

Supply, Installation, Testing and  
Commissioning of Solar PV Mainstreaming for  
SOCOTECO II Franchise Area

## TERMS OF REFERENCE

### *Work Package 2.2: PV Mainstreaming in SOCOTECO II Franchise Area*

#### **I. BACKGROUND**

- I.1** Work Package 2.2: PV Mainstreaming in South Cotabato II Electric Cooperative Inc. (SOCOTECO II) Franchise Area is one of the fifteen (15) work packages to be implemented under Integration of Productive Uses of Renewable Energy for Sustainable and Inclusive Energization in Mindanao (I-PURE Mindanao). The said project is to be implemented by the National Electrification Administration (NEA) in collaboration with Mindanao Development Authority (MINDA) as co-implementer.
- I.2** The specific objective of I-PURE Mindanao is to augment energy access and livelihood opportunities of poor off-grid, un-electrified and under-served households in rural communities in Mindanao through sustainable and renewable energy solutions.
- I.3** Work Package 2.2 aims to augment the availability of electricity service in the franchise area of SOCOTECO II through the provision of one thousand five hundred seventy-seven (1577) solar home systems and demonstrate that it is a viable least-cost electrification option for off-grid and widely dispersed households.

#### **II. RATIONALE**

- II.1** In April 2020, the Department of Finance (DOF) signed the European Union Access to Sustainable Energy Project (EU-ASEP) Financing Agreement rider earmarking additional €6 Million, of which €4.5M Million can be tapped to fund livelihood and electrification projects using renewable energy solutions in the marginalized and disadvantaged communities in Mindanao.
- II.2** On 08 June 2020, the Department of Energy (DOE) recommended to the Head of Development Cooperation of the Delegation of the European Union (EU) to the Philippines, NEA as Program and Fund Manager of the €4.5 Million Funding for pro-poor electrification and renewable energy innovations. This €4.5 Million was covered under the signed Addendum No. 4 to Financing Agreement N° ACA/2014/035-111 between the Republic of the Philippines and the European Union.
- II.3** NEA, together with MINDA, as co-applicant and other partners namely Cotabato Electric Cooperative Inc. (COTELCO), South Cotabato II Electric Cooperative Inc. (SOCOTECO II), Tawi-Tawi Electric Cooperative Inc. (TAWELCO), Sultan Kudarat Electric Cooperative Inc. (SUKELCO), Mindanao State University – Tawi-Tawi (MSU) in coordination with the local government units (LGUs) submitted a proposal for the action entitled “Integration of Productive Uses of Renewable Energy for Sustainable and Inclusive Energization in Mindanao (I-PURE Mindanao)” on March 29, 2021.
- II.4** Hence, on April 16, 2021 the EU awarded financial contribution to finance the implementation of the project through a 100% Grant Agreement signed between EU, and NEA as lead applicant.

#### **III. PROJECT DURATION**

- III.1** The project duration covering the installation of the 1,577 50W-solar home system units shall be for a period of nine (9) months from the issuance of Notice to Proceed (NTP).
- III.2** Exact dates of delivery and/or completion should be reckoned from the date of CONTRACTOR’s receipt of NTP.
- III.3** The liquidated damages shall be imposed for the inability of the CONTRACTOR to comply with the Approved Delivery Schedule, unless a written request for time extension been approved in writing by NEA.

#### IV. SCOPE OF WORK

This tender is for design, supply, and installation of stand-alone prepaid modular **SHS** packages with Lithium-based batteries, associated Vending Machines, warranties of equipment, provision of spares, and training of member-consumers-owners (MCOs), Solar Business Unit (SBU) staff, and Community Based Technicians (CBTs), to electrify rural households using SHS with Lithium-based batteries, all to specifications herein and in verified proper working order.

Prior to installation, SBU teams from SOCOTECO II will precede the contractor team(s) by several weeks to identify specific households within the target areas defined in the bid lot definitions who are able and willing to pay for the level of Solar as a Service (SaaS) being procured in this bid. These households will be signed up by SOCOTECO II as MCOs.

Once the pilot one hundred (100) installations are accepted then the contractor may proceed with the remaining installations. The total duration of the contract is eight and a half (8.5) months from contract signing to supply and installation of all SHS packages along with the vending stations, and trainings. Another ten (10) days is given to complete the Final Training of the SBU staff and conclude the project activity.

NEA, in coordination with SOCOTECO II, will conduct inspection and acceptance of Solar Home System (SHS) and its associated Vending Machines. After acceptance, proper ownership of the goods installed will be passed onto the SOCOTECO II Electric Cooperative Solar Business Unit (EC SBU). Subsequently, after final acceptance, a 24-month warranty period will be honored.

The Scope of Work by the Contractor will include, but not necessarily limited to:

- 1) An **Installation Plan** will be a working document drawn up by the Contractor together with the EC SBU, to ensure efficiency and minimize installation time. The Plan is to be shared with NEA at all times.
- 2) **Tool Kits** are to be delivered to SOCOTECO II to ensure proper operations and management (O&M) by the EC in maintaining the performance of all installed SHS.
- 3) **Provide Training Program** organized in five (5) parts for the EC SBU technicians, CBTs and Selling Point Vendors.
- 4) **Pilot installations.** At the commencement of the installation period, a total of 100 SHS and their associated Vending Machines shall be installed. Installers should familiarize themselves with the inspection requirements and acceptable tolerances (section IX.3), verification checklist (section IX.4), technical specification (section XIII) and Installation of SHS (section XIV).
- 5) **Member-Consumer-Owner Instruction** shall be provided in the use and care of the SHS package, provision of one user manual per household, and provision of one community poster per sitio or purok or household cluster.
- 6) **Installation of 1,577 50W - solar home system units** within the franchise area of SOCOTECO II and must be in compliance with Philippine Electrical Code (PEC). The recipients must be included in the approved list of beneficiaries to be provided by NEA.
- 7) **Weekly Reporting of Installation activities** requires providing an **Installation Acceptance Sheets (IAS)** and detailed per beneficiary installation pictures confirming the installed SHS by the MCO triggering the inspection/verification for each milestone.

- 8) **Warranty Period.** A twenty-four (24) month warranty period that starts on the day of Verification Acceptance from NEA received by the Contractor for the last installation on the lot where the Contractor will expeditiously resolve all warranty claims by the EC SBU, replacing all faulty parts as necessary, on top of the component warranty requirements.
- 9) **Spares** as specified are to be provided by the Contractor but their management shall be undertaken by the EC SBU, ensuring that spares are complete and available.

## V. PRE-AWARDING ACTIVITY

Prior to awarding and after receiving a Notice of Lowest Calculated Bid, the Contractor shall assist NEA, together with SOCOTECO II, and DOE as observers in undertaking the Factory Acceptance Test - Light (FAT-Light) requirements within seven (7) days after receipt of the said Notice. If the NEA representative(s) are satisfied, NEA will release a Factory Acceptance Certificate with “passed” remark and a Notice to Award and Notice to Proceed will be released soon after to the Contractor. If the NEA representative(s) are not satisfied, NEA will issue a Factory Acceptance Certificate with “failed” remark to the Contractor, and release another Notice to the next Lowest Calculated Bid.

## VI. PRE-INSTALLATION PREPARATION

### VI.1 Installation Plan

The Installation Plan is a key document to optimize the installation schedule by careful planning of logistics and grouping and sequencing of clusters. For the initial draft of the Installation Plan, SOCOTECO II might not have signed-up all the households (HHs) to receive an SHS, thus it is imperative that the Contractor work with the management of the EC to understand how they will be allocating resources to this task and structure their installation thereafter accordingly.

Given the Installation Plan is a live document informing NEA of the progress of the Project, it will also be used to record and inform NEA of any schedule impact the Contractor is facing.

The Contractor must take full responsibility to keep the Installation Plan up to date and to submit to NEA each updated version within 3 calendar days of such updating.

Detailed list of households (beneficiaries) per barangay is provided below:

<b>Barangay</b>	<b>Municipality</b>	<b>No. Sitios/Puroks</b>	<b>No. of Households</b>
Baliton	Glan	10	88
Bato	Glan	2	2
Batotoling	Glan	6	46
Batulaki	Glan	5	50
Big Margus	Glan	5	128
Burias	Glan	7	71
Cablalan	Glan	4	39
Calabanit	Glan	6	23
Congan	Glan	15	329

Cross	Glan	8	109
Datal Bucay	Glan	9	110
E. Alegado	Glan	21	457
Glan Padidu	Glan	2	21
Gumasa	Glan	1	1
Ilaya	Glan	5	49
Kaltuad	Glan	19	172
Laguimit	Glan	21	176
Lower Mainit	Glan	1	3
Malungon Gamay	Glan	3	11
Mudan	Glan	12	178
Nagpan	Glan	1	2
New Aklan	Glan	15	205
Pangyan	Glan	8	96
Poblacion	Glan	6	15
Rio Del Pilar	Glan	16	231
San Jose	Glan	6	30
San Roque	Glan	1	1
Small Margus	Glan	10	129
Sufatubo	Glan	10	160
Taluya	Glan	8	72
Tamban	Glan	14	57
Tango	Glan	2	11
Tapon	Glan	10	49
Upper Mainit	Glan	2	9
<b>TOTAL</b>		<b>271</b>	<b>3130*</b>

*\*Excess of 1,553 will serve as a buffer for those beneficiaries who will back-out*

## VI.2 Tool Box

The Contractor shall provide Technicians with tool boxes, with the necessary tools for SOCOTECO II technicians to troubleshoot, repair and replace main components such as panel, battery, charge controller and lamp. The toolbox shall contain at least the following items:

No.	Tool/Item
1	set Jewelers' screw driver
1	Philip screw driver
1	Slotted (-) screw driver
1	Side Cutter
1	Long Nose plier
1	Alligator/Square Jaw plier
1	Digital Multi-meter 0-10A <sub>DC</sub> /1-200V <sub>DC</sub> with fuse protection (10A)
1	Gas/Butane Solder
1	Magnifying Glass
1	Rechargeable LED Flashlight
1	Robust Toolbox

**Table 1: Tool Box Requirements**

The Contractor shall also include any other specific tools required for right manipulations of the solar packages by EC technicians and other equipment that is necessary for the implementation of the Project by the ECs, e.g. adapted tool for tamperproof screws. A

minimum of *5 Tool Boxes including 2 units of GPS are to be provided, prioritizing the SOCOTECO II EC SBU Technicians.*

### **VI.3 Vending Machine Systems**

The Vending Machines and their operation are critical to ensuring a sustained revenue for the SBU and thus ensure the main objective of the program and PVM – for the SBU to become a new business line of the EC providing electrification to the off-grid households.

Immediately prior to the commencement of the installations of SHS into a new cluster area, the Contractor must activate the Vending Machine as requested by the SBU having trained the operator and undertaking testing ensuring proper operation.

