-Diesel-BESS are:

- within the boundaries shown in Attachment D
- plus the connection, along formed roads shown in the *Site location* and *Existing infrastructure Drawings* (under item 3. Drawings, in this Section), to the specified electrical connection point(s) (including any upgrades of equipment at the connection point)

The exact coordinates of the site are **3°39'10.6"S 127°54'22.7"E**

1.1 Access

Access to the site has to be done through a beach landing and then up a small hill.

4 GENERAL REQUIREMENTS

4.1 Bidder responsibility

- Bidder shall be responsible to read and fully comply with all the provisions of the employer's requirements including all appendices and specifications.
- Bidder shall perform in a manner subject to current Occupational Safety and Health Administration standards of the Government of Indonesia. It shall be the responsibility of the Bidder to fully comply with these regulations.
- Bidder is required to read the drawings, familiarize themselves with the scope of works – **available in Attachment I**.
- A **site visit will not be possible due to current COVID-19 situation. NZMATES will organize at least two virtual Q&A sessions to respond any questions, provide more context of project, and support Bidders to familiarize with site**. NZMATES will also facilitate as much as possible photos, videos, layouts, and other details that will support Bidders to develop their proposals.
- Bidder shall assume responsibility for performing all work in a professional manner with due care being taken to avoid unnecessary damage to property. Bidder shall be responsible for all damage resulting from carelessness or work performed in an irresponsible or unworkmanlike manner. Bidder shall repair damaged areas to same or better condition than existing conditions.
- Bidder shall perform all work not covered in the Specifications to applicable industry standards.
- All temporary utilities such as electricity, sanitation services or other services required for construction and other facilities such as safety equipment, fire extinguishers, warning signs, lights or special equipment shall be supplied as needed by the Bidder at their expense.
- The Bidder is permitted to use the specified sites for laydown or equipment storage as may be required. Use of any other areas for laydown, storage, parking, or other such activities is generally not permitted, except by express consent of the Employer.
- The Bidder shall be responsible for the security within the Site of Works.
- Bidder shall assume responsibility for disposing of removed vegetation, tree material, soil, asphalt, concrete, and other surplus material at a site acceptable to the Employer at Bidder's expense.

4.2 Health, Safety, and Security

Bidder shall have a Health, Safety, and Security (HSS) management plan, which is documented, known by and available to all personnel, implemented and maintained at all levels in Bidder's organization. Ideally Bidders and subcontractors with ISO:9001, ISO:14001, ISO:45001 or OHSAS 18001 certification as occupational health and safety management system (OHSMS) or equivalent to manage/mitigate occupational health and safety risk, reduce likelihood of work-related incidents and improve legislative compliance.

Bidder shall have HSS rules and corrective actions: including general policy and procedure requirements, such as:

- Site daily safety meetings
- Daily Job Safety Analysis (JSA) records
- Use of personnel protective equipment (PPE) and clothing
- Confined space
- Working near power lines
- Reporting and investigations of near miss events
- Reporting and investigations of accidents
- Housekeeping and sanitation

Bidder is responsible for providing workers of sufficient skill and knowledge to accomplish the Work in conformance with quality and safety requirements. Bidder shall undertake all training required for its workers to execute the contract Work. All Training Documentation shall be provided upon request.

Bidder shall conduct a safety toolbox meeting prior start working every day and at the start of every new significant work item. All personnel shall attend these meetings, and attendance shall be documented. Topics shall be pertinent to the work the Bidder is performing.

Prior to starting work, Bidder's personnel shall complete an HSS orientation on project site to include as a minimum:

- Bidder HSS standards and rules
- Basic safety induction
- Working at height
- Location and availability of first aid and medical facilities
- Method of reporting incidents
- Emergency response procedures and muster points

The Bidder shall record attendance to these events and record whether personnel understand the HSS requirements.

All personnel must wear minimum standard Personnel protective equipment (PPE): Safety Helmet, Safety Shoes, and high visibility vests on site at all times. During the daily job safety analysis all personnel must determine additional PPE to be used, e.g. safety glasses, arc rated overalls, and gloves specifically for staff doing electrical work within project site, as well as additional PPE specific for the tasks they are undertaking. When working at height all personnel must wear body harness with double lanyard alongside with basic PPE.

