

## REQUEST FOR QUOTATION (RFQ) (Services)

UNDP CO Procurement Services Unit, UNDP – São Tomé e Príncipe	DATE: 16 Nov 2020
	REFERENCE: UN House São Tomé e Príncipe Provision of O&M service for Solar PV System

Dear Sir / Madam:

We kindly request you to submit your offer for the provision of O&M services for the **Grid tied Solar System installed in the São Tomé e Príncipe UN House** as detailed in the Term Of Reference (TORs) of this RFQ.

Please take note of the following important deadlines (**based on/by COB, CEST / CPH time**):

1. Confirmation of participation in Site Visit: 23 November 2020
2. Site Visit: **24 November 2020 – 9:00 AM at the UN House Compound**
3. Request for Clarification: **28 November 2020**
4. Offer Submission: **9 December 2020**

and via ☒e-mail:

**United Nations Development Programme**  
[bidsstp@undp.org](mailto:bidsstp@undp.org) and copy [oimt.green.energy@undp.org](mailto:oimt.green.energy@undp.org)

It shall remain your responsibility to ensure that your offer will reach the address above on or before the deadline. Offers that are received by UNDP after the deadline indicated above, for whatever reason, shall not be considered for evaluation. If you are submitting your offer by email, kindly ensure that they are signed and in the .pdf format, and free from any virus or corrupted files.

Please take note of the following **requirements and conditions** pertaining to the supply of the abovementioned good/services:

<b>Project Title:</b>	UN House São Tomé e Príncipe - Provision of O&M service for Solar System
Customs clearance <sup>1</sup> , if needed, shall be done by:	<input checked="" type="checkbox"/> UNDP
Exact Address/es of Delivery Location/s (identify all, if multiple)	United Nations Development Programme São Tomé e Príncipe São Tomé Avenida das Nações Unidas C.P. 109 GPS Coordinates: 0.3359575, 6.738169
Delivery Schedule	<input checked="" type="checkbox"/> Required
Currency of Quotation	<input checked="" type="checkbox"/> United States Dollars
Value Added Tax on Price Quotation	<input checked="" type="checkbox"/> Must be exclusive of VAT and other applicable indirect taxes
After-sales services required	Please ref to TORs
Deadline for Request for Clarification	<b>COB (CEST / CPH time): 28 November 2020</b>
Deadline for the Submission of Quotation	<b>COB (CEST / CPH time): 9 December 2020</b>
All documentations, including catalogues, instructions and operating manuals, shall be in this language	<input checked="" type="checkbox"/> English
Mandatory requirements for bid submission	1. Site visit
Period of Validity of Quotes starting the Submission Date	<input checked="" type="checkbox"/> 120 days  In exceptional circumstances, UNDP may request the Vendor to extend the validity of the Quotation beyond what has been initially indicated in this RFQ. The Proposal shall then confirm the extension in writing, without any modification whatsoever on the Quotation.

<sup>1</sup> Must be linked to INCO Terms chosen.

Documents to be submitted	<p>THE FOLLOWING SHALL BE INCLUDED IN THE BID SUBMISSION:</p> <p><b>1) TECHNICAL OFFER.</b> Bidders are required to provide the following as part of the technical offer, presenting 10 separate attachments:</p> <ol style="list-style-type: none"> <li>Service scope and detailed list of activities to be executed in the provision of the Operations and maintenance service.</li> <li>Comprehensive details for procedures to be carried out during periodic inspection.</li> <li>Detailed escalation procedures and plan of action in case of system troubleshooting and clear definition of roles and responsibilities;</li> <li>Service targets and service measurements procedure including expected response and resolution time for the most typical issues;</li> <li>Bidder's Statement Regarding Deviations/Non-Compliance (as per template provided in Appendix I in the ToR);</li> <li>A detailed company profile including documentary evidence of similar services performed;</li> <li>CVs of the project focal point/focal points;</li> <li>Details on freight, logistics and installation plan in terms of timelines, delivery time and production time if applicable;</li> <li>Proposed work plan and approach criteria in relation to the requirements in the terms of reference (TORs);</li> <li>Risk assessment and Mitigation plan;</li> <li>Service exclusion;</li> </ol> <p>A representative from the supplier's own staff/ team during commissioning of the system must be provided.</p> <p><b>2) FINANCIAL OFFER.</b></p> <ol style="list-style-type: none"> <li>Price and Delivery Schedule Form: Fully completed and duly authorized (see Term of Reference, Section <b>Error! Reference source not found.</b>).</li> <li>Please note all costs should be specified as indicated in the Price and Delivery Schedule Form. Therefore, the price of an item must not be included into another item.</li> </ol>
Payment Terms	<p>Total Acquisition</p> <p><input checked="" type="checkbox"/> Upon complete delivery of the service every XX months after the delivery of preventive maintenance checklist and report</p>
Evaluation Criteria	<p><input checked="" type="checkbox"/> Technical responsiveness/Full compliance to requirements and lowest price</p> <p><input checked="" type="checkbox"/> Full acceptance of the UNDP Contract General Terms and Conditions</p> <p><input checked="" type="checkbox"/> Full compliance to delivery of documentation in the required format</p>

UNDP will award to:	<input checked="" type="checkbox"/> One and only one supplier
Type of Contract to be Signed	<input checked="" type="checkbox"/> Purchase Order
Conditions for Release of Payment - Acquisition	a. Delivery of annual reporting on system performances and delivery of 4 maintenance report per year b. Full compliance with RFQ requirements and of the agreed service targets
Annexes to this RFQ	<input checked="" type="checkbox"/> Terms of Reference <input checked="" type="checkbox"/> System datasheets (Annex 1) <input checked="" type="checkbox"/> Official UN Holidays (Annex 2)
Contact Person for Inquiries (Written inquiries only) <sup>2</sup>	Email: <a href="mailto:procurement.st@undp.org">procurement.st@undp.org</a> and copy <a href="mailto:oimt.green.energy@undp.org">oimt.green.energy@undp.org</a> Any delay in UNDP's response shall be not used as a reason for extending the deadline for submission, unless UNDP determines that such an extension is necessary and communicates a new deadline to the Proposers.

Services offered shall be reviewed based on completeness and compliance of the quotation/proposal with the minimum specifications described above and any other annexes providing details of UNDP requirements.

The quotation/proposal that complies with all the specifications, requirements and offers the lowest price, as well as all other evaluation criteria indicated, shall be selected. Any offer that does not meet the requirements shall be rejected.

Any discrepancy between the unit price and the total price (obtained by multiplying the unit price and quantity) shall be re-computed by UNDP. The unit price shall prevail, and the total price shall be corrected. If the supplier does not accept the final price based on UNDP's re-computation and correction of errors, its quotation will be rejected.

At any time during the validity of the quotation, no price variation due to escalation, inflation, fluctuation in exchange rates, or any other market factors shall be accepted by UNDP after it has received the quotation. At the time of award of Contract or Purchase Order, UNDP reserves the right to vary (increase or decrease) the quantity of services and/or goods, by up to a maximum twenty-five per cent (25%) of the total offer, without any change in the unit price or other terms and conditions.

Any Purchase Order that will be issued as a result of this RFQ shall be subject to the General Terms and Conditions attached hereto. The mere act of submission of a quotation implies that the vendor accepts without question the General Terms and Conditions of UNDP.

UNDP is not bound to accept any quotation, nor award a contract/Purchase Order, nor be responsible for any costs associated with a Supplier's preparation and submission of a quotation, regardless of the outcome or the manner of conducting the selection process.

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<sup>2</sup> This contact person and address is officially designated by UNDP. If inquiries are sent to other person/s or address/es, even if they are UNDP staff, UNDP shall have no obligation to respond nor can UNDP confirm that the query was received.