### **VI.4 MCO Instruction & Support Material**

The Contractor shall be responsible to provide adequate instructions to MCOs on the proper use of their solar package.

The Contractor shall be responsible to deliver the following **support materials**:

- a) Visual aids for each training team (large poster A4, comic strip, movie, etc.) using English with local dialect translation;
- b) A User Manual / Poster, laminated with plastic (weatherproof plasticised folder or A4 poster) for each MCO; and
- c) A verbal-walk through of the User Manual/Poster with the MCO immediately after installation – ideally with two adult members of the MCO household.

**The Contractor shall prepare these instructions to individual MCOs based on the following:**

- a) The instructions are dedicated to rural MCOs most of whom have little or no electricity/technical background;
- b) The instructions will be very simple and straightforward presenting key information in an easy-to-understand manner;
- c) Language of the User Manual / Poster shall be Tagalog or in Tagakaulo and Blaán, as agreed upon by the EC SBU;
- d) The instructions shall be conducted in Tagalog or in Tagakaulo and Blaán, with the occasional assistance of the EC technician able to translate when needed;
- e) The instructions shall be provided to each MCO just after the installation (and before signing of the IAS);
- f) A maximum of two pages (back-to-back A4 paper) should be enough for the MCO to understand the basics of the system (how it works, how to use it properly, how to identify failed components or system faults, and how to ask for help).

**The Contractor shall include in its bid the detailed content of the support materials, for approval of NEA, which should cover at least the following topics:**

- a) What is a PVM Solar Kit?
  - Solar kit operating principles: “Catch-Store-Use”, the relationship between energy available daily and sunlight conditions, shading, battery charge and discharge, status indicators and protections.
  - System components, type of appliances.

- Typical day load schedule illustrating the number of hours of use of appliances vis-à-vis daily available energy.
- b) What does the MCO need to know about SHS operation and maintenance?
- How to know the number of days left in the credit and battery charge level.
  - Load management - how to optimize appliance use when solar conditions are suboptimal.
  - Do's and Don'ts of proper operation and use.
  - Maintenance activities including panel cleaning and trimming trees to prevent shading.
  - Recommendations in case of extended periods of system non-use.
  - Safety procedures and precautions (if any).
  - Warranties and limits of the system.
  - How to pay for the service?
  - Prepayment and credit management (How to purchase credit and reload the system?).
- c) How to troubleshoot?
- Basic fault diagnosis and key indicators of system or component failure.
  - Contact information for Service Support and break-down maintenance service.

As mentioned above, the Contractor shall be responsible to deliver a User's Manual to every MCO receiving a SHS package. The Manual shall be prepared before installation starts, based on the above requirements, and approved by NEA before replication.

## **VI.5 Technician Training & Support Material**

The Contractor shall provide comprehensive and properly documented training to both the Community Based Technicians (CBT) and the SOCOTECO II EC SBU Technicians as specified below. CBTs act as the first line of O&M, addressing more complex troubleshooting issues than MCOs have been instructed in recognizing and fixing themselves, but referring upward to an EC SBU Technician should the issue be out of the CBTs scope or parts need to be replaced. The SOCOTECO II EC SBU Technician is responsible for the post-installation services on full O&M of the SHS and Vending Machines and all warranty claims.

It is mandatory that the Contractor has available SHS package identical to that being installed to assist with the training, where it can be assembled and disassembled to show the various parts, function, simulate troubleshooting and repair.

The Contractor shall be responsible to provide training prior to the delivery of SHS. The Bidder shall propose in its bid a detailed **Training Program** organized in 5 parts, as follows:

1. **BASIC SOLAR KITS TRAINING WORKSHOP FOR CBTs** at SOCOTECO II headquarter (or venue selected by SOCOTECO II near the off-grid sites), 1 day
  - a. Basics on solar energy, solar systems, etc. (theory)
  - b. Prepayment and credit vending system
  - c. Installation and operation basics
  - d. Maintenance and troubleshooting basics
  - e. Vending machine troubleshooting

2. **ADVANCED SOLAR KITS TRAINING WORKSHOP FOR EC SBU TECHNICIANS** (at EC headquarter, 2 days min.)
  - a. Basics on solar energy, solar systems, sizing, etc. (theory)
  - b. Vending System
    - i. Installation and operation
    - ii. Prepayment and credit
    - iii. Management software system (The software used to configure, manage, and report on operational procedures.)
    - iv. Training and management of vending agents at selling points.
  - c. Installation of SHS
    - i. Operation and maintenance
    - ii. Inspection and maintenance report (log sheet)
    - iii. Troubleshooting and replacement
    - iv. Data collection and reporting and database management
    - v. Warranty service claims training
  - d. Component testing, repair, or replacement
  - e. Claims process (provide claim's forms)
  - f. Warranty hotline
    - i. Stock and inventory management
    - ii. Basic training and management of CBTs
  
3. **VENDING MACHINE SYSTEM TRAINING** for the various SBU technicians, CBTs and selling point vendor, where and when required for proper operation and maintenance.
  - a. Operation and management of vending machines including trouble shooting for vendors and CBTs, and diagnosis for SBU technicians.
  - b. Operation and management of management software. (The software used to configure, manage, and report on operational procedures.)
  - c. Basic accounting requirements for vendors
  
4. **ON-THE-JOB TRAINING** (during installation): for both EC SBU technicians and local CBTs in the field, over installation period.
  - a. Best locations (including orientation & tilt) for PV module, box, lamps, etc.
  - b. Installation (including securing and fastening) techniques
  - c. Testing and commissioning
  - d. Credit vending process
  - e. MCO instruction (see MCO Instruction & Support Material)
  
5. **FINAL WORKSHOP** for EC SBU technicians at EC headquarter, 1 day
  - a. Review of learning
  - b. Open forum
  - c. Evaluation
  - d. Presentation of Certificates to passing technicians



The Contractor shall be responsible to deliver the following support materials:

1. Training materials, posters, tools, etc.
2. Demo kits of the SHS packages installed
3. Guidelines for EC technicians (see below section)
4. Training Certificates for passing technicians

### ***TECHNICAL GUIDELINES FOR EC SBU TECHNICIANS & CBTs***

The Contractor shall provide Technical Guidelines on SHS installation, O&M, training, and troubleshooting to both the EC SBU and CBTs as described above for those attending the training. The Guidelines shall be prepared before Advanced EC SBU training and Basic CBT training, and approved in writing by NEA before replication. The EC SBU Technical Guidelines are based on the requirements below.

A simplified version of the Technical Guidelines shall also be prepared for the CBT as reference material when practicing in the field. Please note that the level of previous training for the CBT could be close to none and thus the instructions need to present the information in a clear and simple manner.

The Guideline for EC Technicians is dedicated to EC technicians who have a basic electrical background, can understand what a solar system is, how it works, how to diagnose breakdowns or faults, and to some extent, how to repair or replace parts.

- The Guideline shall help the EC technicians to conduct maintenance, repairs, moving, and new installations of solar packages and vending units, beyond the training provided by the Contractor.
- The Guideline shall also help EC trainees to train the vending agents in the field with the credit selling terminals/tools provided by the Contractor.
- The Guideline should be simple and well-illustrated (pictures and drawings preferable than explanation texts).
- The Guideline shall be prepared in English but the support materials shall allow easy translation of the content by the EC.

The Guideline shall cover at least the following **topics**:

1. A complete **list of components** (all system sub-items), with associated specifications, manufacturer's literature warranties and ordering references.
2. Complete **Installation instructions**:
  - Detailed instructions to choose the best locations/places for components and to install the solar module, the wiring, the lamps. Include clear "do's/don'ts" pictures/drawings.
  - A recommended post-installation **acceptance test procedure**, including all appropriate test procedures.
3. Complete **MCO Instructions**:
  - Explain to the user the system operating principles, load management requirements, warranties and limits of the system, impact of shading/dirt of the array and how to check and avoid it, user maintenance checks and how to conduct them, how to load and manage their credits, and how to get service support.

- Explain to the vending agent (EC staff) how to operate and manage the vending unit, the credit sales to customers, and the reporting to EC (transaction data transfer).

4. Complete **O&M instructions**:

- A recommended routine **maintenance schedule**, with inspection/maintenance instructions.
- Specific **care and maintenance guide** for the system and components (controller, battery, PV module, lamps, Vending Machine, etc.).
- A detailed **troubleshooting guide** referencing all the system sub-items. This shall include repairs and diagnostic procedures that can be done by the EC or a qualified third party. Repairs and procedures not to be attempted by non-electricians and/or electricians unfamiliar with photovoltaic systems shall also be identified.
- Recycling procedure for main components.
- A complete list of all system components, with associated manufacturers literature, specifications and warranties.
- A functional block diagram showing the placement of all hardware and ratings of all component and a physical layout diagram.
- Instructions on handling and management of used or damaged SHS packages, spare parts, and wastages from the packing/staging materials.
- Detailed instructions on the use of the Vending Machines and their software to manage SHS and their associated MCOs, including:
  - Registration of an MCO;
  - Registration of SHS;
  - Linking and unlinking of an MCO to a SHS;
  - Vending of credit to an MCO;
  - Reports on registered MCOs, registered SHS, total vending activity (for vendor cash reconciliation), vending activity by MC, non-vending exception reports;
  - Issuance of maintenance tokens to SBU technicians and CBTs;
  - Upload and backup of all data on a weekly basis to the EC SBU; and
  - Black log sheet template

5. Procedures on how to undertake a Warranty Claim.

The Guidelines shall comply with RA 6969 or the Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990, and related national regulations for recycling and/or special disposal of batteries including battery collection, storage and recycling schemes. Disposal through a DENR registered Transport Storage and Disposal (TSD) facility will need to be clearly stated.

The Contractor shall also be responsible to provide any technical support/assistance on the operation and maintenance of its SHS to the EC SBU staff throughout the Contract term. The EC will provide a training room at its headquarters or in an appropriate venue.

From five (5) to a maximum of fifteen (15) SOCOTECO II EC SBU technician/staff will require training, while no more than 30 CBTs will be trained by the Contractor.

## VII. SUPPLY AND INSTALLATION OF SHS

### VII.1 System Description Summary

The SHS service levels offered are designed to meet the basic power demands of most rural customers. Only the second, higher Service Level 2 is to be supplied and installed in this bidding.

The Bidder cannot contest the minimum sizing of Service Level 2, defined in Table below. The bidder may, however, propose larger PV modules and batteries.

Package	Est. Ave. Daily Consumption (Wh/d)	Min PV Power (Wp)	Min Battery Effective Capacity (Ah)
Service Level 2	95	50	24

**Table 2:** System Summary Description – Minimum Sizing

The technical details of the Service Level 2 SHS are described in XII.1. Although TVs are not required to be supplied under this tender, the Bidder is encouraged to offer specifications and pricing of DC TV for its SHS which the EC SBU (alone or in joint venture with the supplier or other companies) might consider selling, leasing, or renting to households in a separate unregulated business outside the scope of the current PVM project.