Fall protection (an approved guardrail, fall restraint or personal fall arrest system) shall be used any time there is a fall hazard of more than 1.8 meters or more above the ground or next lower working surface.

Bidder shall be responsible for providing fall protection and required training for all personnel in accordance with the requirements of ANSI Z359 when working at height.

All personnel shall have certified fall protection competent trained individual on site when working at height, exposed to fall hazards and using fall protection equipment.

The Bidder shall verbally report immediately all injury / illness incidents to NZMATES for the following:

- Fatalities
- Loss time injury/illness
- Restricted work injury/illness
- Medical treatment injury/illness
- First aid
- Loss of consciousness,
- All significant diagnosed injury
- All significant diagnosed illness,
- Environmental incidents (spills); and
- Near misses

Bidder and NZMATES shall investigate all incidents, including near miss incidents, and shall identify the root and contributing causes of the incident. The Bidder shall provide qualified senior management, line management and safety representatives to oversee and participate in incident investigations.

The Bidder shall develop daily Job Safety Analysis (JSA) or permit to work to communicate risks/hazards and the mitigation requirements necessary to protect the individual work personnel based on job tasks being performed. JSA must be approved by supervisor/HSS officer prior to start working.

When hazards are identified, Bidder shall attempt to eliminate the hazard. When elimination is not achievable, Bidder shall control the hazard through use of each engineering controls, administrative controls, additional protective equipment, or heightening awareness of the hazard.

Bidder shall provide a security plan, in compliance with NZMATES security requirements, and which may address, but not be limited to, the following: Security Management; Perimeter Barriers; Access Controls; Protective Lighting; Guard Service Operations; Incident Reporting and Investigation; Security of Information; and Compliance Assurance Program.

4.2.1 COVID-19

Bidder shall follow COVID-19 protocol applied in the Maluku region during construction process. Bidder will develop a Covid-19 management plan and a Business Continuity Plan with potential scenarios.

4.3 Environmentally-sound good practices

Prior to starting work, Bidder's personnel shall complete a Construction Environmental Management Plan (CEMP) for managing waste on site and relevant to activities. The Bidder shall make every effort to keep the Site of Works in a clean and tidy condition for the duration of the Works. The Bidder shall, from time to time, and on completion of any area of the works or were directed by the Employer, remove rubbish, surplus materials or any other construction debris from such areas as may be attributable to the Work under the Contract and generally leave them in a satisfactory condition and to the approval of the Employer.

Upon completion of the Works, the Bidder shall remove all rubbish, debris, temporary earthworks or surplus materials from the site of the Works. The site shall be left in a neat and tidy condition

to the satisfaction of the Employer. When mobilizing materials, be careful not to damage the productive plants (long term or short term) belonging to the community.

Bidders should avoid the use of single-use plastics and seek to minimize waste on-site. All waste generated on-site directly related to works must be removed from Pulau Tiga and manage properly in Ambon waste facilities. Bidder is responsible for properly separating and managing waste in accordance to landfill and recycling facilities available in Ambon. NZMATES will coordinate support from local NGO Green Moluccas to minimize environmental impact of project in community.

In response to the Governor of Maluku initiative on "*Maluku bebas sampah plastic*", the use of plastic bottles/cups is discouraged, and Bidders are recommended to provide reusable water bottles or cups and use of water gallons for drinking water. NZMATES can support with logistics on this.

4.4 Cross-cutting issues

4.4.1 Community engagement

Bidder shall inform and coordinate with government at sub-district, village, and sub-village level on the construction process. Bidder is required to attend the socialization of PLTS improvement project held by NZMATES. Bidder is also encouraged to utilize local community services for provision of food during the construction process. Bidder is required to read, understand, and sign NZMATES cultural guidelines (**see Annex B. NZMATES Cultural Guidelines**) in order to adapt with local community, respect local traditions and ensure positive interactions between Bidder and local community.

Bidder shall establish proper feedback channels and regular communications with community regarding works, interruptions, and support necessary. Bidders must assign a Community Representative that will be responsible for providing updates to community leaders and members, being available for questions or feedback from the community and ensuring that a positive relationship and strong engagement with the local community is maintained throughout the contract works.