Please be advised that UNDP's vendor protest procedure is intended to afford an opportunity to appeal for persons or firms not awarded a purchase order or contract in a competitive procurement process. In the event that you believe you have not been fairly treated; you can find detailed information about vendor protest procedures in the following link: <http://www.undp.org/content/undp/en/home/operations/procurement/protestandsanctions/>

UNDP encourages every prospective Vendor to avoid and prevent conflicts of interest, by disclosing to UNDP if you, or any of your affiliates or personnel, were involved in the preparation of the requirements, design, specifications, cost estimates, and other information used in this RFQ.

UNDP implements a zero tolerance on fraud and other proscribed practices and is committed to identifying and addressing all such acts and practices against UNDP, as well as third parties involved in UNDP activities. UNDP expects its suppliers to adhere to the UN Supplier Code of Conduct found in this link : [http://www.un.org/depts/ptd/pdf/conduct\\_english.pdf](http://www.un.org/depts/ptd/pdf/conduct_english.pdf)

**Thank you and we look forward to receiving your quotation.**

**Sincerely yours,**

Katarzyna Wawiernia

Resident Representative



# UN House São Tomé e Príncipe



## Terms of Reference:

Operations and Maintenance service for Solar System for UN House São Tomé e Príncipe

Solar PV  
Capacity (kWp)



45

Renewable  
Fraction (%)



18

CO<sub>2</sub> Emissions  
Reductions  
(tons/year)



20.5



## About

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UNDP OIMT/CIAS

*Prepared 27/10/2020 by.  
Last Update: 30/10/2020.*

OIMT Green Energy Team.

**ISO 9001** *Approved for Release by*  
Gerald Demeules  
*Global ICT Advisor*



# Terms of Reference: Solar Hybrid System

UN House São Tomé e Príncipe

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## 3. Acronyms

**AI** - Artificial Intelligence  
**COB** - Close of Business  
**GHG** - Green House Gas  
**HQ** - Head Quarters  
**ICT** - Information and Communications Technology  
**IoT** - Internet of Things  
**O&M** - Operation and Maintenance  
**OIMT** - Office of Information Management and Technology  
**PCMM** - Power Consumption Measuring and Monitoring  
**PSU** - Procurement Services Unit  
**SDGs** - Sustainable Development Goals  
**TOR** - Terms of Reference  
**UAT** - User Acceptance Test  
**UNDG** - United Nations Development Group  
**UNDP** – United Nations Development Programme



## Terms of Reference: Provision of services for the Operation and Maintenance of the Solar System

### UN House São Tomé e Príncipe

#### 4. Scope of the Document

The Terms of Reference (TOR) sets the requirements to facilitate the provision of services to secure the correct and uninterrupted operations of the solar system installed in the **UN House São Tomé e Príncipe**. The scope of the service is to provide preventive and corrective maintenance. An overall high-quality service is expected, as it is fundamental for UNDP to ensure high system availability at sustainable costs.

#### 5. Structure of the Document

The ToR include the following components:

1. Introduction;
2. Service Description and available documentation;
3. Statement of Work;
4. Price and Delivery Schedule Forms;
5. Project Management and Communication Plan.

All the requirements included in this ToR are numbered and boxed.

#### 6. Introduction

The **UN House São Tomé e Príncipe**, in cooperation with the UNDP Office of Information Management and Technology (OIMT) Green Energy Team, has been operating a solar installation in their premises for the last 3 years. The system comprises of 45kWp solar PV system.

The system has operated smoothly for the first 3 years, providing approximately 42 MWh/year to the UN House. The Solar PV system guaranteed a renewable fraction of 18%, reducing the Country Office's CO<sub>2</sub> emissions by 20.5 tonsCO<sub>2eq</sub>/year.

##### 6.1 Sustainable Development Goals

The Sustainable Development Goals (SDGs) are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice. The Goals interconnect and in order to leave no one behind, it is important that we achieve each Goal and target by 2030. As a leading agency in the fight against climate change, UNDP is committed to “walk the talk” by demonstrating that we run our operations in a resources-efficient, sustainable and accountable way.



Substantial progress has been achieved in making UNDP “greener,” more resilient operations both at Head Quarters and in many Country Offices (CO) and Regional Centers. Around the world, our offices are working to minimize the environmental impact associated with operations, from green building renovations and sustainable procurement practices to staff training and bicycling programs. By now, over 20 UNDP CO – out of a total of 167 - have installed or are installing photovoltaic systems to reduce Green House Gas (GHG) emissions and enhance office energy security.



Figure 1. Sustainable Development Goals (SDGs)

Recently UNDP adopted a 'Climate Neutrality and Sustainability Plan for Global UNDP Operations' committing UNDP to reduce GHG emissions by 10% over 5 years and achieving climate neutrality for global operations starting effective 2014<sup>3</sup>.

## 6.2 Smart UN Facilities

The concept of Smart UN Facilities revolves around using data insights and interconnected technologies to transform UN Country Offices and related facilities into “smart” premises; in effect, local capacity to carry out the UN’s goals is augmented.

<sup>3</sup> UNDP - Greening the Blue Initiative (<http://www.greeningtheblue.org/what-the-un-is-doing/unitednationsdevelopment-programme-undp>)

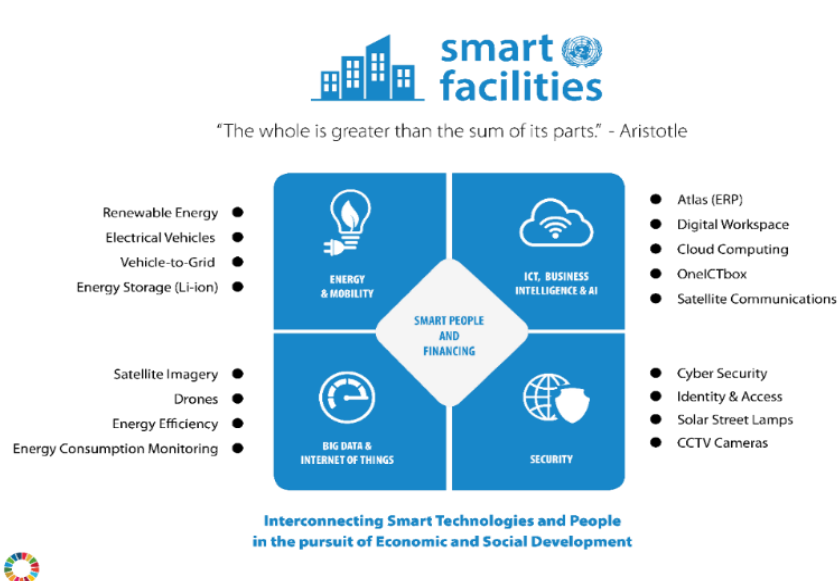


Figure 2. Smart UN Facility Framework

This is rooted in two aspects, which are manifested in multiple technology systems provided by OIMT:

1. Fourth Industrial Revolution – the advent of connected technologies including robotics, the Internet of Things (IoT), autonomous vehicles.
2. Smart cities – utilization of sensors for data collection, insights, analysis, and subsequent enhancement of services.

In view of the benefits, it leads to make the first step in transitioning into a low-carbon and digital organization through smart integration of various equipment. As it is depicted below, **Error! Reference source not found.** shows the main technologies that set and establish the Smart UN Facilities including:

1. Energy & Mobility
2. ICT, Business Intelligence & AI
3. Big Data & Internet of Things
4. Security

### 6.3 Seven Step Green Energy Process

Use of the United Nations Development Group (UNDG) recommended 7-Step process will be adopted for the project. The approach is a holistic end-to-end process with preliminary assessment of project practicability and the post-installation operation & maintenance.