### VII.2 Installation

Once the applicable trainings have been undertaken, the Installation Plan has been accepted by NEA, and the initial Vending Machines have been installed and tested in the pilot clusters, the Installers will proceed to the Pilot Installations.

The Pilot Installations will be the benchmark for the installation practice to be used and will serve as the approved "blueprint" for the standard of installations. This will provide the Contractor with an opportunity to iron out any installation issues prior to proceeding with the remaining units-installations. Any additional installation requirement(s) identified through the parallel verification during the Pilot Installation shall become requirements for acceptance of the remaining SHS packages.

The Contractor is to meet the installation requirements as specified in this Terms of Reference.

Prior to verification, the Contractor is to complete the Installation process and are required to:

- Request the SBU's technician/representative to seal with box with the EC's electrical seal;
- Provide the MCO household head and interested members with Member Consumer Instruction; and
- Request the MCO household head to sign the Installation Acceptance Sheet (IAS), further described below in *Reporting*.

At the completion of the 100 SHS Pilot Installations, along with any non-conforming aspects / defects being corrected at the Contractor's expense identified from verification, the Contractor shall be authorized to proceed with the remaining installations.

### **VII.3 Reporting**

The Reporting process is streamlined, incorporating existing EC MCO registration practices with some added requirements ensuring transparency and accountability.

The *Installation Acceptance Sheet (IAS)* is a document approving the completion of the installation by requiring signatures from the MCO household head and the accompanying the SOCOTECO II technician or staff member.

The IAS will contain basic information of the MCO's name and address, MCO's geographical coordinates, the MCO identification number assigned by SOCOTECO II, and the list of equipment installed with their serial numbers. The IAS will also provide a series of tick box questions confirming installation and instruction. The format of the IAS is to be made available by the Contractor for approval by NEA prior to installation.

In support of the IAS, the Contractor will provide clear and high-resolution digital copy of per beneficiary installation pictures of:

1. Member-Consumer-Owner (MCO) with complete name, address and identification number;
2. MCO residential house;
3. Installed SHS major components (panel, battery and charge controller) including its serial number;
4. Torch lamp;
5. DC Radio;
6. Phone Charger; and
7. Lamps and lamp switches.

The images including IAS are to be filed in a folder with the MCO identification number.

To summarize the IAS and to provide an update to NEA, an Installation Report will be submitted weekly together with the IAS and support pictures starting five (5) days after the first week of installation. Installation Report (IR) will contain the total number of installed SHS per barangay and a corresponding excel file (updated excel file for the succeeding reports) having the list of beneficiaries with MCO identification number, barangay municipality address and date of installation for each. Template of the IR is to be submitted to NEA for approval.

### **VII.4 Verification**

Verification will be undertaken by NEA and SOCOTECO II Inspection Team. The first one hundred (100) pilot installations will be randomly inspected to fine tune the verification checklist in coordination with the Contractor, and the EC SBU. The Contractor must provide an Installation schedule to coordinate the pilot installation and provide the Installation Report (IR) to for the Verification.

Additional installations will commence only after the first 100 SHS installations were verified.

### **VII.5 Hand-over process**

The Contractor shall take full responsibility for the care of the SHS and related goods until Acceptance by NEA of both Completed Installation Report (CIR) and the Final Verification Report (FVR).

If any loss or damage to the SHS or related goods occurs during the period when the Contractor is responsible for their care, the Contractor shall rectify the loss or damage at the Contractor's risk and cost so that the SHS and related goods and Contractor's documents conform with the Contract. The Contractor shall not be liable for any loss or

damage caused by any actions performed by the household after FVR has been accepted by NEA, except defects covered by warranty.

## **VIII. AFTER SALES SERVICE (POST-INSTALLATION)**

Payment will be made to the Contractor after final verification of the installation of the SHS and their associated Vending Machines and no other on-site obligations will be demanded of the Contractor except for the standard warranties under the Warranty Period.

The warranties will cover both the entire SHS package as well as individual components and accessories to the package.

### **VIII.1 Warranty Period**

Under the Warranty Period, the Contractor shall provide a 2-year full system warranty under which the Contractor will assist SOCOTECO II through every means possible to ensure the replacement of faulty parts (covered by the warranty) within a two-week period at no (zero) cost to NEA and EC. The Warranty Period is an additional requirement to the standard Component Warranties.

The Warranty Period will start on the day of Verification Acceptance from NEA received by the Contractor for the last installation on the lot.

The Contractor will bear full transportation costs of faulty equipment and replacement parts being claimed under warranty for the entire duration covering the Warranty Period.

The Contractor will be the focal point for the life of the Warranties and all claims will be undertaken through the Contractor for replacement units, components, and accessories.

The Warranty Period will last for two years reckoned from the day of Acceptance, from NEA to the Contractor, of the last Installation.

The SOCOTECO II EC SBU is responsible to undertake O&M, and to promote an efficient and sustainable O&M service, a smooth warranty claim process is required. The Contractor will work with the EC SBU staff to establish such a process, training EC SBU technicians to test and undertake the fixing of minor issues, and defining the terms and procedure for parts replacement under warranty, as required.

A Hotline directing all technical queries shall be set up for EC SBU technicians to have immediate and direct communication with the Contractor technician when required, for the entire period of the Warranty Period.

### **VIII.2 Component Warranties**

In addition to the general Warranty Period, warranties on the components shall meet the following requirements:

Component	Warranty (yr)	Description
PV Module	10	80% of stated power after 10 years*
Batteries	2	
Charge Controller	2	
Vending Machine	3	
LED Lights	2	LED to 70% of initial lumen output
Other Appliances	1	Other appliances not mentioned above

**Table 3: Component Warranty Requirements\***

Manufacturers' Warranties will start at the same time as the Warranty Period, detailed in Warranty Period.

### VIII.3 Spares

As part of the Warranty Period undertaking, the Supplier shall maintain the EC defined stock level ensuring responsibility for the claim and replacement of any spare part, as detailed in, the Warranty Period.

Component/Accessories	Spare Requirement %/lot size
SHS kits	0.2%
PV modules	2%
Battery	2%
Charge Controller	2%
Vending Machine	15% of total number of vending machines
PV module mounting hardware	1%
LED bulb	1W lamp 3% 2W lamp 6%
Lamp socket	
Lamp wire	
Lamp switch	
Lamp plug	
Torch & charging cable	2%
Radio & charging cable	1%
USB Port	2%
USB phone charging cable	1%
PV to controller cable	1%

**Table 4: Spare Part Requirements**

The Supplier shall maintain the EC stock at this level throughout the Warranty Period.

### VIII.4 Rejection of faulty equipment

If within the first twelve (12) months of the Warranty Period, ten percent (10%) or more of any class of equipment fails based on SOCOTECO II EC SBU record-keeping, NEA may, at its sole discretion, have the right to demand the replacement of all of that class of

\* PV Module Warranty shall require a linear degradation year on year

component or material throughout the entire set of equipment supply or tender installations awarded to that Supplier.

**IX. FACTORY ACCEPTANCE TEST-Light, VERIFICATION CHECKLIST AND TOLERANCES**

**IX.1 Factory Acceptance Test - Light (FAT-Light)**

The Bidder that submits Lowest Calculated Bid shall have its submitted sample undergo Factory Acceptance Test - Light (FAT-Light). FAT-Light will be under taken prior to Notice of Award and Contract Signing.

Hence, to ensure that the goods being manufactured comply with the requirements, the Bidder with the Lowest Calculated Bid shall organize an online video conferencing with representative(s) of NEA, together with DOE and COTELCO within seven (7) days after receipt of the Notice of Lowest Calculated Bid to conduct the following process:

FAT	Description	FAT-Light Process
FAT-0001	Visual Screening	-Video Conference to witness actual production of SHS Units. - Personnel on production site shall mark one unit produced on the same production date that will be part of the first delivery of SHS Units. -Original IEC Certifications shall be brought to NEA.
FAT-0002	Battery and BMS Performance	-Video Conference to witness conduct of Full Battery Testing. -Partial Battery Testing can be conducted, however, warranty of the battery may be extended to cover lack of full battery testing.
FAT-0003	Solar PV Module	-Video Conference to witness conduct of Solar Panel testing
FAT-0004	Charge Controller	-Video Conference to witness conduct of Charge Controller Testing
FAT-0005	Prepayment and VMS	-Video Conference to witness conduct of VMS Testing
FAT-0006	LED Lamps	-Video Conference to witness conduct of LED Lamps testing

General Observations:

1. All required FAT Test will be conducted through video conference. Original test results will be submitted to NEA and furnish a copy to EC.
2. Original copies of all required IEC Certifications and other certifications will be presented in actual to NEA if possible. If not, bidder may opt to present IEC certifications through video conference if the NEA will agree.
3. If there are available basic test kits for any of the testing required, the bidder must supply it to the NEA so that the NEA may conduct basic testing. The bidder may need to deliver initial units if the NEA wishes to conduct basic testing.

4. NEA and the winning bidder will set the date when to conduct their FAT-Light and inform EC. EC will join as observer.
5. Winning bidder will be responsible to look for testing facilities.
6. FAT-Checklist will be provided to the Bidder that submits Lowest Calculated Bid

The Contractor will coordinate closely with NEA to facilitate FAT-Light Activities and should have a representative of their own to witness the tests.

If the factory or assembly plant does not have the required testing facilities or laboratory, the Supplier will be required to introduce such entities within close proximity.

The NEA could also request the following during the online inspections:

1. Inspect factory and take sample for possible future tests;
2. Inspect original certificates offered;
3. Check original laboratory certificates;
4. In case on certificates not being based in full IEC standards, but based on ISO17025 lab or in-house testing;
5. Visit the test laboratory, assess test bed and approach;
6. Confirm the test undertaken and number of samples;
7. Check results;
8. Request any short terms tests in his presence, at purchaser cost; and
9. Take photos.

The NEA could also request the following before inspections:

1. Complete sample of the solar home system being offered to be delivered to NEA main office before the conduct of FAT-Light.

Only when NEA Representatives are satisfied with the above requirements will they release a Factory Acceptance Certificate which will trigger the NEA's notice to the Supplier to proceed with the production and shipping of the SHS packages. If the NEA's Representatives are not satisfied with the output of the Supplier, NEA will notify the Contractor of the issues which need correcting, agree on these requirements and then the Supplier will have to rectify the agreed issues and request for NEA's Representatives to undertake a second assessment.

The Supplier is required to budget for this accordingly, based on a lithium battery expert and SHS/solar expert, spatial location of factories, and test requirements depending on the technical qualifications of the SHS package as per Section XIII.

## **IX.2 Verification Checklist and Tolerances**

Installation of SHS will be carried out at households and locations within the SOCOTECO II service area.