4.4.2 Gender inclusion

Bidder is encouraged to ensure women's involvement in the PV-diesel-battery mini-grid project activities. An equal gender representation is highly encouraged for personnel involved in the design, engineering, management, construction, engagement, and training activities.

4.4.3 Human rights

Mercy Corps has zero tolerance for any contact towards children that is exploitative or abusive, and towards sexual exploitation or abuse of any community members.

Bidder is required to read and understand Mercy Corps' **Child Safeguarding Policy** (See Annex C) and **Prevention of Sexual Exploitation and Abuse (PSEA) of Program Participants & Community Members Policy** (see Annex H) prior to construction, and to ensure that all personnel adhere to them at all times during the implementation of this contract, including non-working hours spent in the Pulau Tiga community.

Bidder is required to participate in an induction session on these policies provided by NZMATES prior to construction.

4.5 Local resources

Construction materials including water, sand, and stones, cannot be extracted from P. Tiga and must be brought from outside the island.

It is recommended that Bidders use human resources from Maluku as much as possible for construction, logistics, electricians, and/or other services. It is recommended that bidders build partnerships with companies that are members of the Indonesian Electrical Bidders Association (AKLI), Ambon branch, and shipping service companies in Ambon in order to support the implementation of the work. **See Annex D. List of companies available in Ambon.**

Bidders are also encouraged to use human resources from P. Tiga. Some of the available skills in P. Tiga are carpenters, logistical support, modules install, et al. NZMATES can provide potential contacts in P. Tiga for people that can support community engagement work, logistics, accommodation, food, workforce, and other services which Bidders are highly encouraged to use, and this should be highlighted in proposal.

4.6 Engagement with PLN MMU staff

The Bidder must have a close coordination with PLN Maluku and Maluku Utara (MMU) Wilayah for execution of works and access to sites. NZMATES will support coordination meetings between Bidder, PLN MMU, and NZMATES at a bi-weekly frequency. PLN MMU staff will work along the Bidder to ensure that PLN MMU team is well informed and versed in the works of the PLTS. Moreover, the use of PLN MMU in the works and support build the site is highly recommended.

4.7 Innovative solutions

Suppliers are encouraged to submit innovative concepts, ideas, and seek to highlight as much as possible design, construction, equipment, configuration, or other innovative approaches that can lead to better performance, efficiency, lifetime, environmental sustainability, et al.

5 EARTHWORK

5.1 Excavation

Excavate aggregate material from on-site locations as indicated when directed by Employer. Stockpile materials and spoils on site at locations approved by Employer. Direct surface water away from stockpile site to prevent erosion or deterioration of materials. Stockpile unsuitable or hazardous materials on impervious material and cover to prevent erosion and leaching, until disposed of. Remove all disturbed load bearing soil, which is no longer has its original bearing capacity. Trim excavation. Remove loose matter.

Remove lumped subsoil, roots, stumps, loose dirt, broken asphalt or concrete, boulders, and large rock. Notify Employer of unexpected subsurface conditions. Correct areas over-excavated with material as directed by Employer. Prevent displaced or loose soil from falling into excavation; maintain soil stability. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

5.2 Backfill

5.2.1 Examination

Verify subgrade is suitable for placement of backfill.

5.2.2 Preparation

Compact subgrade to density requirements for subsequent backfill materials.

Cut out soft areas of subgrade not capable of compaction in place. Backfill with suitable structural fill and compact to density equal to or greater than requirements for subsequent fill material.

5.2.3 Backfilling

Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet or spongy subgrade surfaces.

Place backfill in maximum 20cm layers and compact to 95 percent, maximum dry density, ASTM D698, Standard Proctor. Lift size may be increased when it is demonstrated that compaction requirements can be met using other methods. The Engineer will make the final determination on the thickness of each lift in the field.

Maintain optimum moisture content to backfill materials to attain required compaction density.

5.2.4 Tolerances

Top Surface of general backfilling: plus or minus 3cm.

Compaction Testing: In accordance with ASTM D698.

When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

Engineer to perform a site inspection to examine all bearing surfaces after compaction.