This is depicted in **Error! Reference source not found.** and elaborated in the subsequent text.



## 7 STEP GREEN ENERGY SOLUTION



Recognized best practice for UNDG Solar implementation

Figure 3. 7 Step Green Energy solution process

### 7. Step 1: Assessment using IoT

- a) The CO installs IoT devices, such as the Power Consumption Measuring and Monitoring Device (PCMM).
- b) OIMT will monitor the quality of the grid and the genset. The solution proposed for the Solar Hybrid System should be compatible with the monitoring system.
- c) The office is required to complete the Preliminary Site Survey form which will provide information on the physical structure and more details on electrical installations.
- d) If the previous options are not applicable, a technical mission from a qualified engineer can be used to complete this step.

### 8. Step 2: Business Case

- a) This step serves to provide essential information and data for decision-making. With the information gathered during Step 1, OIMT compiles a load profile of the energy consumption. This enables an analysis that results in the draft of a business case, presenting a potential green energy solution for the CO.

### 9. Step 3: Procurement and Site Preparation

- a) Compilation and publication of solicitation documents will be carried out in accordance to UNDP rules as applied by PSU in such projects
- b) Evaluation of bids/proposals will be carried out jointly between OIMT, CO, PSU, and a government representative/ CO focal point

### 10. Step 4: Site survey – vendor

- a) The awarded vendor carries out an on-site survey to exhaustively take into consideration all aspects that can adversely affect the implementation of the project, and information for the final costing of the project including required materials/equipment and time frames.
- b) The vendor acts as implementer, working closely with focal point at the CO, when necessary, and OIMT exercising technical oversight and project management. Submission of the final **Site Survey Report** marks the end of this step.



## 11. Step 5: Design

- a) The selected vendor drafts the final system design, taking into consideration findings from the site survey in the previous step.
- b) As part of technical oversight, OIMT must endorse the final design before actual installation starts. Submission of the **final design** certified by the manufacturer and **implementation schedule** marks the end of this step.

## 12. Step 6: Installation

- a) The vendor carries out all the necessary installations, in the process giving regular progress updates to all stakeholders;
- b) Critical milestones are defined, at which point OIMT makes the necessary assessments as part of the technical oversight
- c) Six-month stabilization period, to allow end user to get acquainted with the system and basic troubleshooting.
- d) Among other critical requirements, the step entails end-to-end testing, physical inspection of the installation, user training, and complete documentation of the system.
- e) This step involves carrying out User Acceptance Testing (UAT) in which all parties play a role. This test is to be developed in collaboration with OIMT.
- f) A **signed checklist** confirming full compliance with all requirements marks the end of the step, giving way to O&M.

## 13. Step 7: Operation and Maintenance

- a) Regular **bi-annual maintenance** by the supplier and regular monitoring from UNDP.
- b) After the first 3 years of operation covered by the initial contract the service is renewed for the remaining project lifetime.

## 14. Communication and Publicity

Parallel to the 7-step process of green energy solution, OIMT Communications Team and the Communications Country Office Team carry out the promotions of the successful project within the country and globally through the UN network. This process involves highlighting the benefits of the installed system and spread word about the human impact. Furthermore, this aims at motivating similar installations in other parts of the country.





## 15. System description and service requirements

### 15.1 Project Objectives

The main goal of the operation and maintenance service is to ensure the correct and uninterrupted operations of the solar hybrid system in order to guarantee the profitability of UNDP assets. OIMT requires **high quality** of the service as the system serves as a show case at a national and international scale, proving the long-term durability, reliability and profitability of solar installations. The following section(s) provides minimum requirements and guidelines for the service to be provided. However, improvements on the minimum requirements to guarantee adequate system performances are highly encouraged.

### 15.2 Service High Level Requirements

This service seeks to ensure the continuous operations of the solar installation to guarantee stable energy supply for the UNDP premises. The installed solar system has 45 kWp power capacity. Overall inverter capacity is 41 kW. Along with the solar system 2 energy sources are available:

1. 1 diesel generators of 150 kVA. However, the generator maintenance is out of the scope of this RfQ.
2. National Grid

The requirement is for the vendor to provide a comprehensive offer for the provision of the operation and maintenance (O&M) services, both predictive and corrective, for the **Solar PV installation for an overall duration of 1 year**. High level requirements for the service are as follows:

1. System support and troubleshooting;
2. Ensure continued system connectivity for remote monitoring and data collection;
3. Corrective maintenance visit if requested;
4. 4 predictive maintenance visits per year, including cleaning of panels and general system inspections;
5. Identification of potential improvements and system optimization strategies;
6. Support in replacement of defective components.;
7. Availability of recognized maintenance certifications for the specific inverter make and model will be considered as a strong advantage

The Solar PV system is expected to keep performances in line with or above the performance of the first 3 years of operations. In particular the main parameter monitored will be:

1. Solar system yearly generation [kWh];
2. Solar system performance ratio;
3. Overall, Renewable fraction [%] provided no changes on the load;
4. Overall system up-time [h] and system availability [%];
5. System mean time to failure [h];



The measurements taken from the UNDP Green Energy Team during the first three years of operations will serve as a benchmark to measure the quality of the service. Periodical reduction of 5% per year will be considered as acceptable for parameter number 1. Benchmarking parameter will be reassessed in case of changes in system configurations.

It is essential that the Solar PV system operates in a robust and continuous manner with regards to energy supply for the CO. The weather in São Tomé e Príncipe has many variations, and due to its location, the area is prone to earthquakes and geological activities. Hence, it is important that the periodical checks on overall system stability and status are performed, in particular related to hazardous events and/or harsh climatic conditions. The signed contract will be renewed on an annual basis from UNDP depending on satisfactory performance by the supplier. Supplier performances will be evaluated against benchmark values of system performances and against response and solution time (section 3.3 below.)

### 15.3 Description of the Site and of the installed system

UN House São Tomé e Príncipe Premises is located at: Avenida das Nações Unidas C.P. 109, São Tomé, São Tomé e Príncipe, at the following GPS Coordinates: 0.3359575, 6.738169.

The energy system covers the load of an office building. Aerial pictures of the installations can be seen below in **Error! Reference source not found..**



Figure 4. Aerial view of the UNDP premise

The system was inaugurated in 2017 and has now been in operation for 3 years. During this period, the system has been well maintained and accurately monitored by both the original system supplier, the UNDP São Tomé e Príncipe country office and the UNDP Green Energy Team in Copenhagen.

#### 15.3.1 Location of PV Panels and solar field layout

The Solar Panels are located on the roof of UN House building, as well as on top of three canopies. The detailed layout on the terrace of the building can be seen in Figure 5. The detailed string disposition is provided in Figure 6.

