



UNDP-GEF BRANTV Project ID 5926
Department of Energy (DoE), Ministry of Climate Change, Private Mail Bag 9067
Nambatu, Port Vila, VANUATU, Tel: +678 25201

TERMS OF REFERENCE

Consultancy:	To Supply, Deliver and Install the Low Voltage Single Phase Distribution Network for a Pico Hydro PV Solar Hybrid System in Lol tong, Pentecost Island.
Unit	: Project Management Unit (PMU)
Languages Required	: English
Start Date	: 24 th May 2021
End Date	: 31 st July 2021
Duty Station	: Lol tong North Pentecost
Project Title	: Barrier Removal for Achieving the National Energy Road Map Target of Vanuatu (BRANTV)

1. Background

The UNDP, being the implementing agency on behalf of the Global Environment Facility (GEF), is supporting the Government of Vanuatu through the Department of Energy (DoE) in implementing the Barrier Removal for Achieving National Energy Road Map Targets of Vanuatu (BRANTV) project. The project's objective is to enable the achievement of the energy access, sustainable energy, and green growth targets of Vanuatu, as represented in the country's National Energy Road Map (NERM). It does so in the interrelated areas of capacity, policy and planning, institutional framework, financing, and technical and economic viability. Central to the approach is demonstration of sub-programs in each of hydropower, village-scale PV, household and family compound-scale PV, Energy Efficiency (EE) cook stoves and productive livelihood-enhancing uses of RE and EE.

The BRANTV Project Management Unit (PMU) had worked in collaboration with the DoE, the Technical Working Group (TWG) and the Communities to identify 40 project sites demonstrating RE Off-Grid Community-Scale PV solar systems, Family-Compound Nano-Grid, Pico-Hydro power systems and Pico-Hydro PV Solar Hybrid mini-grid. These demo sites are based on the GEF requirement of funding incremental activities of existing Community energy project or Community planned energy project.

Lol tong community in North Pentecost was the only site identified to demonstrate Pico Hydro Solar PV hybrid system. This is to rehabilitate an existing Pico Hydropower system that was constructed by the Community in 2016, funded by the New Zealand High Commission Small Grants Programme, the Vanuatu Government and the Community. The Government of Vanuatu through the New Policy Proposal (NPP) funding facility will support GEF/UNDP funding towards the implementation of the hybrid system.



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The Project Management Unit (PMU) took 2 years to conduct feasibility study of Lolong. This study involves site inspections, load demand surveys and data collections to substantiate demonstrating RE Off-grid mini-grid with the proposed technology application. In this period, stakeholders and suppliers were consulted and technical contracts with required expertise were employed as part of retaining capacity but most importantly to confirm confidence in the economic and technical viability and long-term sustainability of sustainable energy of Lolong demo site. Based on the assessment the hybrid system at Lolong will be supplying electricity to 107 potential end users. The 107 potential users constitute of residential homes, small business retail shops, boat & vehicle workshops, wood carpentry, a health clinic and two schools.

This demo hybrid mini grid system is summarized in Table 1 below:

Table 1. Summary of the Pico Hydro PV Solar Hybrid System.

Component	Detail
Hydroelectric generation	6.4 Kw
PV solar generation	2.6 kWp
Grid forming Inverter/charger	15 kVA 48V
Battery bank	30 kWh LFP
230V 50Hz single-phase underground distribution network	2.8 km
Potential end users	107

Both generation sources of the demo hybrid system will be installed in the generator house. The output of the generators will be AC and DC-coupled to the system in the control room. The control room, situated around 300 m from the generator house, will house battery bank, the grid forming/inverter and the AC distribution panel where the 230V 50Hz single-phase distribution network will originate from. A total of 107 potential users will be connected to the distribution network using a metering system.

The PMU is seeking the expertise of a Supplier/Vendor or a Contractor to supply, deliver and install the Low Voltage Single-Phase Underground Distribution Network, and metering system for a Pico Hydro PV solar Hybrid mini grid System in Lolong on Pentecost Island.

The contractor is also required to supply, deliver and install the required service line, protections and internal wiring requested by each willing-to-be-connected user. Each user will have to cover the cost of its installation. The PMU will provide support to survey the needs of each user.