5.2.5 Protection of Finished Work

All areas showing signs of settlement shall be filled and maintained by Bidder during all construction phases and for a period of one year following the date of final acceptance. When Bidder is notified by the Engineer that any backfill is hazardous, the condition shall be corrected at once.

Bidder shall be responsible for supplying, at the Bidder's expense, with suitable soils tests from a licensed independent soils testing laboratory, with gradient and proctor density data for any material used in the work for backfill.

5.3 Discovery of archeological and other historical items

In the event of an archaeological find during any phase of construction, the following procedure will be followed:

- Construction shall be halted, with as little disruption to the site as possible.
- The Bidder shall notify the Engineer in writing.
- The Engineer will review the situation and will direct the Bidder how to proceed.

5.4 Construction site erosion and sediment control measures

Bidder must construct temporary earth embankments to divert storm water flow from the construction site and creating sedimentation runoff from the exposed soils to reduce pollutants from storm water runoff from construction activities that result in a land disturbance. Bidder must also ensure necessary civil works are done to avoid site erosion after the construction.

6 SCHEDULE

Bidder to provide construction schedule with bidding documents which will be reviewed and accepted by the Employer. Construction schedule shall be coordinated with the Employer, PLN, and local community.

7 DESIGN and DOCUMENTATION

7.1 Design documentation for bid

The Bidder is responsible for preparation of the detailed design for the whole hybrid PV-Diesel-BESS power plant, as well as a Homer Energy simulation. Design drawings, calculations and plans should be prepared and submitted as part of the supporting documentation of the current bid. The following is the minimum list required of preliminary drawings and documentation to be submitted for the current tender process:

- Site Layout drawings
- Sub-surface works layout drawings
- Powerhouse and security fence remediation plan
- Solar array footings/ foundation and mounting drawings
- Solar array layout and SLD
- BESS layout, schematic and SLD
- Switchboard layout, schematic and SLD
- SLD of whole system
- Details on earthing and protection plan
- Details on cabling, trays, and trenching
- Communications network drawing
- Homer Energy balance modeling for the proposed system.

All drawings shall be provided in A3 CAD (e-transmit) and PDF format in English, clearly labelled and legible. Datasheets of all major components are to be provided, including at a minimum:

- Solar PV modules
- Mounting system
- Power conditioning equipment (i.e. inverters, charge controllers (if applicable), etc).
- BESS
- Cables, Connectors, Cable terminations and Junction / Combiner boxes
- Lightning arrestor
- Switchgear & Protection gear
- Monitoring & Control system
- Meteorological station

Annex E. Documentation Checklist provides a list of all the minimum documentation that has to be submitted by all BIDDERS:

7.2 Design documentation – contract

The drawings shall be in accordance with PLN requirements and shall use IEC electrical symbols. Documents required to be submitted for approval after works onsite are completed:

- Provide hard copies of as-built plans and an electronic digital copy in AutoCAD version DWG format. As-Built Drawings means a drawing or series of drawings that depict improvements as they were actually constructed, and that are drawn to the same scale,

with the same detail, accuracy, format and form as the drawings that were submitted for original approval.

- Manufacturer's software packages needed for future operation and maintenance
- Operations manuals, logbooks, and asset register
- Commissioning report
- Documents required to be submitted for review during or after works onsite:
- Weekly & Monthly progress reports
- Safety incident reporting
- Environmental incident reporting
- Monthly safeguards monitoring report
- List of maintenance tools supplied
- List of other tools that the employer should hold
- One hard copy and one electronic copy (in pdf) of the Operations and Maintenance manual in Bahasa Indonesian
- The O&M Manual **must** comply with PLN formats and must be redacted in accordance to PLN procedures and protocols. Operational reports from PLN must be included in the O&M manual.
- Ten-year Maintenance plan

8 WARRANTIES

Upon completion of all work to be performed under this contract and acceptance of same by the Employer, the Bidder shall execute and deliver in a form satisfactory to the Employer, a guarantee that all workmanship and materials used in the performance of the contract shall remain free from defects for a period of two year from the date of the completion as determined by the Employer. The Bidder shall repair any defects during the warranty period at their own expense.