The following section describes the inspections and tests that shall be performed to verify that the Solar Home Systems being supplied and installed conform to the technical specifications detailed in Technical Specifications, as well as to a high quality of workmanship.

The table in the next section outlines the inspection requirements and acceptable tolerances that form the basis of the Inspection and Tests that the verification team will perform on installed SHS.



Should an installed Solar Home System fail to fall within the acceptable tolerances for any of the aspects or equipment outlined in the next section, or for any equipment or workmanship judged to be defective, the Contractor must undertake remedial action outlined in the following table.

### IX.3 Inspection Requirements and Acceptable Tolerances

The table below shows the Inspection Requirement and Acceptable Tolerances for installed SHS including remedial actions to be undertaken by the Contractor in the event of unsatisfactory workmanship or defective components found during the inspection.

Items	Acceptable Tolerance	Actions in the event of unsatisfactory installation or defective components**
<b><u>Solar PV module mounting</u></b>		
Exposure	Min 6 hours from 9am to 3pm	Trim trees and notify the MCO for regular trimming, relocate the PV module.
Orientation of PV module slope	+/- 10° from S	Adjust PV mounting pole orientation.
Tilt from the horizon	from 10° to 15°	Adjust the PV mounting bracket tilt/pole vertical mounting.
Mounting bracket pole attachment	Sturdy	Tighten loose clamps, bolts, nuts.
Mounting pole upper attachment	Sturdy	Fix/clamp pole to fascia board, roof frame, truss, support structure.
Mounting pole lower attachment	Sturdy	Clamp, buried on hard ground, attach in support structure
Mounting pole position	Vertical	Adjust pole attachments
PV module junction box position	Upper	Reorient the PV module
Roof penetration (if allowed by MCO)	Sealed	Seal roof against leaks
<b><u>PV Cable</u></b>		
Attachment to the bracket and pole	Strapped securely	Strap the PV cable to the pole with UV rate cable ties
Drip loop	Looped	Loop the cable on the pole before entering the house
Cable entry into the house	Secured	Secure cable entry from entry of water, insects, and pests.

Connection to controller box	Secured	Fasten PV cable for secured connection to the controller box
Excess cable length	Spooled	Spool and fasten excess cable
Chaffing of cable on roof edges	None	Adjust cable run to avoid sharp edge of the roof from chaffing the cable
<b><u>Charge Controller and Battery Enclosure</u></b>		
Location	Visible and accessible	Relocate for visibility of display and access to reload credits, radio and phone charging
Mounting	Stable	Provide stable mounting
Accessible to connections	Accessible	Adjust for accessibility
Protected from sunlight and rain	Protected	Relocate/ provide protection
Check tamperproof seal	Not tampered	Add a seal if non, inform MCO
PVM Identification label/sticker	Present	Add label/sticker on Box if non
Box integrity	No damage	Replace if damaged
<b><u>LED Lamps, wires and switches</u></b>		
Lamp (indoor) location	Indoor	Transfer indoor lamp in the house
Lamp (outdoor) location	Protected	Transfer or provide protection
Switch location	Accessible	Adjust with consent from MCO
Wire solidly and neatly fastened	Fastened	Fasted wires solidly and neatly
Excess wire lengths	Spooled	Spool and fasted excess wires
<b><u>Accessories, manuals and posters</u></b>		
USB Charging port and cable	Accessible	Provide USB charging cable
Radio	Accessible	Provide Radio
Torch and charging cable	Accessible	Provide torch w/ charging cable
Manuals and posters	Accessible	Provide manuals and posters

#### IX.4 VERIFICATION CHECKLIST

The below table outlines the Verification Checklist that will be used as a guide whether an installed Solar Home System has successfully met the Verification requirements. A

document to this effect will also be countersigned by the Contractor, a designated representative of the electric cooperative, and the member-consumer-owner (household).

This will be carried out in line with the Verification Process outlined and forms the basis for the Supplier's workmanship.

***Verification Checklist for Solar Home System equipment***

(a) Visual Inspection

Solar PV Module mounting	Yes	No
PV Cable	Yes	No
Charge Controller and Battery Enclosure	Yes	No
LED Lamps, wires and switches	Yes	No
Solar cable fixed well, protected from UV	Yes	No
Accessory: Mobile charger cable	Yes	No
Accessory: Radio	Yes	No
Accessory: Torch and charging cable	Yes	No
Manuals and posters	Yes	No

(b) Functional test

Control box indicators are OK (no fault)	Yes / No
All lights and switches functioning	Yes / No
Phone charger functioning	Yes / No
Radio & Torch light functioning	Yes / No
Prepaid functioning	Yes / No
Weather condition during inspection	Sunny / Rainy / Cloudy

(c) Pictures

Member-Consumer	Yes / No
PVM Solar Module after installation	Yes / No
PVM Solar 'Control Box' after installation	Yes / No

**X. APPROVED BUDGET FOR THE CONTRACT (ABC)**

X.1. For and in consideration of the performance and accomplishment of the INSTALLATION OF 1,577 50W-SOLAR HOME SYSTEM UNITS, NEA shall pay the CONTRACTOR the total amount of Forty-Three Million Two Hundred Fourteen Thousand Five Hundred Thirty-One Pesos (PhP 43,214,531.00) subject to pertinent laws on government contracts and auditing procedures.

X.2. The contract price is inclusive of all duties and taxes.

X.3. No changes shall be made on the Contract Price by reason of escalation in currency. Any adjustment in Contract Price shall be done in accordance with guidelines provided by law.

X.4. The payment of escalation costs shall be subject to the unilateral and written approval of NEA and to availability of funds.

## **XI. QUALIFICATIONS**

The CONTRACTOR must:

XI.1. Preferably satisfy the criteria set forth in section 2.3 of the Practical Guide to contract procedures for the European Union external actions specifically 2.3.1 the rule on nationality and origin.

### *a. The Nationality Rule*

Participation in tender procedures managed by the beneficiary(ies) is open on equal terms to all natural who are nationals of and legal persons (participating either individually or in grouping-consortium- of tenderers) effectively established in a Member State or a country, territory or region mentioned as eligible by the relevant regulation/basic act governing the eligibility rules for the grant as per Annex A2a to the practical guide. Tenderers must state their nationality in their tenders and provide the usual proof of nationality under their national legislation.

This rule does not apply to the experts proposed under service tenders financed by the grant.

### *b. The Rule of Origin*

If the basic act or the other instruments applicable to the programme under which the grant is financed contain rules of origin for supplies acquired by the beneficiary in the context of the grant<sup>1</sup>, the tenderer must be requested to state the origin<sup>2</sup> of the supplies, and the selected contractor will always have to prove the origin of the supplies.

For equipment and vehicles of a unit cost on purchase of more than EUR 5 000, contractors must present proof of origin to the beneficiary(ies) at the latest when the first invoice is presented. The certificate of origin must be made out by the competent authorities of the country of origin of the supplies and must comply with the rules laid down by the relevant Union legislation. Failure to comply with this condition may result in the termination of the contract and/or suspension of payment.

Where supplies may originate from any country, no certificate of origin needs to be submitted.

XI.2. Have previously worked on similar projects within the past 3 years;

XI.3. Have demonstrated efficiency in installing solar home system units on previous projects with Certificate of Acceptance as proof;

XI.4. Have the ability to deliver signed weekly accomplishment report submitted on a timely manner via online;

XI.5. Submit list of completed and on-going projects. The list of completed projects must be for the past three (3) years with the contract price of equal to or greater than Php 21,607,265.50 and with Certificate of Acceptance for each project;

XI.6. Must submit a Single Largest Completed Contract with Certificate of Acceptance;

XI.7. Must be PHILGEPS registered; and

XI.8. Submit the following additional documents:  
(To be submitted during Post Qualification)

- a. DTI Business name registration or SEC registration certificate, as the case may be. For corporations, submit updated General Information Sheet;
- b. Valid and current mayor's permit/municipal license (principal place of business);
- c. Clearance from SSS, PAG-IBIG and PhilHealth; and
- d. BIR Clearance for Value Added Tax registration and VAT payment.

## **XII. OTHER DOCUMENTS REQUIRED** (To be submitted during Post Qualification)

1. Certificate of origin/importation/delivery proving the materials and equipment are brand new (to be submitted upon 100% delivery)
2. Confirming statement on the delivery schedule;
3. Confirming statement on the installation schedule;
4. Confirming statement on warranty being offered;
5. List of dedicated personnel
  - At least six (6) equipped teams with at least two (2) installers each team;
6. Document stating total years in the solar installation industry; and
7. List of organic/permanent personnel including their education and relevant trainings.

## **XIII. TECHNICAL SPECIFICATIONS**

The following section defines the Technical Specifications and Standards required for the supply, delivery, installation, testing and commissioning, including labor, material and equipment.

This section aims to provide a strong guidance in forming the required package while also providing some flexibility by defining the specifications. Any apparatus, material, or work not indicated in the submitted plan of the Contractor or any incidental accessories necessary to make the work complete and perfect in all aspects and ready for operation even if not particularly stated in this TOR, shall be provided, delivered, and installed by the Contractor without additional expense to the procuring entity.

Further, this section aims to provide strong guidance in forming the required whole package also providing some flexibility by defining the specifications.

It is expected that the SHS have been designed to have an operation life of at least 10 years with one battery and controller replacement.

### XIII.1 System Requirement

<b>Total Design Load (per day)</b>	<b>88 Wh</b>
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The designed level of service requirement is outlined in the following two tables, separated as Lighting & Accessories:

Qty	Description	Part ID	Usage	Minimum Brightness	Maximum Power	Daily Demand
			Hrs/day	Lumens	Watts	Wh/day
1	Indoor/Outdoor	LAMP1	8	100	1	8
2	Indoor Lamps	LAMP2	4	200	2	16
1	Indoor Lamps	LAMP3	3	300	3	9
4				800	8	<b>33</b>

**Table 5 :** Daily Home Lighting Service Requirement

Clarification to the Table:

- 1) LAMPS are defined by their maximum power allowance and their minimum lumen requirement. Below the schedule of lumen requirement will not be accepted and above the scheduled power rating will also not be accepted.