2. Objective:

The objectives of the assignment are as follows:

- I. Supply and Deliver the specified items/materials including any necessary accessories for the distribution network and metering infrastructure,
- II. Construction & Installation of the distribution network,



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- III. Construction & Installation of the metering system
- IV. Supply, deliver and install the required service line, protections and internal wiring requested by each willing to-be-connected user,
- V. Perform test and commissioning of the distribution network, metering system and HH wiring, and
- VI. Provide training on operation of maintenance of distribution network and metering system (including billing system) to the appointed Energy Committee (in charge of the system operation) and DoE staff.

3. Scope of Work:

More specifically, the selected contractor will be responsible for:

- a) Supply, delivery, installation and commissioning and testing of all the necessary items and materials specified in Table 2 below for the 230V, 50Hz, single-phase distribution network. Noting the following:
 - The distribution network will start on the AC distribution panel to-be-installed in the control room. The AC distribution panel will be supplied and installed by the contractor in charge of this part of the installation and it is not part of this scope of work. The AC distribution panel will have three single-phase circuit breakers and each section of the distribution network (3) will connect here.
 - The project has already purchased most of the cables required for the distribution line (indicated as available on site in Table 2 below). Some of the cables are CU 4 core + E but the installation is to be done single-phase, utilising two of the cores for line and two cores for neutral.
 - The interfacing of the CU and AL conductors needs to be addressed properly to prevent electrical corrosion and increased temperatures. All connections need to be done using cable lugs and/or ferrules as necessary.
 - The contractor is requested to supply conduit and accessories as required to meet applicable standards and to prevent potential damage of the cables.
 - The installation needs to comply with AS/NZ standards including but not limited to NS130 and AS/NZS 3000:2018 standards.
 - Layout of distribution network and location of users is displayed in figure 1 below. Additionally, a google earth file with all available information and a spreadsheet with the list of users, projected demand, distribution pillar to be connected to and distance to their distribution pillar can be supplied upon request.
 - The contractor has flexibility to propose the type of distribution pillars to be used and an alternative layout allowing to achieve a more affordable overall installation. The distribution pillars used should be capable of housing service fuses and/or disconnect switches as required. They should allow for the disconnection of any user without causing a service disruption to any of the other users serviced from the same distribution pillar. The pillars should be outdoor



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rated, made of UV stable material rated for marine environments and to be grounded according to manufacturer specifications and applicable AS/NZ standards. They should be installed at the edge of the existing roads and paths so that they do not disrupt the traffic of vehicles and people and need to be elevated a minimum of 20 cm to avoid ingress of water in case of flooding.

- There are three sections of distribution line that are required to be installed overhead (see Figure 1 below). The number and location of poles to be utilised in each section and the specifications of the poles and accessories to be used is to be defined by the contractor. They need to comply with applicable AS/NZ standards.
 - Both distribution pillar and poles should be rated to withstand a design wind speed of 70m/s.
 - The soil is partly rocky. The community is fully responsible to do all the trenching works required for the installation of the underground distribution networks. The community will also provide labor for any other civil works required. DoE will provide continuous support for the coordination and supervision of the works to be done by the community.
- b) Supply, delivery, installation and commissioning and testing of all the necessary items and materials specified in Table 2 below for the metering system. Noting the following:
- The project currently requires the installation of 107 meters for 107 users. In addition to the 107 meters to be installed, the project also required the supply of 8 meters and enclosures to be kept as spare for potential additional connections.
 - The meter should be of pre-paid type with a user-friendly interface for recharging. The recharging process can be done using scratch cards, tokens, RF cards or automatically through a remote server. Additionally, the meter should have a screen and/or a LED light that visualises main parameters such as credit balance, daily energy consumption, total energy consumption, and alarms (e.g., low energy or credit balance, overcurrent, etc). The meters should be supplied with current limiters and anti-tamper detection such as opening cover and reverse connection. They should be able to support service-based, energy-based and time-of-use (TOU) tariffs and a daily energy control algorithm.
 - Several meters can be installed together in a centralised support structure. This structure should be made using welded galvanised steel C profiles rated for marine environments. The structure foundations should be made of concrete and it should be electrically grounded. The foundations should be enough to withstand the design wind speed (70m/s).
 - Each meter should be installed inside of a sealable, IP 65 rated enclosure. The meter centralisation will be installed next to the distribution pillar where the meters are connected to.
 - The output of each meter should be connected to a 2 poles 30mA 20Amp RCD installed in the enclosure.