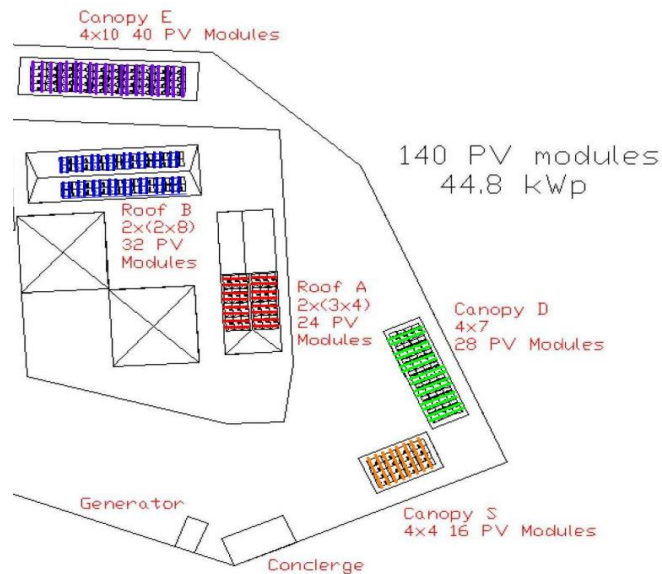


Figure 5. Panel Disposition

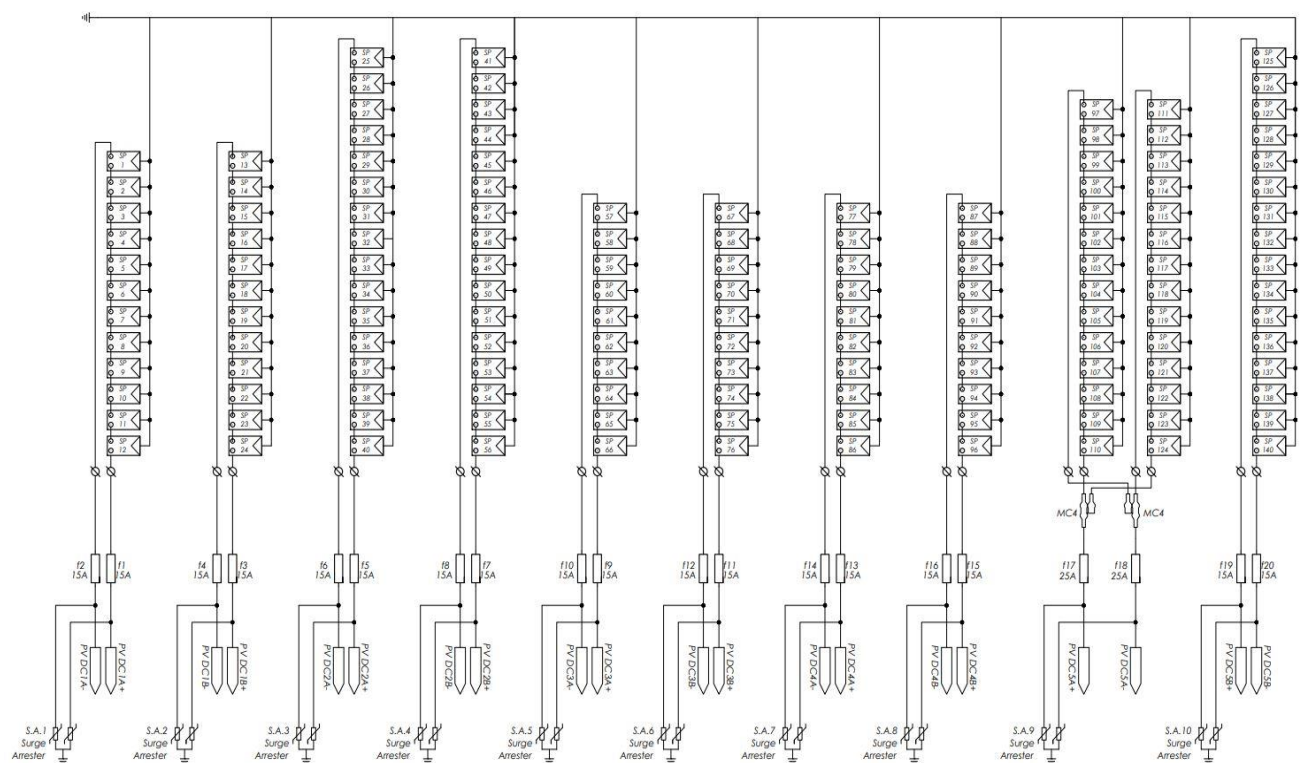


Figure 6. String DC wiring

### 15.3.2 As built system diagrams

The Solar field is composed of 140 panels divided into 11 strings. All the panels are directly installed on the building roof and the canopies and are following the roof tilt. Strings are collected into 5 inverters, 2 STP 6000TL of 6 kW capacity each, one STP 7000TL of 7 kW capacity, one STP 10000TL of 10 kW capacity and one STP 12000TL of 12 kW capacity. The solar inverters are connected to an AC bus bar to which are connected the system loads and the grid and generator. Switching between grid and generator is regulated by an ATS. Detailed datasheet of the main system components is



available in Annex 1: System's components datasheets. SLD and other details will be made available to the winning bidder.

### 15.3.3 As built technical room layout

The technical room is located on the ground floor of the main building and it is provided with the following security systems;

Temperature and Humidity of the technical room has been kept under control as much as possible in the past years.

### 15.3.4 Load Consumption and solar system generation

The load and solar generation measurements are provided by the online monitoring platform SMA sunny portal. This will remain the main data source to evaluate system performances. The average daily load in the compound is 675 kWh/day and the solar system is providing 18% of it. The average daily generation is 115.23 kWh/day.

Average load profile and relative solar generation are available in Figure 7, Figure 8 and Table 1.

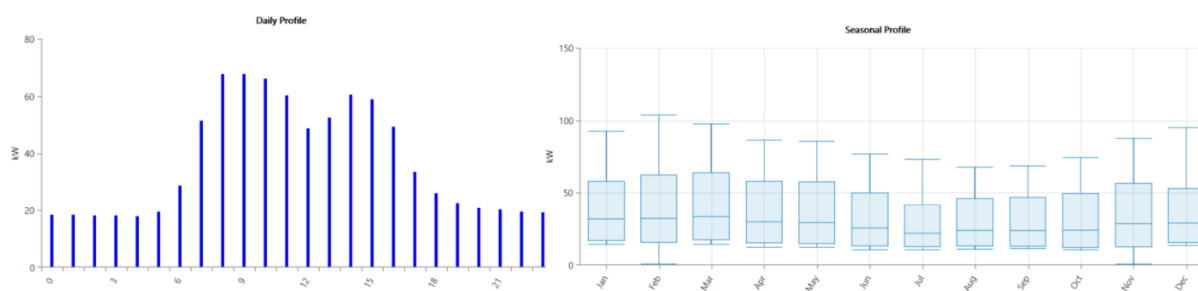


Figure 7. UN House São Tomé e Príncipe Load Profile

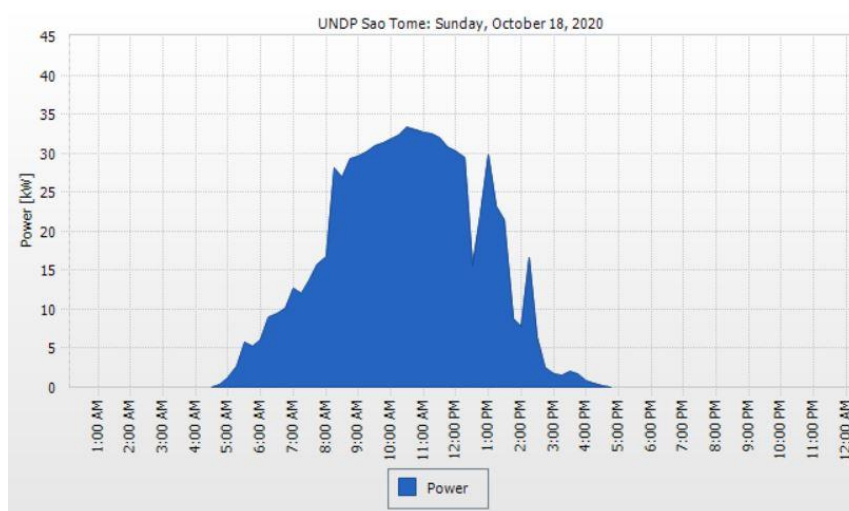


Figure 8. PV generation daily profile

Table 1. Load Profile Metrics

Metric	Baseline
Average (kWh/day)	674.82



Average (kWh)	28.12
Peak (kW)	103.71

### 15.3.5 External power sources

It is expected for the solar hybrid system to keep operating in a smart, integrated manner with the other available power sources. As per the original installation, the system's electricity supply is expected to operate according to the follow logic/priorities shown in Figure 9.