Qty	Description	Part ID	Usage	Minimum Brightness	Maximum Power	Daily Demand
			Hrs/day	Lumens	Watts	Wh/day
1	Torch Lamp	TORCH	5	50	1	5
1	DC Radio	RADIO	5	-	1	5
1	Phone Charger	MOBCH	3	-	3	9
1	DC LED TV <sup>1</sup>	LEDTV	4	-	9	36
4				50	14	<b>55</b>

**Table 6 :** Daily Home Accessories Service Requirement

Clarification to the Table:

- 1) TORCH is service defined as being the charging load on the SHS battery unit to recharge the torch battery. The assumption has been made on the torch battery being no greater than 5Wh in capacity and requiring full charge daily.
- 2) RADIO service is defined by that required to either:

Charge the internal battery of the radio via the SHS battery with the assumption of the radio battery being no greater than 5Wh in capacity and requiring full charge daily; and

<sup>1</sup>DC LED TV is not included in the package to be supplied but the consumption is included in the sizing the capacity of the system

- a) Power the radio directly from the SHS battery with the radio requiring no greater than 1W of power to drive at 75% of maximum volume.
- 3) MOBCH service is defined by that required to charge 2x phones in one day from the SHS battery unit. The assumption is that a 1x phone requires approximately up to 4.5Wh to recharge. Alternatively, the design accounts for 1x “smart” phone charge per day, requiring up to 9Wh to recharge.
- 4) LEDTV service is on the assumption that the TV offering from the Manufacturer is 9W or less when operating without the LED backlight activated (indoor use). DC LED TV is not included in the package to be supplied but the consumption is included in sizing the capacity of the system for future adaption of the member consumer.

### **XIII.2 Labelling and Database**

Each system and each major component (module, battery, charge controller) shall be trackable by individual barcode reader number along with the minimum labelling requirements that are to transfer to a central database to work in unison with the Vending Management System.

Minimum labelling and database requirements for the SHS and their components are as follows:

1. Label for each major component (panel, battery and controller box) and for the assembled SHS to identify stock. These labels shall be permanent and indelible with the following fields:
  - a. unique barcode;
  - b. manufacturer name;
  - c. model number; and
  - d. serial number.
2. Database for each major component and assembled SHS supplied including the following fields:
  - a. unique barcode;
  - b. manufacturer name;
  - c. model number;
  - d. serial number;
  - e. supplier name;
  - f. date of manufacture (for components);
  - g. date of assembly (for SHS);
  - h. Tranche no (as shipped);
  - i. Date of installation; and
  - j. Date of warranty commencement.
3. Any other specific labelling requirements per component will be detailed below, under the component specifications.

Barcode reader information shall be included in any packing slips on the outside of the crates, to enable equipment tracking at any time during shipment and storage.

### **XIII.3 Packaging and Delivery**

The SHS Contractor shall provide the PV system components, pre-assemble them into integrated packaged SHS in accordance with the specified design, and deliver and install the packaged SHS in the MC’s house.

All goods supplied shall be packaged to prevent shipping related damage at any point through to its final installation. The Contractor is responsible for settling any shipping

related damage claims and must replace any damaged systems through to installation in a timely manner.

The Contractor will also be required to collect all packaging, cartons, and any other material used to transport the goods and dispose of them appropriately and in accordance with any Environmental & Social Safeguards requirements. If the Contractor agrees with MCOs and/or local officials to donate the packaging materials, this must be recorded with their consent.

### **XIII.4 Component Specifications and Certifications Standards**

#### **XIII.4.1 Minimum Standard Certification**

Each component and/or appliance of the package, if not fully Lightning Global Quality Test Method (LG-QTM) verified, should also comply with the minimum standard certification requirements as listed in Table 7, and any further requirement stipulated in each specific component section, further below. In general, the standard of the International Electro-technical Commission (IEC) is applied, but equivalent standards may be offered. A certified copy of the component’s Test Certificate shall be required from the ISO17025 accredited Test Center.

<b>Component / Appliance</b>	<b>Minimum Certification requirements</b>
<b>PV module (crystalline)</b>	IEC 61215, IEC 50380, IEC 61701,
<b>Charge controller</b>	IEC 62509, IEC 62093, CE marked
<b>Battery (Li-on)</b>	IEC 62133 or UL 1642 and IEC 61960 or IEC61620 or IEC 61427-1
<b>LED Lights</b>	IEC LM-79-08, IEC LM-80-08, IEC LM-21-11
<b>Other Components Appliances</b>	IEC 62093 (or Pass Global Leap Testing requirements for the TV)

Table 7: Component Standards: Summary of Required Standards

Components must be certified according to one of the methods below in XIII. 4.3.

#### **XIII.4.2 IEC Standard Certificate**

This highest certification is a full certificate from an accredited testing and certification organization acceptable to NEA to confirm that the specific model of products or components offered complies with the entire referenced technical standard, based on the sampling approach of that technical standard, including.

- A certified copy of the component’s Test Certificate from the ISO17025 accredited Test Center.
- A copy of the Test Center’s accreditation certificate, to conduct and certify the specific tests in the standard under consideration.
- This level of certification is required for the following components:
  - a) PV modules (IEC 61215)
  - b) Li-ion cells used in batteries (IEC 62133 or UL1642)



### **XIII. 4.3 Test Result Certifications Based on Testing to Partial IEC Standard**

The testing of components in ISO17025 certified laboratories to the full IEC standard using the required sampling is both expensive and time-intensive. Therefore, provision is made for testing to only the relevant parts of the standard (as a second-tier level of certification). Certified test results are required from an accredited testing and certification organization acceptable to NEA to confirm that the specific model of products or components offered have been tested to referenced test procedure in the standard.

- A copy of the test center accreditation certificate, to conduct and certify the specific tests in the standard under consideration.
- Detailed test results shall be provided for the specific tests conducted in the standard for all the samples tested.
- This form is acceptable for the following components only:
  - a) Li-ion batteries cycle life tests, but cell itself must be certified to IEC 62133 or UL1642
  - b) Charge controllers
  - c) LED lights constructed using certified LM-79/80 LED chips and drivers

### **XIII. 4.4 Photovoltaic Modules**

#### Certification standards

*Compulsory certifications are both of:*

**IEC 61215:** Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval

**IEC 61701 Ed.2:** Salt mist corrosion testing of photovoltaic (PV) modules

Other compliance:

**IEC 50380:** Datasheet and nameplate information for photovoltaic modules

#### General requirements

The PV Modules will have an output of not less than 50Wp and will be sourced to have the following characteristics;

1. Only silicon crystalline technology (poly or mono), thin films are not acceptable;
2. Cells in series;
3. Positive tolerance only on nominal power;
4. Anodized aluminum frame required: marine grade / minimum thickness of frame 30mm;
5. High transmission and high strength tempered glass;
6. Equipped with a waterproof junction box (IP65) and a pre-assembled UV-resistant PV cable;
7. A label certifying compliance with IEC 50380 shall be placed to the rear of the module with the main characteristics of the panel (manufacturer, type and reference, serial number, peak power,  $I_{sc}$  –  $I_{mpp}$ ,  $V_{oc}$  –  $V_{mpp}$ , standards ... ) ;
8. All PV modules must be identical and use the same (i)production processes and construction methods; (ii)materials; and (iii)quality control procedures as a previously certified module.

### **XIII. 4.5 Enclosure Box and Charge & Prepayment Controller**

#### Certification standards

Compulsory certifications are:

**IEC 62509 Ed.1:** Performance and functioning of photovoltaic battery charge controllers;

OR

**IEC 62093 Ed. 1.0:** BOS components - Environmental reliability testing - Design qualification and type approval.

AND

#### **CE marking for electronics**

Optional certifications:

**IEC 62109:** Safety of power converters for use in photovoltaic (PV) power systems - Part 1: General requirements; Part 3: Controllers

#### General requirements

The charge controller and battery shall be housed within a robust 'plug & play' enclosure/box, resistant to tampering and manufactured with all support or fixing system needed.

The **CONTROLLERS** will have the following minimum specifications:

1. The controller shall be specifically designed for Lithium-based battery management. The Contractor shall provide proof or otherwise attest to this important point.
2. The printed circuit boards (PCB) shall be coated with heavy-duty varnish to protect from corrosion.
3. The controllers shall be machine manufactured (no manual assembly and welding).
4. The controller shall have a microprocessor, with static regulation. PWM is preferred. DC-DC converter with MPPT is also possible, but not required.
5. The controller must be well protected against short-circuits, overload, reverse polarity, and surge voltage.
6. The controller shall be easily dismountable and replaceable by a qualified technician. In the event of replacement, the procedure to maintain the continuity of the prepayment credit and avoid loss of any purchased credit must be provided.
7. All parts of the compartment subject to battery electrolyte contact shall be corrosion resistant.
8. The charge controller shall have a charging regime applicable to the battery, with voltage set points preset at the factory.
9. The controller shall be protected against short circuit of input and output terminals as well as reverse polarity.
10. Electronic automatically resettable cut-offs are required- mechanical fuses are not acceptable.
11. The controller shall be able to safely accept 125% of the module open circuit voltage when battery is removed.
12. The controller shall be able to safely accept 125% of the module short circuit current.
13. Indication of the battery state of charge (SOC) and indication of PV production shall be included and easily understandable for every customer.

The **PREPAYMENT REQUIREMENTS OF THE CONTROLLER** should have the following minimum specifications:

1. Off-line, GSM-free, typically using dongle or front panel keypad.
2. Unit of sale to be days (not kWh), and this should be fully programmable to suite the EC SBUs desires.
3. Compatible with Vending machine and Vending Machine token/SHS charge code/Dongle Key.
4. Seamless operation with charge controller, and not interfering with battery charging at any time.
5. Integrated prepaid solution to the controller/battery box, not an external device.
6. Full display of credit level shall be included and easily understandable for every customer.



**Diagram 1:** *Electrical seal to be added by EC SBU at Installation completion*

#### Documentation and labelling

A **label** with main characteristics of the **Solar Package** (manufacturer/assembler, type and reference, serial number, individual ID number, battery capacity, PV peak power, standards) shall be placed on the battery box.

The charge controller must be labelled indicating at minimum:

- Manufacturer;
- Model Number;
- Battery Li-ion and type (LiCoO<sub>2</sub> LCO, LMO, NMC, LFP, NCA, LTO);
- Nominal voltage;
- PV and Load Currents; and
- Barcode

#### **XIII.4.6 Lithium Batteries**

Today, the lithium-based batteries are generally recognized as the best future technology for energy storage with renewable energy. The fact that most of the systems certified by Lighting Global have Li-based batteries confirms this trend, thus, it is required as part of these SHS service levels.

Given the growth in the SHS market, inclusive of the demand for Lithium-based batteries, distinct results and performance of the various types of Lithium batteries are now available. Based on a review of the battery performance and safety results, Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt Oxide, or Lithium Titanate will be the only battery accepted under the PVM program.

Any mention of Lithium-based battery throughout the bidding documents is in reference to

any one of the three Lithium-based batteries mentioned above.

All lithium-ion cells shall have valid full IEC certificate (or accepted equivalent specified below) for:

**IEC 62133 (2012):** Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary cells, and for batteries made from them, for use in portable applications;

OR

**UL 1642:** Standard for lithium-ion batteries;

AND

**IEC 61960:** Secondary cells and batteries containing alkaline or other non-acid electrolytes – Secondary lithium cells and batteries for portable applications;

OR

**IEC 62620:** Secondary cells and batteries containing alkaline or other non-acid electrolytes. Secondary lithium cells and batteries for use in industrial applications;

OR

**UL 1642:** Standard for lithium-ion batteries;

OR,

**IEC 61427 Ed. 2.0 (2004-05):** Secondary Cells and Batteries for Photovoltaic Energy Systems (PVES) – General Requirements and Methods of Test Other certifications for life cycle testing.