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- The management of the payments process and overall operation of the metering system will be responsibility of the Energy Committee. The contractor should train the Energy Committee and DoE so that they are fully capable of managing the metering system.

Table 2. List of materials & items for the distribution network.

Item	Quantity ¹	Status
Dominion 4C+E 35mm ² CU underground cable	182m	200 m available on site
Dominion 4C+E 25mm ² CU underground cable	1,106m	1,300m available on site
Dominion 2C+E 16mm ² CU underground cable	1,118m	1,500 m available on site
Underground conduit and accessories	As required	To be supplied by contractor
Distribution pillars– inclusive of required protections, grounding and accessories	23 ²	To be supplied by contractor
2C 25mm ² AL aerial conductor	64m	To be supplied by contractor
2C 50mm ² AL aerial conductor	90m	To be supplied by contractor
Distribution poles and accessories	As required	To be supplied by contractor
Meters, enclosures and support frames	107 to be installed and 8 spares	To be supplied by contractor

- c) Supply, delivery, installation and commissioning and testing of all the necessary material required to connect each user to the corresponding meter and provide an internal wiring installation. Noting the following:
- The cost associated with each installation will be covered by each user. The project does not cover this component.
 - The service line should be installed using underground rated 6mm² cable under a conduit. Loltong currently has over a 1km of 6mm² underground cable installed from the previous electrification project. The contractor should evaluate if the condition of this cable is adequate to be utilised for the service line and to reduce the cost of the installation to the community. The community will be responsible for any work required to dig out the already installed cable. The PMU will support with the coordination of this activity.
 - All residential end-users are expected to require the similar installation which should be composed of the following elements:
 - 3 x 5W LED lighting fixtures;
 - 3 x switches (1x per lighting fixture);
 - 2 x 10A surface sockets;
 - 1 x switchboard inclusive of (1 x 20A 30mA Residual Current Device and 1x 10A³ circuit breaker);

¹ The distances has been measured manually and a 10% margin has been added.

² Contractor can propose an alternative distribution pillar configuration if it allows a more affordable design.

³ Current limiting is to be controlled by the meter. The circuit breaker rating is selected according to the size of the conductor to be used (1.5mm²)

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- Required cabling (minimum 1.5mm²), trunking, and grounding system.
- The final number of lighting points, sockets and switches to be installed to each user will be provided by the PMU once the cost for each unit is agreed with the contractor and communicated to the users.
- Each user will support the installation by digging the trench required for the service line.
- The PMU will also support the contractor and the community to organise the payments to be done by each user for this component.

In addition to the above information, below are a few pictures that illustrates the overall distribution network.



Figure 1. Google Earth view showing the overall distribution network and distribution pillars.

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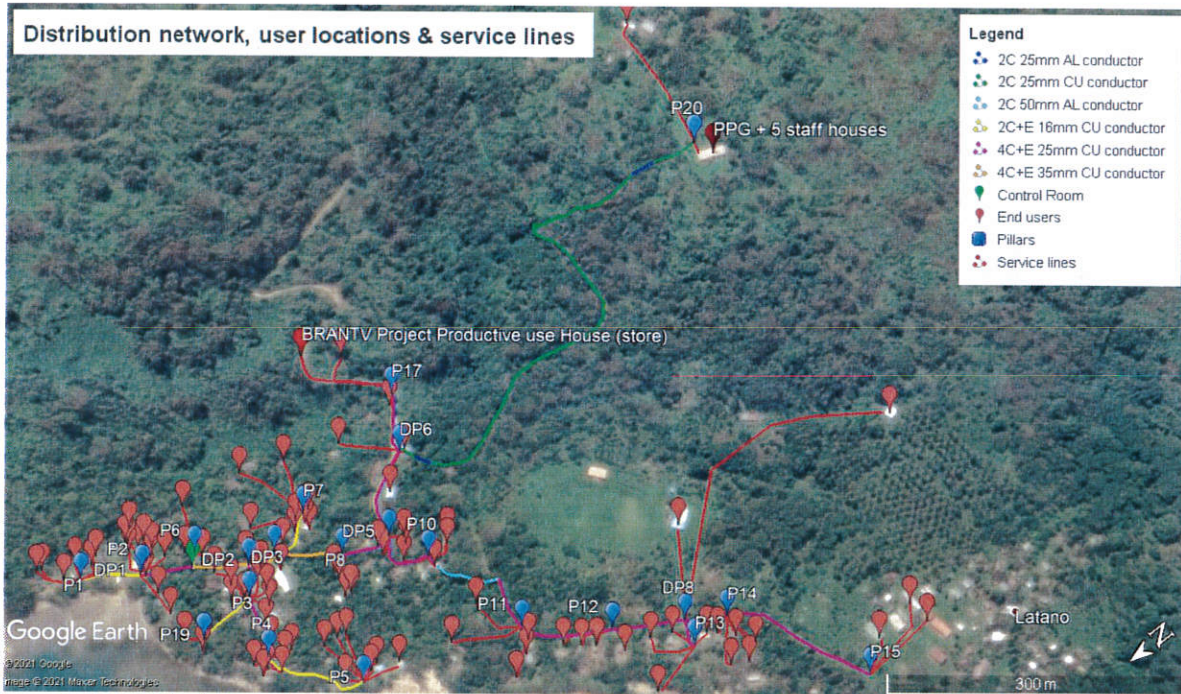