Figure 9. System's operating logic

## 16. Statement of Work

### 16.1 Site Visit

Necessary site information, including photos, have been provided. However, for preparation and submission of an offer, the vendor will be able to collect additional information during the Site Visit (without cost to UNDP). The data collected on the site assessment visit, together with the data included in this document, are what shall be considered for the offer preparation and submission.

Site Assessment Visit is scheduled for the **24 November 2020 at 9:00 AM at UN House Compound**. The Assessment can be conducted by the vendor's own staff or by authorized personnel. Conducting a site visit is **compulsory** for the offer to be valid.

The UNDP focal contact in **Sao Tome is Marina Trigueiros**. Please note that it is necessary to arrange the site visit in advance. As such, please inform your local partner accordingly. **Please confirm** your intention to undertake Site Assessment Visit (without cost to UNDP) **by 23 November 2020 COB (Copenhagen Time)** by sending an email to: [oimt.green.energy@undp.org](mailto:oimt.green.energy@undp.org) and [marina.trigueiros@undp.org](mailto:marina.trigueiros@undp.org). Kindly provide in this email the following information for UNDP CO and UNDP OIMT to make the necessary arrangements for assessment.

Confirmation of site visit in the <b>specified day and time</b>	
Name of company/local partner undertaking site visit	
Name of visitor, ID and contact details	
Please refer to the address stated in this RfQ:	<b>OIMT to copy Address</b>

### 16.2 Requirements

The awarded company shall perform the services stated below sections (**Error! Reference source not found.** - Warranty). Compliance with or deviations from the specification shall be clearly stated by the vendor in the below and submitted as part of the offer (*Please refer to Appendix I*). It is expected for the awarded service provider to be the exclusive provider of operation and maintenance service for the system and, except in emergency situation, the awarded service provider shall not perform or permit any repair, maintenance or operation activity on or related to the system by another provider without UNDP's prior written consent.

Availability of recognized certification in operating and/or commissioning the specific inverter make and model will be considered as a relevant advantage.



Availability of recognized certification in operating and/or commissioning the specific batteries make and model will be considered as a relevant advantage.

#### **16.2.1 Preventive maintenance service**

At least 4 preventive maintenance visits per year shall be executed to guarantee correct system operations and optimal performances. It is mandatory that 2 of these 4 preventive maintenance visits are performed during dry season (gravana) period (from July until September) as during this period PV modules usually get covered in dust, compromising the overall efficiency of the system.

The awarded service provider shall perform all necessary preventive maintenance adjustments electrical replacements and cleaning (interior and exterior) and provide the necessary documentation in support. It will be responsibility of the awarded service provider to ensure that all the warranties are preserved and that equipment working conditions are compliant with such warranties. Preventive maintenance will include correction of loose electrical connections, ground



connections and other minor maintenance repair work. Each preventive maintenance visit shall include the following activities.

*Table 3. PV modules mounting technical requirements*





16.2.1.1	Solar field and components	<ol style="list-style-type: none"> <li>1. Solar Panels cleaning;</li> <li>2. Replacement of broken or damaged modules;</li> <li>3. Vegetation management and wildlife prevention if applicable.</li> <li>4. Solar field visual inspection (wiring, mounting system, junction box, strain relief);</li> <li>5. <math>I_{mpp}</math> testing on all DC strings, If <math>I_{mpp}</math> testing show unbalanced strings <math>V_{oc}</math> and <math>I_{sc}</math> test should be performed in order to locate the fault. If fault is identified resolution plan shall be provided.</li> <li>6. Check and tighten eventual loose electrical connections in combiner boxes, switchgears and inverters.</li> <li>7. Capacity to execute thermographic inspection of electrical components like combiner boxes and PV system and capacity to check for hotspots and cracks on solar panel will be considered an advantage.</li> </ol>
16.2.1.2	Technical room (inverter)	<ol style="list-style-type: none"> <li>1. Cleaning of the equipment and all the electrical enclosure;</li> <li>2. Cleaning of the inverters' filters and filters replacement if necessary;</li> <li>3. Perform preventive maintenance on the inverters as required by the manufacturer's warranty;</li> <li>4. Cables and connections checking;</li> <li>5. Technical room temperature measurement checks.</li> </ol>
16.2.1.3	Technical room (ventilation and AC system)	<ol style="list-style-type: none"> <li>1. Cleaning of AC and ventilation system;</li> <li>2. Cleaning and replacement (if necessary) of AC and ventilation system filters;</li> <li>3. Visual inspection of the AC and ventilation system checking for water leakages/stagnation.</li> </ol>



<b>16.2.1.4</b>	Technical room (structure/container integrity)	<ol style="list-style-type: none"><li>1. Visual inspection of the room/container overall conditions and integrity;</li><li>2. Inspection of security infrastructure or equipment (i.e. fences, security cameras...) (if applicable).</li></ol>
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### **16.2.2 Corrective maintenance service**

The awarded service provider shall perform basic corrective maintenance services for the system upon request of the CO and/or of the Green Energy Teams and shall be available to respond in case of emergency/hazardous situations. Corrective maintenance shall include the following minimum requirements:



Table 4. Power electronics technical requirements

<b>16.2.2.1</b>	Emergency response	<p>Rapid intervention in case of emergency/hazardous situation with remote support to the country office identified technical focal point. Full availability to perform on-site direct intervention if required. Minimum response time for these situations shall be 2 hours during working hours and 12 hours outside working hours or official UN holidays (Annex 2). Emergency situations include the following:</p> <ol style="list-style-type: none"> <li>1. Events that will cause serious impact on system performances, affecting 80% to 100% of system productivity;</li> <li>2. Events that represent a direct danger for local staff or for local office equipment (i.e. office appliances, critical loads, backup generator).</li> </ol>
<b>16.2.2.2</b>	Response time	<p>During working hours:</p> <ol style="list-style-type: none"> <li>1. 2 hours for Emergency or critical situation (more than 80% loss in productivity);</li> <li>2. 24 hours for system failure (more than 50% loss in productivity);</li> <li>3. 48 hours for minor issues (less than 50% loss in productivity);</li> </ol> <p>Outside working hours or during official UN holidays:</p> <ol style="list-style-type: none"> <li>1. 12 hours for Emergency or critical situation (more than 80% loss in productivity);</li> <li>2. 36 hours for system failure (more than 50% loss in productivity);</li> <li>3. 72 hours for minor issues (less than 50% loss in productivity)</li> </ol> <p>Acknowledgment of the issue from the CO and/or the Green Energy Team will be taken as starting point for the response time evaluation.</p>
<b>16.2.2.3</b>	Installation/replacement of components	<p>Installation visits to replace or install a component provided by UNDP shall be covered. Commissioning of such component shall be provided.</p>

Corrective maintenance will not cover procurement of key components of the system such as PV, inverters, batteries. Corrective maintenance does not require the service provider to have spare components in stock.



### 16.2.1 Warranty management

The warranty of the system's components will be managed by UNDP as well as replacement logistics and related costs (unless for the conditions stated in paragraph 3.1).

## 16.3 Benchmarks of system performances

The KPI used to evaluate the service level performances will be the following.