Battery models which have not been certified as meeting the above full standards need to be tested according to the General test conditions and Method as listed in IEC 61427 (2004-05), section 7 and 8.

AND

**UN 38.3 UN Transportation Testing (UN DOT 38.3) for Lithium Batteries**

The expected battery life under the solar design cycling conditions (shall be determined from the certified battery cycle life curves, and shall exceed 1,000 cycles (3 years), before further de-rating for temperature conditions.

#### General requirements

The Lithium-based battery shall have a minimum storage capacity of **24Ah** and a nominal voltage of 12Vdc.

The battery controller shall control in real time the charge/discharge of each cell of the battery, and to protect the battery by preventing it from operating outside its typical safe operating range. In case of batteries in parallel, the controller is required to properly manage the energy flow and the voltage. The controller will protect the battery against full discharge by disconnecting the load when Depth of Discharge (DOD) reaches 90%.

#### Documentation and labelling

The Contractor is required to provide for the Battery Box offered with the following data:

- The battery must be labelled indicating at minimum Manufacturer, Voltage and

- Capacity;
- Type of the battery;
- Battery Voltage;
- Battery Capacity@C20;
- Warranty information; and
- Barcode.

The supplier is required to provide for each battery type the following test data:

- Battery discharge performance curves at C10 and C50, at a minimum; and
- Battery cycling curves against IEC 61427-1:2013 or similar cycling test to 90% DoD.

The supplier is required to provide the following general data:

- Battery discharge performance versus temperature;
- Battery cycle life versus depth of discharge;
- Battery cycle life versus battery temperature; and
- Product brochure.

The Supplier shall provide instructions to the EC SBU on how and where to recycle worn batteries as part of the Technical Training.

### **XIII.4.7 Vending Machines and Vending Management**

#### General requirements

The Vending Machine and Management System must be designed to provide Solar as a Service (SaaS) credit, which will deactivate the SHS when credit is empty, not specifically as Pay as You Go (PAYG) installment payment to purchase the SHS. Credit shall be purchased by end-users at “Selling Points”. The number of vending machines shall be one per one hundred (100) SHS units.

The Vending Machine Systems will include;

1. Prepayment software to be operated by the SBU;
2. Appropriate Selling Point hardware (e.g. smartphone or tablet);
3. A centrally managed database portal managed on a computer operated by the SBU, backed up on a cloud server; and
4. Synchronicity with the prepayment meter installed as part of the SHS.

The Vending Machine System must meet the following specifications:

1. The Vending Machine shall operate without reliance on any mobile signal being present either at the MCO’s house or at the selling point. If there is reliable mobile signal at the selling point, this may be used to upload vending data on a weekly basis to the EC’s vending management system. Regardless whether or not there is mobile signal at the selling point, the vending machine shall be mobile so that uploading can be done by swapping units on a weekly basis.
2. The way to reload the credit shall be simple and reliable (paper token, text message, etc.) and entered into the SHS via a simple keypad.
3. The credit purchased by any customer shall be unique and loadable only to his own SHS. It must not be possible to use the same code or scratch card for another SHS.
4. Credit should be generated in “days of operation”. The number of days’ credit purchased shall be in pre-defined denominations of days with the earliest being three (3) days and

the latest being thirty (30) days, ultimately as specified by the SBU.

5. Purchase of new credit should not overwrite or cancel any existing credit but should simply be added to it.
6. The prepayment system shall allow for a grace period which allows to run the system without reloading credit after it expires, for a day or two for every thirty day's credit purchased. This should be managed/programmed through the software and not the hardware.
7. Provide a SHS package unique Maintenance Code for when a technician needs to undertake troubleshooting or O&M for no longer than a 30-second period together with an alternative Maintenance Code for periods of up to one (1) hour but limited to five (5) times, preventing the undermining of the program.
8. The vending software or app used to generate the code (or equivalent support) shall include a database that registers and maintains a separate customer account number and SHS package serial number for the records. The vending machine shall generate a code that is unique to the combination of the customer account number and SHS package serial number. When and if the EC SBU retracts the SHS package from the MCO, for whatever reason, they must be able to reset the SHS units programming the unit to work with a new account number, for which the prepayment load is unique to.
9. This same database also records every vending transaction. Every transaction should include at least: customer/MCO account number, SHS unit number, date and time of transaction, and amount of credit bought.
10. All transaction data shall be accessible by EC and shall be exportable in a standard, non-proprietary format (e.g. CSV file type) to be used by EC in their own customer management software. The file format is not imposed but shall be compatible with Microsoft Office or equivalent software.
11. Customer and SHS unit records and cumulative transaction histories should be captured during weekly backup and copied to master vending management software maintained centrally at the EC Head Office either by uploading if mobile signal is present and reliable at the selling point, or by physically swapping out the vending machine and transferring it to the EC Head Office for upload. It is the responsibility of the EC Head Office to maintain global backups and to set-up and ensure compliance with individual vendor back up processes.
12. The software should provide data and dashboards for monitoring individual customers, individual SHS units and vendor sales.
13. Only an integrated prepaid solution to the controller/battery box is acceptable, not an external device.
14. All file formats must be fully open and accessible at the lowest level of data granularity collected by the vending machines to ensure interoperability of the central database if future SHS deployments use vending machines from a different supplier. Suppliers should include with their bid a data model showing all the data fields captured and maintained and organized by customer (MCO), asset (SHS) and transaction (vend).
15. Ideally, vending machine system and prepayment system designed on a universal PAYG operating platform.

## Vending Software

Software Updates	The Contractor must commit to providing ongoing support of the software platform for the life of the Product.
Software Guarantee	All software provided, whether it be propriety or 3 <sup>rd</sup> party software, ongoing use of the software for the life of the system must be guaranteed of no additional cost to the Procuring Entity to that of the upfront cost of the hardware.

The Supplier shall commit in the case in which the Supplier can no longer service the hosting or management of the Vending Software platform, to hand ownership & hosting of the software platform to the respective EC(s). A written commitment to this effect shall be provided in the Bid Submission.

### **XIII.4.8 Lamps and LED Lights**

#### Certification requirements

All lanterns that are tested and found compliant with Lighting Global standard IEC 62257-9-1 are acceptable so long as they provide the type of light service required (desk or ambient, lumen output and duration hours), as per the full General Requirements, in which case no further certifications are required.

#### Compulsory certifications

The generally applicable standards for LED luminaires and integrated LED lamps are Illumination Engineering Society's (IES). All LEDs used shall comply with these requirements:

**IES-LM-79-08:** Approved method for electrical and photometric measurements for solid-state lighting products

**IES-LM-80-08:** Approved method for measuring lumen maintenance of LED light sources

**IES-LM-21-11:** Projecting long-term lumen maintenance of LED light sources or equivalent:

Lamps that do not have Lighting Global compliance certification should be supported by documentation or certificate of the following, that they provide the type of light service required (desk or ambient, lumen output and duration hours):

- Certificate stating that luminaires comply with General Requirements, as well as providing test results for light output.
- Confirmation that LED lights are constructed using LM-79/80-certified LED chips and drivers, as well as providing the required LM certificates.

#### General requirements

Lights, Lamps and Lighting fixtures are to meet the following requirements:

1. Each lamp shall be made of high efficiency LEDs with an efficiency of at least 90 lm/W. Each lamp shall have a minimum of 100lm with a wide light distribution angle.

2. Light points are expected to be 100lm - 200lm - 300lm. 2 or 3 lamps of 100lm each can alternatively be provided instead of lamps of respectively 200 or 300lm. If a diffuser is included, the cover should be dismountable to remove dust and insects.
3. Lumen maintenance as per IES-LM-80 and IES-LM021: The lifetime of the LED package must exceed 20,000 hours when operating at rated voltage (at 25 deg C). At the end of 20,000 hours, lumen output should be at least 70% of nominal value.
4. The switches shall withstand high cycle level as per IES-LM-80.
5. Temperature of the heat sink of the driver circuit of the LED lamp should be tested and at still air condition, increase in temperature of the heat sink should not be more than 20° Celsius after one-hour operation.
6. Color of LED light shall be white.
7. Lamps should have a way for attaching safely to ceiling or wall.

Documentation and labelling

Lamps should be indelibly marked with:

- Manufacturer Name;
- Model;
- Voltage and Power; and
- Date of manufacture or batch number.

Additional information required:

- Product brochure;
- LED brand used, model number, and certification;
- Nominal voltage range; and
- Color temperature.

### **XIII.4.9 Bundled Appliances**

The Bidder shall include for each solar package the following bundled appliances as part of the procurement:

1. **Phone Charger:** Minimum one USB adaptor for mobile phone charging (5V)

General Requirements

The solar charge controller should have provision for USB outlet. Therefore, the only requirement on provision of mobile phone charger is a 5-1 cable adapter as shown in Diagram 2 below. Provision of “cigarette” style adapters is not permitted, due to the large array of heavy loads that can easily be used with this type of adapter.





Diagram 2 : Accepted Phone Charger type (L) and not accepted Phone Charger type

### Minimum Specifications

Particulars	Parameter
Type of port connection accepted	USB
USB Port minimum specification	5V 1A
USB Port maximum specification	5V2.1A
Min. number of phone types supported	5
Required phone adapter types:	Micro USB
	Mini USB
	Nokia Type

Table 8: Minimum USB Adapter Specifications

2. **Radio: One AM/FM radio** (independent with an internal battery).

### General Requirements

The radio should be a rechargeable type with its own internal replaceable battery for portability and not integrated into the SHS device. The radio should be recharged from the USB port(s) and not from the lighting output ports.

### Minimum Specifications

Particulars	Parameter
Type of port connection accepted	USB
Minimum Autonomous Runtime (at 50% volume, radio function)	5hrs
Minimum Speaker Size	3W 4ohm
Required bands	AM & FM
Maximum Energy Capacity of Battery	5Wh

Table 9: Minimum Radio Specifications

3. **Torch Lamp: One torch lamp** of minimum 50 Lumen and with a minimum autonomy of 5 hours.

### General Requirements

The torch shall be a rechargeable type with its own internal replaceable battery. The torch should be recharged from the USB port(s) and not from the lighting output ports. The internal battery should be sized to meet the following:

### Minimum Specifications

Particulars	Parameter
Type of port connection accepted	USB
Minimum Autonomous Runtime (full brightness)	5hrs

Minimum lumen output	50lms
Colour Temperature Range	10-15,000K
Maximum Energy Capacity of Battery	5Wh

Table 10: **Minimum Torch Specifications**

#### **XIII.4.10 Television Option**

A DC LED TV is not required to be supplied as a part of the package (not evaluated in the basic offer), however the Bidder should submit a proposed TV option as part of their Bidding Documents.