Figure 2. Google Earth view of the distribution network, user location and service lines connecting to the corresponding pillar.



Figure 3. Creek that normally floods during heavy rainfall. Conductor needs to be aerial.

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Figure 4. Small creek crossing that normally floods during heavy rainfall. Conductor needs to be aerial.



Figure 5. Road crossing a creek that normally floods during heavy rainfall. Conductor needs to be aerial. Typical soil composition (partially rocky) can be observed in this picture

4. Core competencies and Experience

The contractor is expected to meet the following core competencies & experience;

- a) At least 5 years of professional experience in designing, constructing and installing low voltage distribution networks and/or micro-grids including the metering infrastructure.
- b) Recognized licenced contractor with resources to complete the task within the specific timeframe
- c) A track record of undertaking similar assignment in the past in similar rural communities in Vanuatu.
- d) Previous experience installing and operating and maintaining pre-paid metering systems in rural areas of Vanuatu



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5. Duration of the Work

The duration of the contract will be up to 2 month, and is expected to commence in May 2021 and ends in July 2021.

6. Key Deliverables and Schedule of Payments

Payment will be made upon acceptance/approval of the key deliverables as shown in the below schedule:

	Deliverables	Percentage payment linked to the outcome
1	Provide a detailed workplan that outlines how to execute the assignment	50% of contract amount
2	Conduct commissioning and testing of the distribution network and metering system. Training on operation and maintenance of the distribution network and metering system to Energy Committee and DoE completed.	50% of contract amount

7. Administration and Logistics requirements

The selected contractor will be responsible for:

- arranging and directly covering the costs of the most direct route for its transportation to and from Loltong, Pentecost.
- arrange its accommodation in Loltong with the assistance from the PMU.

8. Institutional Arrangements

The selected contractor will report directly to the BRANTV Project Manager and the appointed Supervisor that will be available on site during the installation phase.

9. Evaluation criteria

The winning bidder will be the bidder meeting the core competence and experience requirements and submitting lowest valued (in Vatu) technically compliant offer meeting.



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10. Recommended Presentation of Offer

- Detailed offer including cost in Vatu per unit (delivered in Loltong) for each material to be supplied as indicated in table 2. The list of material can be complemented with any additional accessories (cables, ties, cement...) required to complete the installation.
- Provide separate labor cost required for the installation of the distribution network and metering system. The labor cost needs to be provided per unit (day) using different rates for different type of labor.
- Provide brief description on the team that will implement the project including project management and installation crew.
- Provide details of previous experience as required in Section 4 (Core Competencies and Experience)
- Provide datasheet and required drawings (if necessary) of all material to be used for the distribution network and metering system. Detail explanation of the operation of the metering system (including billing) needs to be provided.

11. Timeframe

Offers to be submitted electronically by email or hand delivered to the office of Energy Department before 5pm 10th May 2021 to:

Ms. Doreen Leona

BRANTV Project Manager

Email: dleona@vanuatu.gov.vu or gmail: doreenleona16@gmail.com

Phone: + 678 25201 or Mobile + 678 7741034

12. Approval


This ToR is prepared by : Doreen Leona

Signature : 

Name and Designation : BRANTV Project Manager

Date of Signing : 27 April 2021

This ToR is approved by : Antony Garae

Signature : 

Name and Designation : Director, Department of Energy

Date of Signing : 27 April 2021