*Table 5. KPIs used to evaluate service level performance.*

<b>16.3.1.1</b>	Solar system generation [kWh]	The benchmark value is 115 kWh/day (average). A variation of 5% will be considered acceptable. An annual reduction of 2% will be considered acceptable
<b>16.3.1.2</b>	Solar system RE fraction	The benchmark value is 16%. Variation of the value will be considered acceptable if the average daily load connected to the system will vary more than 5%.
<b>16.3.1.3</b>	Solar system Up-time	Target value is 8,300 hours or 95% over the 12 months period; Down time will be considered as loss of more than 50% of system productivity (system failure).
<b>16.3.1.4</b>	Mean time between failure (MTBF)	Target value is 4,380 hours.
<b>16.3.1.5</b>	Response time	Target values are the following During working hours: <ol style="list-style-type: none"> <li>4. 2 hours for Emergency or critical situation (more than 80% loss in productivity);</li> <li>5. 24 hours for system failure (more than 50% loss in productivity);</li> <li>6. 48 hours for minor issues (less than 50% loss in productivity);</li> </ol> Outside working hours or during official UN holidays: <ol style="list-style-type: none"> <li>4. 12 hours for Emergency or critical situation (more than 80% loss in productivity);</li> <li>5. 36 hours for system failure (more than 50% loss in productivity);</li> <li>6. 72 hours for minor issues (less than 50% loss in productivity).</li> </ol> Acknowledgment of the issue from the CO and/or the Green Energy Team will be taken as starting point for the response time evaluation.

Service performances will be assessed by the Green Energy Team and the CO on a yearly basis and will be subsequently discussed with the service provider on a yearly service performance review meeting.

## 16.4 Misuse of equipment and responsibilities

The Contractor will be held responsible for any damage caused to the solar system or to any other UNDP equipment during the execution of the service. The supplier will be also held accountable for warranty invalidation caused by incorrect maintenance or misuse of the equipment.



## 16.5 Security on the workplace

The Contractor shall:

1. Put in place and maintain an appropriate security plan, taking into account the security situation in the country where the services are being provided;
2. Assume all risks and liabilities related to the Contractor's security and ensure at any time the full implementation of the security plan.

UNDP reserves the right to verify whether such plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this contract. Notwithstanding the foregoing, the Contractor shall remain solely responsible for the security of its personnel and for UNDP's property in its custody.

## 16.6 Timelines

### 16.6.1 Tasks and deliverables

The overall deliverables and their respective deadline after Purchase Order (PO) signature are indicated below in Table 6. The tasks are to be performed within the proposed timeline.

*Table 6. Tasks and responsibilities timeline*

<b>16.6.1.1</b>	<b>Signature of the contract</b>	PO
<b>16.6.1.2</b>	<b>Deadline to request missing documentation to the CO or the Green Energy team (i.e. SLD, Warranties, As built representations)</b>	PO + 1 weeks
<b>16.6.1.3</b>	<b>Preventive maintenance visit report including resolution plan for outstanding issues</b>	Visit + 1 week
<b>16.6.1.4</b>	<b>Corrective maintenance visit report including resolution plan for outstanding issues</b>	Visit + 1 week
<b>16.6.1.5</b>	<b>Operations report and recommended actions</b>	Yearly service performances review + 1 week

## 16.7 Contact Details

<b>Marina Trigueiros (UNDP CO)</b>	End user	<a href="mailto:marina.trigueiros@undp.org">marina.trigueiros@undp.org</a>	+239 2221122
OIMT GET (GET)	Project Manager	<a href="mailto:oimt.green.energy@undp.org">oimt.green.energy@undp.org</a>	+45 45 33 61 14
<<Vendor name>> (Service provider)	Solution provider	Vendor's email TBA	TBA



## 16.8 Communications Conduct

**Meetings:** - Ad-hoc project meetings will be convened whenever there is need for in-depth discussions that cannot be achieved through e-mail or telephone communication. A record of the meeting proceedings will be kept, particularly action points and agreed decisions.

**Email:** - E-mail communication is considered an official record in UNDP and this applies for solar PV installation projects as well. Most issues and information with clear cut intents will be communicated through e-mail to the relevant parties. To keep all informed and for audit trail purposes, all parties should be copied as suitable and the same thread used as much as possible. All circumstances that may impact on delivery timelines should be proactively communicated by the concerned party to allow for timely resolution.

**Informal Communications:** - For successful and timely project implement, informal communication is a necessary ingredient especially in solar PV projects. Given the nature of the projects, interaction between the parties, informal communication will form a sizable chunk of overall communication in this project. However, caution needs to be exercised to avoid negative consequences at a later stage. All communication that commits either part/stakeholder should be formally documented and communicated accordingly.



## 16.9 Price Schedule A

Table 7. Price Schedule A

1.	Yearly cost of preventive maintenance service			
2.	Yearly cost of corrective maintenance service			
3.	Documentation and reporting			
4.	Total initial 5 years cost			





## 17. Annex 1: System's components datasheets

Include all the datasheets of the system's components (inverter, batteries, solar panels, monitoring system....)

### 17.1 Solar Inverters

Technical Data	Sunny Tripower 6000TL	Sunny Tripower 7000TL
<b>Input (DC)</b>		
Max. generator power	9000 Wp	13500 Wp
Max. input voltage	1000 V	1000 V
MPP voltage range / rated input voltage	295 V to 800 V/580 V	290 V to 800 V / 580 V
Min. input voltage / start input voltage	150 V / 188 V	150 V / 188 V
Max. input current input A / input B	11 A / 10 A	15 A / 10 A
Max. short-circuit current input A / input B	17 A / 15 A	25 A / 15 A
Number of independent MPP inputs / strings per MPP input	2 / A:2; B:2	2 / A:2; B:2
<b>Output (AC)</b>		
Rated power (at 230 V, 50 Hz)	6000 W	7000 W
Max. AC apparent power	6000 VA	7000 VA
Nominal AC voltage	3 / N / PE; 230 / 400 V	3 / N / PE; 230 / 400 V
AC grid frequency / range	50 Hz / -5 Hz to +5 Hz	50 Hz / -5 Hz to +5 Hz
Rated power frequency / rated grid voltage	50 Hz / 230 V	50 Hz / 230 V
Max. output current	8.7 A	10.2 A
Power factor at rated power	1	1
Adjustable displacement power factor	0.8 overexcited to 0.8 underexcited	0.8 overexcited to 0.8 underexcited
Feed-in phases / connection phases	3 / 3	3 / 3
<b>Efficiency</b>		
Max. efficiency / European efficiency	98 % / 97.4 %	98 % / 97.5 %
<b>Protective devices</b>		
DC disconnect device	●	●
Ground fault monitoring / grid monitoring	● / ●	● / ●
DC reverse polarity protection / AC short-circuit current capability / galvanically isolated	● / ● / –	● / ● / –
All-pole sensitive residual-current monitoring unit	●	●
Protection class (according to IEC 62103)/overvoltage category (according to IEC 60664-1)	I / III	I / III
<b>General data</b>		
Dimensions (W / H / D)	470 / 730 / 240 mm (18.5 / 28.7 / 9.5 inch)	470 / 730 / 240 mm (18.5 / 28.7 / 9.5 inch)
Weight	37 kg (81.6 lb)	37 kg (81.6 lb)
Operating temperature range	-25 °C to +60 °C (-13 °F to +140 °F)	-25 °C to +60 °C (-13 °F to +140 °F)
Noise emission (typical)	40 dB(A)	40 dB(A)
Self-consumption (at night)	1 W	1 W
Topology / cooling concept	Transformerless / Opticool	Transformerless / Opticool
Degree of protection (according to IEC 60529)	IP65	IP65
Climatic category (according to IEC 60721-3-4)	4K4H	4K4H
Maximum permissible value for relative humidity (non-condensing)	100 %	100 %
<b>Features</b>		
DC connection / AC connection	SUNCLIX / spring-cage terminal	SUNCLIX / spring-cage terminal
Display	Graphic	Graphic
Interface: RS485, Modbus, Speedwire / Webconnect	○ / ● / ●	○ / ● / ●
Multifunction relay / Power Control Module	● / ○	● / ○
Guarantee: 5 / 10 / 15 / 20 years	● / ○ / ○ / ○	● / ○ / ○ / ○
Certificates and permits (more available on request)	6, C10/11:2012, DIN EN 62109-1, 7/MEA², IEC 62109-2, NEN EN 50438, RD 1699:2011, SI 4777, UTE C15-712-1, 1105, VFR 2013, VFR 2014	AS 4777.2:201 NRS 097:2
Type designation	STP 6000TL-20	STP 7000TL-20