The Supplier must indicate if they are interested to do business alone or in joint venture with the EC SBU, wherein they might sell, lease or rent these TVs to the MCs – possibly in joint venture with the EC-SBU, a microfinance company or other third party. There is also potential to use the prepayment system being procured for instalment purchase of TVs subject to the ECs agreement

##### General Requirements

A colour LED TV meeting Global Leap Certification requirements and provision in the SHS device should be made for an output port dedicated to the TV rated to carrying the maximum load requirement of the TV.

##### Minimum Specification

<b>Particulars</b>	<b>Parameter</b>
Colour TV Voltage Range	10 - 16V
Maximum Power (LED backlight OFF)	9W
Maximum Standby Power	0.5W
Minimum Screen Size	15.6"
Built in Tuner & Antenna	Analog
Built in Speaker	Required
Available built in ports	USB / SD /Audio / Video
Remote Control	Required
Compliance	RoHS /CE
Operators Manuals (TV/Remote)	Required
DC Cable Length	5m
DC Cable Minimum XSA	0.75mm <sup>2</sup>
Compatible Connector with SHS Port	Required

Table 11: **Minimum DC TV Specifications**

#### **XIII.4.11 Cabling, Wiring and Switches**

Stranded and flexible insulated copper wiring shall be used. Cables used for wiring shall have three years of warranty.

- 1) DC solar PV module cable:

Flexible (class 5 or 6) multi-strand copper conductor, with 2 conductors in duplex configuration in flexible UV resistant sheath with polarity indication. Minimum

4mm<sup>2</sup> cross sectional area (XSA) conductor for 50Wp of minimum length 8m. Maximum permissible voltage drop over the length of the cable is 2%.

Should the Manufacturer find that the PV module cable type cannot fit their connector type, provision is made for a short 1m cable of 4mm<sup>2</sup> XSA to be joined to the cable end for final connection.

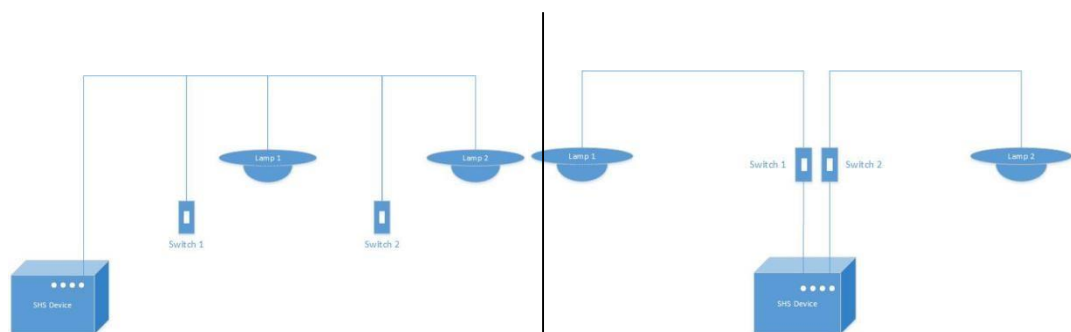
2) DC cables from Charge Controller to DC light switch:

Flexible (class 5 or 6) multi-strand copper conductor, with 2 conductors in flexible polyvinyl chloride (PVC) sheath, with polarity indication. Minimum 0.5mm<sup>2</sup> cross sectional area (XSA) conductor up to maximum 25m with all lighting loads if daisy chain. Should the total wiring loom length (including that to switches) be greater than 30m, then minimum 1.0mm<sup>2</sup> cross sectional area (XSA) conductor is required up to 50m. The minimum distance from either SHS central device to light point is 5m or from light point to light point of 5m. Maximum permissible voltage drop over the length of cable is 2%.

The Manufacturer may provide one of two options (or both) for wiring & switching:

- a) “Daisy-chain” wiring loom connection to multiple light points, then each lamp shall have its own switch on the same loom and no more than 2 lamps per daisy-chain in the event of cable/connector failure;
- b) Parallel cables from the SHS device, with each having its own input plug on the SHS device and own switch to the lamp.

Either a daisy chain”or “series” wiring loom for higher quality and more functional installations can be provided, similar as shown in Figure 6. However, Bids with bothwill also be considered. Where a specification is given for a cable length, if in daisy-chain configuration - the length is specified as the total length of all daisy-chain cables from the central SHS device connection to LAMP1, followed by distance from the LAMP1 to LAMP2 and so on.



Daisy-chain' connection (left) and 'parallel' connection (right)

Switches shall be pre-assembled to the cable, controlling on/off switching from the central SHS device is not acceptable. Dimming switches are not accepted in the SHS design.

#### Minimum DC Cable Specifications

Particulars	Parameter
Solar PV Module Cable:	
Solar PV Module Cable Length (min)	8m
Solar PV Module Cable XSA	4mm <sup>2</sup>
Maximum permissible voltage drop (including connectors)	2%
UV rated cable ties to suit outdoor cable	min 10pcs per cable
Other DC Cable:	

LAMP1DC Cables LED Lamps Length	10m
LAMP2DC Cables LED Lamps Length	5m
DC Cables to LED Lamps XSA up to 25m	min 0.5mm <sup>2</sup>
DC Cables to LED Lamps XSA 25m up to 50m	min 1.0mm <sup>2</sup>
Maximum permissible voltage drop	3%
Length from SHS Device to Switch (parallel)	1m
Length from wiring loom to Switch (daisy chain/series)	min 1m
Cable clips to suit internal DC cables	min 1pcs per 0.3m of cable
DC Cable Switches:	
Minimum cycle life	20,000

#### XIII.4.12 Cable Connectors

Field connections shall be snap connectors for joining ‘play & play’ cables using polarity-protected plugs. Approved plugs/sockets include:

- a. Co-axial power connectors 5.5mm OD, 2.1mm pin rated
- b. SAE connector.



**Diagram 3:** *Approved co-axial plug/socket (left) and SAE connector (right)*

#### **XIII.4.13 Toolbox**

The Bidder shall provide at least five (5) electrical toolboxes and two (2) units of GPS with other necessary tools for EC Technicians to troubleshoot, repair, and replace main components such as panel, battery, charge controller, and lamp. The toolbox shall contain at least the following items:

- 1 set Jewelers' screw driver
- 1pc. Philip screw driver
- 1pc. Slotted (-) screw driver
- 1pc. Side Cutter
- 1pc. Long Nose plier
- 1pc. Alligator/Square Jaw plier
- 1pc. Digital Multi-meter 0-10A<sub>DC</sub>/1-200V<sub>DC</sub> with fuse protection (10A)
- 1pc. Gas/Butane Solder
- 1pc. Magnifying Glass
- 1pc. Rechargeable LED Flashlight
- 1pc. Robust Toolbox

The Bidder shall also include any other special tools required for right manipulations of the solar packages by the EC Technicians, e.g. adapted tool for tamperproof screws.

#### **XIII.4.14 OTHER ACCESSORIES**

The Supplier shall include all necessary accessories for supporting or fixing components (module, battery box, appliances, switches, cable ties, etc.) during installation.

### **XIV. INSTALLATION OF SHS**

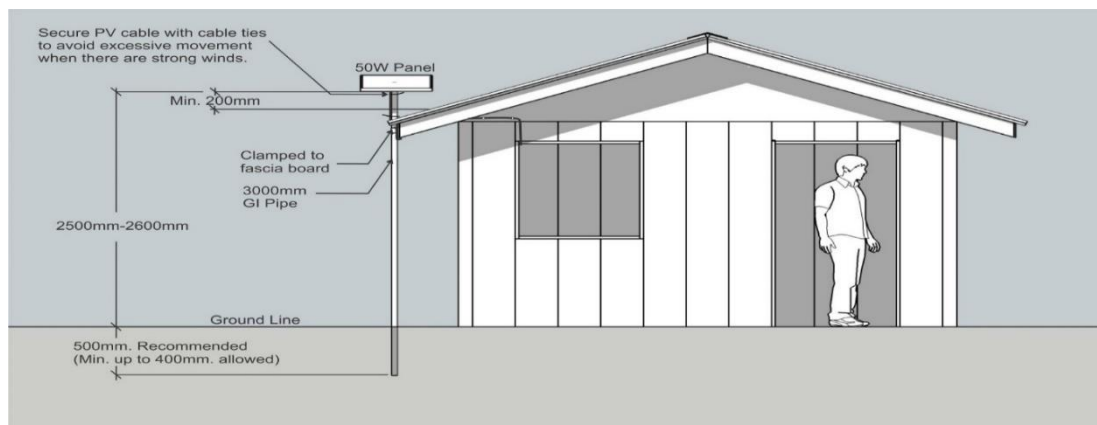
The installation of the SHS shall follow best practices suitable to the type of houses of the MCO's and the local environment of the site. This section provides the recommended installation procedures based on earlier experiences in the implementation similar projects. These procedures serve as a guide for installers and will be the basis for the Verification Agent for accepting the installation or for requiring corrective measures. Modification of these procedures shall be approved by NEA in consultation and in agreement with the Contractor and the Verification Agent.

## XIV.1 PV Module Mounting

The PV module shall be installed in a location within the premises of the MCO with maximum exposure to the noon sun, minimum shading from the east to the west, and securely fixed on its mounting structure against damage from strong winds. The minimum exposure of the PV module to the sun shall be 6 hours (e.g. from 9AM to 3PM). Exposure of the PV module to the morning sun is preferred over the afternoon sun if 9AM to 3PM exposure is not possible.

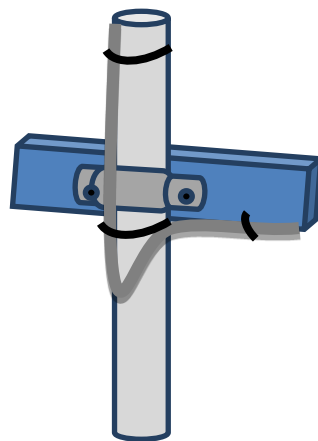
### XIV.1.1 Roof-Side Pole Mounted Option

The base of the mounting pipe is buried on the ground and the upper part of the pipe is clamped to the fascia board or on a sturdy structure on the side of the roof with the solar module on top of the pipe positioned above the roof. The depth of how the pipe is buried shall allow the PV module to have a minimum vertical distance of 20cm above the roof.



**Diagram 4. Side.** Roof-side Pole mounted PV module option

The PV cable shall be securely connected to the junction box with the correct polarity and laid along the frame and strapped to the top of the post to avoid stress on the junction box. The PV cable shall be strapped on the outside part of the pipe going down and bent to make a drip loop before entering the house for connecting to the PV input of the battery enclosure. No holes shall be drilled on the side pipe that could damage its galvanization and compromise its mechanical integrity.



**Diagram 5.** Drip loop for PV cable.

Care should be taken to avoid PV cable from resting on the sharp edges of the roof that could damage its insulation. The mounting straps and cable ties used to fasten the cable shall be UV rated. The PV cable shall be laid neatly and clamped on the beams and posts

of the house towards the battery enclosure. The extra PV cable length shall not be cut but spooled neatly and fastened near the battery enclosure.



Sample Roof-side Pole mounted installations

This mounting option is preferred to avoid penetration on the roof for both GI sheet roofs and thatched (nipa or cogon) roofs. This is only possible for roofs with elevations of around 2 meters from the ground. This may not be applied for roofs with high elevation and roofs with no strong structure that will hold the pipe securely on the side.

#### XIV.1.2 Through-roof Pole Mounting Option

In this type of installation, the pole is passed through the roof with the lower part of the pipe clamped on the post of the house while the upper part of the pipe is above the roof holding the PV module on its mounting bracket with a minimum vertical distance of 20cm above the roof.

This type of installation will have roof-penetration and shall only be allowed upon the consent of the house owner/MCO. The installer shall assure that all necessary materials are available to avoid any leaks on the roof.

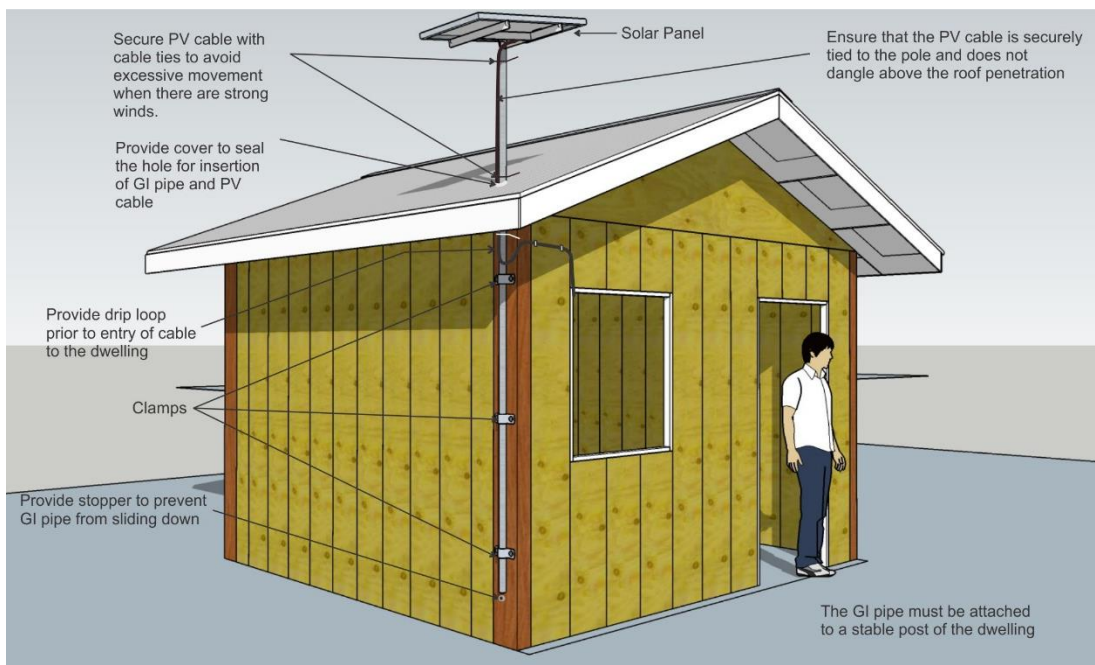


Diagram 6 : Through-Roof Pole mounted installations

For houses with GI sheet roofs, the pipe can be positioned on the inside part of the house fastened to the house post passing through the GI sheet roof. The PV cable shall be laid on the side the pipe. A drip loop is made on the PV cable before making the PV cable run to the battery enclosure. The penetration on the GI roof shall be sealed against leaks using appropriate roof sealing materials.



**Diagram 7 :** Roof-through Pole mounted installations on GI roofs

For thatched roof (nipa or cogon) where sealing of the roof may still have some leaks, the pipe shall be positioned on the outside part of the house to prevent leaks on the roof from entering the house. Effort should be done to seal the leaks using the same roofing material or appropriate sealing material.



**Diagram 8 :** Roof-through Pole mounted installations on thatched roof

The PV cable shall be laid neatly and clamped on the beams and posts of the house towards the battery enclosure.

#### **XIV.2 Charge Controller and Battery Enclosure**

The charge controller and battery box enclosure shall be securely mounted inside the house for easy access to read the displays and indicator lights as well as entering the credits into the unit. The position of the PV cable connected to the enclosure shall avoid stresses on the connector and avoid water from dripping into the enclosure. The location of the enclosure shall be accessible to connect the lamps, accessories, and other appliances. It shall be protected from direct sunlight and exposure to rain.



### XIV.3 LED Lamps

There are four LED lamps included in the system. One lamp rated at 1W is designed to be installed indoors and outdoors with the necessary protection. The rest of the lamps shall be installed inside the house protected from rain and dust. The lamps shall be positioned to provide the most effective illumination to the area. The lamps shall not be installed along the path of the household members that they can be easily be damaged. Installing the lamp directly above the cooking area shall be avoided due to the fast accumulation of soot on the lamps.

### XIV.4 Wires and Switches

The LED lamps are supplied with wires and switches with a DC plug connected to the battery enclosure. The wire shall be laid neatly from the battery enclosure to the lamp with a switch positioned on an accessible location. It is recommended to install the switches with a height of 1.2m above the floor as appropriate for the house structure or as preferred by the user. The switch shall be securely mounted to prevent it from being damaged. Daisy chain looms can be used with a maximum of two lamps per circuit. Excess cable lengths shall not be cut but spooled neatly and fastened near the battery enclosure or in an appropriate location.

### XIV.5 Accessories

The accessories such as the torch, the portable radio, and the cellular phone charging jacks shall be located near the battery enclosure where they are plugged to the USB port.

## XV. DELIVERABLES

	<b>DELIVERABLES</b>	<b>DUE DATE</b>
Factory Acceptance Test		
<b>1</b>	Factory Acceptance Test	Within seven (7) days after receipt of Notice of Lowest Calculated Bid.
Training		
<b>2</b>	Conduct of training (installation and operation)	Within two (2) months from receipt of FAT-Light Report with “passed” remark and Notice to Proceed.
On-Site Delivery of Materials		
<b>3</b>	Delivery of 100% materials on site	Within three (3) months from receipt of FAT-Light Report with “passed” remark and Notice to Proceed
Installation of Solar Home System		
<b>4</b>	Installation of Solar Home System should be at least 22% accomplished	Within four and a half (4.5) months from receipt of FAT-Light Report with “passed” remark and Notice to Proceed (this includes the inspection of first 100 SHS)

<b>5</b>	Installation of Solar Home System should be at least 44% accomplished	Within five and a half (5.5) months from receipt of FAT-Light Report with “passed” remark and Notice to Proceed
<b>6</b>	Installation of Solar Home System should be at least 66% accomplished	Within six and a half (6.5) months from receipt of FAT-Light Report with “passed” remark and Notice to Proceed
<b>7</b>	Installation of Solar home system should be at least 88% accomplished	Within seven and a half (7.5) months from receipt of FAT-Light Report with “passed” remark and Notice to Proceed
<b>8</b>	Installation of Solar home system should be at 100% accomplished	Within eight and a half (8.5) months from receipt of FAT-Light Report with “passed” remark and Notice to Proceed
<b>Accomplishment Reports</b>		
<b>9</b>	Submission of Weekly Installation Report (IR) together with the individual folder of high-resolution IAS and detailed per beneficiary installation pictures	Reporting starts five (5) days after the first week of installation.
<b>10</b>	Submission of final Installation Report together with last addition of individual folder of high resolution IAS and detailed per beneficiary installation pictures	Within five (5) days after completion of installation

**XVI. OBLIGATIONS OF THE CONTRACTOR**

The CONTRACTOR shall assume the following obligations:

- a) Ensure timely delivery of equipment and materials;
- b) Guarantee the safe keeping of equipment and materials on-site;
- c) Ensure timely installation based on the deliverables;
- d) Provide weekly accomplishment reports and final report based on the approved format and schedule;
- e) Must provide a dedicated person in-charge (PIC) as contact point and project coordinator. The PIC is liaise directly with the Project Management Unit (PMU) of I-PURE Mindanao. Template will be provided.

**XVII. PAYMENT SCHEME**

Payments to the CONTRACTOR shall be made based on the schedule below:

	<b>Contract Milestones</b>	<b>%</b>

		<b>of the Total Budget</b>
<b>1</b>	<ul style="list-style-type: none"> <li>- Factory Acceptance Test Report with “passed” remark</li> <li>- With signed contract</li> <li>- With Notice to Award and Notice to Proceed</li> </ul>	15%
<b>2</b>	<ul style="list-style-type: none"> <li>- Training (installation and operation) already conducted except the final training of the SBU staff</li> <li>- 100% on-site delivery of materials</li> <li>- Certificate of Delivery issued by NEA</li> </ul>	25%
<b>3</b>	<ul style="list-style-type: none"> <li>- Installation of Solar Home System should be at least 50% accomplished with complete Installation Report (IR) and individual folder of high-resolution IAS together with detailed per beneficiary installation pictures submitted to NEA.</li> <li>- Certificate of Partial Completion/Verification issued by NEA.</li> </ul>	25%
<b>4</b>	<ul style="list-style-type: none"> <li>- Installation of Solar Home System should be at least 90% accomplished with complete Installation Report (IR) and individual folder of high-resolution IAS together with detailed per beneficiary installation pictures submitted to NEA.</li> <li>- Certificate of Partial Completion issued by NEA.</li> </ul>	25%
<b>5</b>	<ul style="list-style-type: none"> <li>- Certificate of Final Inspection and Acceptance/Final Verification issued by NEA</li> </ul>	10%

	<ul style="list-style-type: none"> <li>- Complete Final Training of the SBU staff</li>   <li>- Final Installation Report (IR) and individual folder of high-resolution IAS together with detailed per beneficiary installation pictures submitted to NEA.</li>   <li>- Certificate of Completion submitted by the Contractor (SHS and Vending Machines)</li> </ul>	
		<b>100%</b>

**XVIII. PENALTIES / LIQUIDATED DAMAGES**

Failure to comply with the Terms and Conditions of the contract will result in the payment of corresponding penalties/liquidated damages in the amount equal to 1/10 of 1% of the cost of the unperformed portion for every day of delay. Once the cumulative amount of liquidated damages reaches 10% of the amount of the contract, NEA shall rescind the contract, without prejudice to other courses of action and remedies open to it.