Technical Data	Sunny Tripower 10000TL	Sunny Tripower 12000TL
<b>Input (DC)</b>		
Max. generator power	13500 Wp	18000 Wp
Max. input voltage	1000 V	1000 V
MPP voltage range / rated input voltage	370 V to 800 V / 580 V	440 V to 800 V / 580 V
Min. input voltage / start input voltage	150 V / 188 V	150 V / 188 V
Max. input current input A / input B	18 A / 10 A	18 A / 10 A
Max. short-circuit current input A / input B	25 A / 15 A	25 A / 15 A
Number of independent MPP inputs / strings per MPP input	2 / A:2; B:2	2 / A:2; B:2
<b>Output (AC)</b>		
Rated power (at 230 V, 50 Hz)	10000 W	12000 W
Max. AC apparent power	10000 VA	12000 VA
Nominal AC voltage	3 / N / PE; 230 / 400 V	3 / N / PE; 230 / 400 V
AC grid frequency / range	50 Hz / -5 Hz to +5 Hz	50 Hz / -5 Hz to +5 Hz
Rated power frequency / rated grid voltage	50 Hz / 230 V	50 Hz / 230 V
Max. output current	14.5 A	17.4 A
Power factor at rated power	1	1
Adjustable displacement power factor	0.8 overexcited to 0.8 underexcited	0.8 overexcited to 0.8 underexcited
Feed-in phases / connection phases	3 / 3	3 / 3
<b>Efficiency</b>		
Max. efficiency / European efficiency	98 % / 97.6 %	98.3 % / 97.9 %
<b>Protective devices</b>		
DC disconnect device	•	•
Ground fault monitoring / grid monitoring	• / •	• / •
DC reverse polarity protection / AC short-circuit current capability / galvanically isolated	• / • / –	• / • / –
All-pole sensitive residual-current monitoring unit	•	•
Protection class (according to IEC 62103)/overvoltage category (according to IEC 60664-1)	I / III	I / III
<b>General data</b>		
Dimensions (W / H / D)	470 / 730 / 240 mm (18.5 / 28.7 / 9.5 inches)	470 / 730 / 240 mm (18.5 / 28.7 / 9.5 inch)
Weight	37 kg (81.6 lb)	38 kg / 84 lbs
Operating temperature range	-25 °C to +60 °C (-13 °F to +140 °F)	-25 °C to +60 °C (-13 °F to +140 °F)
Noise emission (typical)	40 dB(A)	40 dB(A)
Self-consumption (at night)	1 W	1 W
Topology / cooling concept	Transformerless / Opticool	Transformerless / Opticool
Degree of protection (according to IEC 60529)	IP65	IP65
Climatic category (according to IEC 60721-3-4)	4K4H	4K4H
Maximum permissible value for relative humidity (non-condensing)	100 %	100 %
<b>Features</b>		
DC connection / AC connection	SUNCLIX / spring-cage terminal	SUNCLIX / spring-cage terminal
Display	Graphic	Graphic
Interface: RS485, Modbus, Speedwire / Webconnect	○ / ● / ●	○ / ● / ●
Multifunction relay / Power Control Module	● / ○	● / ○
Guarantee: 5 / 10 / 15 / 20 years	● / ○ / ○ / ○	● / ○ / ○ / ○
Certificates and permits (more available on request)	AS 4777.2:2015, CE, CEI 0-21:2016, C10/11:2012, DIN EN 62109-1, EN 50438 <sup>1</sup> , G59/3, G83/2, IEC 61727/MEA <sup>2</sup> , IEC 62109-2, NEN EN 50438, NRS 097-2-1, PPC, PPDS, RD 661/2007, RD 1699:2011, SI 4777, UTE C15-712-1, VDE0126-1-1, VDE AR-N 4105, VFR 2013, VFR 2014	
Type designation	STP 10000TL-20	STP 12000TL-20

## 17.2

## 17.3

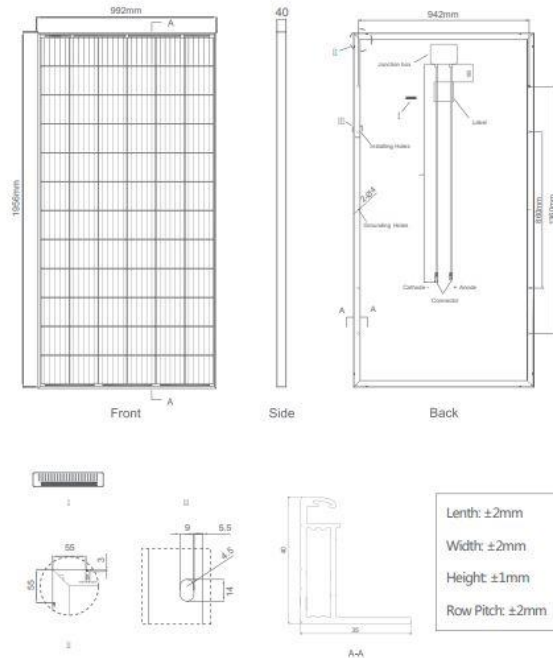
## 17.4

## 17.5



## 17.6 Solar PV panels

### Engineering Drawings

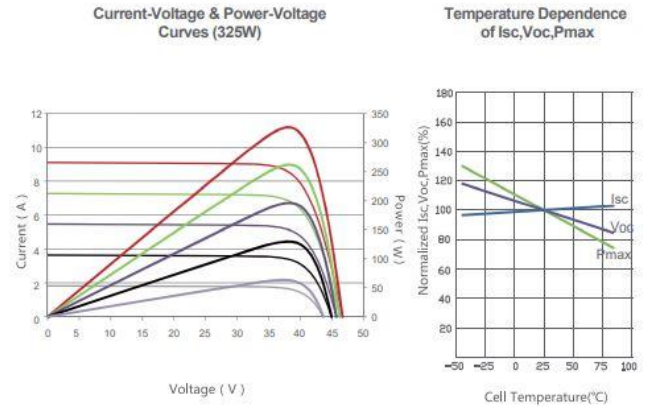


### Packaging Configuration

( Two pallets=One stack )

27pcs/pallet, 54pcs/stack, 648 pcs/40'HQ Container

### Electrical Performance & Temperature Dependence



### Mechanical Characteristics

Cell Type	Poly-crystalline 157×157mm (6 inch)
No. of cells	72 (6×12)
Dimensions	1956×992×40mm (77.01×39.05×1.57 inch)
Weight	22.5 kg (49.6 lbs.)
Front Glass	3.2mm, Anti-Reflection Coating, High Transmission, Low Iron, Tempered Glass
Frame	Anodized Aluminium Alloy
Junction Box	IP67 Rated
Output Cables	TUV 1×4.0mm <sup>2</sup> , Length: 1200mm or Customized Length

## SPECIFICATIONS

Module Type	JKM320PP-72		JKM325PP-72		JKM330PP-72		JKM335PP-72		JKM340PP-72	
	JKM320PP-72-V		JKM325PP-72-V		JKM330PP-72-V		JKM335PP-72-V		JKM340PP-72-V	
	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT	STC	NOCT
Maximum Power (Pmax)	320Wp	237Wp	325Wp	241Wp	330Wp	245Wp	335Wp	249Wp	340Wp	253Wp
Maximum Power Voltage (Vmp)	37.4V	34.7V	37.6V	35.0V	37.8V	35.3V	38.0V	35.6V	38.2V	35.9V
Maximum Power Current (Imp)	8.56A	6.83A	8.66A	6.89A	8.74A	6.94A	8.82A	6.99A	8.91A	7.05A
Open-circuit Voltage (Voc)	46.4V	43.0V	46.7V	43.3V	46.9V	43.6V	47.2V	43.8V	47.5V	44.0V
Short-circuit Current (Isc)	9.05A	7.35A	9.10A	7.40A	9.14A	7.45A	9.18A	7.52A	9.22A	7.98A
Module Efficiency STC (%)	16.49%		16.75%		17.01%		17.26%		17.52%	
Operating Temperature(°C)	-40°C~+85°C									
Maximum system voltage	1000/1500VDC (IEC)									
Maximum series fuse rating	20A									
Power tolerance	0~+3%									
Temperature coefficients of Pmax	-0.38%/°C									
Temperature coefficients of Voc	-0.31%/°C									
Temperature coefficients of Isc	0.06%/°C									
Nominal operating cell temperature (NOCT)	45±2°C									



## 18. Annex 2: Official UN Holidays – Sao Tome

Les 10 jours fériés officiels qui seront observés par le Système des Nations Unies à São Tomé et Príncipe au courant de l'année 2021 :

- Jour de l'An	1 janvier
- Jour de Roi Amador	4 janvier
- Journée des Héros Nationaux	3 février
- Fête International du Travail	1 mai *
- Eid al-Fitr	13 mai
- Fête de l'Indépendance Nationale	12 juillet
- Eid al-Adha	20 juillet
- Réforme Agraire	30 Septembre
- Jour de Peuple	21 décembre
- Noël	25 décembre *

Veuillez noter que les jours signalés avec un astérisque (\*) seront pris le vendredi précédent.

Veuillez noter que les jours signalés avec un astérisque (\*) seront pris le lundi suivant.



19. Appendix I: Compliance Response Form		Understood	Understood with reservations	Comments	
5.1 Introduction					
Introduction	Introduction	<input type="checkbox"/>	<input type="checkbox"/>		
Sustainable Development Goals	Sustainable Development Goals	<input type="checkbox"/>	<input type="checkbox"/>		
Error! Reference source not found.	Smart UN Facilities	<input type="checkbox"/>	<input type="checkbox"/>		
Error! Reference source not found.	7-Step Green Energy Process	<input type="checkbox"/>	<input type="checkbox"/>		
5.2 System description and service requirements					
Project Objectives	Project Objectives	<input type="checkbox"/>	<input type="checkbox"/>		



Service High Level Requirements		<input type="checkbox"/>	<input type="checkbox"/>		
Description of the Site	Description of Site and of installed system	<input type="checkbox"/>	<input type="checkbox"/>		
Error! Reference source not found.	Location of solar panels and solar field layout	<input type="checkbox"/>	<input type="checkbox"/>		
2.3.2	As built system configuration	<input type="checkbox"/>	<input type="checkbox"/>		
2.3.3	As built technical room layout	<input type="checkbox"/>	<input type="checkbox"/>		
2.3.4	Load consumption and solar system generations	<input type="checkbox"/>	<input type="checkbox"/>		
Error! Reference source not found.	External power sources	<input type="checkbox"/>	<input type="checkbox"/>		
3	Statement of work	<input type="checkbox"/>	<input type="checkbox"/>		
3.1	Site visit	<input type="checkbox"/>	<input type="checkbox"/>		
3.2	Requirements	<input type="checkbox"/>	<input type="checkbox"/>		
5.3 Requirements		Compliant	Deviations	Comments	Reference
Error! Reference source not found.2.1 Error! Reference source not found. Maintenance					
Error! Reference source not found.	Solar field and components	<input type="checkbox"/>	<input type="checkbox"/>		



source not found.					
Error! Reference source not found.	Technical room (inverter)	<input type="checkbox"/>	<input type="checkbox"/>		
Error! Reference source not found.	Technical room (batteries)	<input type="checkbox"/>	<input type="checkbox"/>		
Error! Reference source not found.	Technical room (ventilation and AC system)	<input type="checkbox"/>	<input type="checkbox"/>		
Error! Reference source not found.	Technical room (structure/container integrity)	<input type="checkbox"/>	<input type="checkbox"/>		
Error! Reference source not found. Error! Reference source not found. <b>Maintenance</b>					
19.	Emergency response	<input type="checkbox"/>	<input type="checkbox"/>		





			<p>11. Solar field visual inspection (wiring, mounting system, junction box, strain relief);</p> <p>12. <math>I_{mpp}</math> testing on all DC strings, If <math>I_{mpp}</math> testing show unbalanced strings <math>V_{oc}</math> and <math>I_{sc}</math> test should be performed in order to locate the fault. If fault is identified resolution plan shall be provided.</p> <p>13. Check and tighten eventual loose electrical connections in combiner boxes, switchgears and inverters.</p> <p>14. Capacity to execute thermographic inspection of electrical components like combiner boxes and PV system and capacity to check for hotspots and cracks on solar panel will be considered an advantage.</p>		
<b>Error! Reference source not found.</b>	Corrective maintenance visits	<input type="checkbox"/>	<input type="checkbox"/>		
3.2.2.3	Installation/replacement of components	<input type="checkbox"/>	<input type="checkbox"/>		
3.2.2.4	Emergency response	<input type="checkbox"/>	<input type="checkbox"/>		
3.3	Benchmarks of system performances	<input type="checkbox"/>	<input type="checkbox"/>		
3.4	Misuse of equipment and responsibilities	<input type="checkbox"/>	<input type="checkbox"/>		



3.5	Security on the workplace	<input type="checkbox"/>	<input type="checkbox"/>		
<b>5.4 Timelines</b>					
3.6.1	Tasks and deliverables	<input type="checkbox"/>	<input type="checkbox"/>		
3.7	Contact details	<input type="checkbox"/>	<input type="checkbox"/>		
3.8	Communications Conduct	<input type="checkbox"/>	<input type="checkbox"/>		
3.9	Price schedule A	<input type="checkbox"/>	<input type="checkbox"/>		

# Who we are

## UNDP OIMT/CIAS

### Our Vision

Creating Smart Facilities to build local capacity and inspire a movement.

### Our Mission

To support and guide Country Offices in leveraging technology for efficient delivery on the organization's mandate.

**The Office of Information Management and Technology is the leader in digital transformation, so UNDP can be agile and effective in its global delivery.**

UNDP OIMT is headquartered in New York and UN City Copenhagen Denmark, a smart facility which hosts 9 UN agencies and is built with a high focus on sustainability. Our combined efforts provide standardized practices for UNDP country offices to achieve the Sustainable Development Goals and incite other local and international entities to follow our lead.

To illustrate our work, in the wake of the 2014 West Africa Ebola outbreak, country offices in Guinea, Sierra Leone and Liberia could not rely on the grid to meet their energy requirements and diesel shortages restricted access to a sufficient power supply. In order to address this, UNDP OIMT leveraged its experience in implementing smart facilities to roll out solar solutions in the affected countries.

Following this outbreak, UNDP OIMT has aided the installation of solar panel systems in over 13 countries worldwide.

We look forward to implementing the Smart Facilities concept even further.



**United Nations Development Programme**  
Office of Information Management & Technology  
Country Office ICT Advisory Services

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2100 Copenhagen  
Denmark

[www.undp.org](http://www.undp.org)