



صندوق تطوير وإقراض الهيئات المحلية
Municipal Development & Lending Fund



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Municipal Development and Lending Fund
(MDLF)

استدراج عروض أسعار – بضائع

اسم المشروع : توريد وتركيب نظام خلايا شمسية لمبنى صندوق تطوير وإقراض الهيئات المحلية

رقم العقد : MDPIVCI-4.1.2.2



BOQ (50 kWp grid-tie PV – MDLF Headquarters Building)

1- Steelwork cost:-

Item No.	Item description	unit	Quantity	Unit price (Euro)	Total (Euro)
1	Supply and install the galvanized steel structure for the installation of PV panels, and the galvanization should be approved by a testing laboratory certification. All beams and support sections : RHS 100*100*3.2\ RHS 80*40*3\ D 16\ D 12 Columns section : RHS 100*100*3.2 All sections must be S275 bases on specification of EN 10025-2 The price includes all welding work using CO₂ welding with original Zika wires. The price includes hot galvanizing of all metal sections with a zinc layer thickness of at least 80 microns (µm) or 610 g/m², according to ASTM A123 / ISO 1461. Galvanizing is subject to corrosion and thickness tests. Any scratches or welds after galvanizing must be treated with a cold zinc paint according to the same specification. The price includes re-insulating the roof and re-installing the waterproofing layers affected by the installation work, in a manner that ensures no leakage occurs. (N.B. the tenderer shall provide their proposal design in detail and draw in their offers) (N.B. The winning tenderer must provide a Structural analysis of the frame.	L.S	1		



Item No.	Item description	unit	Quantity	Unit price (Euro)	Total (Euro)
**	The tenderer must fill in the details of the Panel distribution for each array proposed in their design. Below:				
2	Supply and install concrete foundation , with strength of B300, including steel reinforcement and anchor bolt to allow for each foot to be fixed on base with screws, the dimension of each foundation is (40 cm*40 cm*40cm) (N.B. the tenderer shall provide their design in detail in their offers).	L.S	1		
	Total				



2- Electrical Components work cost:

#	Item description	unit	Quantity	Unit price (Euro)	Total Euro
3	50 kWp– MDLF Headquarters building Supply, install, and test of PV modules: capacity minimum 660 Wp, Monocrystalline (N.B. the Bid winner shall provide their proposed design/drawing in their offers)	L.S	1		
4	Supply, install, and test of Hybrid grid-tied Interactive Inverters , pure sine wave, three phases, 25 KW, rated frequency 50 Hz, IP65, include independent MPP input, include data logger, with/without LCD/ LED indicator, with THD <3%	UT.	2		
5	Supply and installation of 2* 6 mm2 DC cable for connection between PV modules & PV modules with DC Junction box on steel structure, the cable must be fixed in tranches on the steel structure, while maintaining the aesthetic form of the project, all according to the direction and approval of the project engineer of the employers / Project Consultant	L.S.	1		
6	Supply and installation of 2*6/10 mm2 DC cable (solar type) in trenches for connection from DC junction box to inverter, the cable must be fixed in tranches while maintaining the aesthetic form of the project, all according to the direction and approval of the project engineer of the employers / Project Consultant	L.S.	1		
7	Supply and installation of duct steel trunk: cable trays & cable ladders for cables, including boxes, covers, angles, cable trays fixing arms, tees, crosses, risers, elbows, supports, connectors, earthing, bonding jumpers' connection under supervision and approval by the project engineer of employers and the Project Consultant	L.S.	1		



#	Item description	unit	Quantity	Unit price (Euro)	Total Euro
8	Supply and installation of 5*16 mm² XLPE AC cable in trenches to connect the output of inverters with 3-phase & E bus bar in (AC DB/ panel),	L.S.	1		
9	Supply and installation of 3*25 + 2 * 16 mm² XLPE AC cable in trenches to connect the output of the bus bar in (AC DB/ panel), then with the existing MDB of the JSC building	L.S.	1		
10	Supply and installation of PV junction box on steel structure , including all necessary protection devices (cylindrical fuses, surge arrester, C.B. which will be installed in JB), with lock and IP 65 Enclosure, Transparent door, and have enough space to install all elements, terminals for incoming and outgoing cables. the cost includes all protection fuses, connections, fixing, and all necessary work for that purpose; all work must be approved by the project engineer of the employers and the Project Consultant.	Ut.	2		
11	Supply and installation of the box (AC DB/ panel) near the Inverter AC side with lock and IP 65 Enclosure, including terminals for income and two outcomes cables “ one to main DB and one for Vehicle Charger”, all necessary protection devices/RCD, surge arrester, C.B, two MCB, MCCB, and bus bars, the price includes all protection device inside the box, connections, fixing and all necessary work for that purpose, all work must be approved by project engineer of employers and Project Consultant.	Ut.	1		
12	Supply and install earthing systems (DC and AC Grounding) for all equipment: solar panels, inverter, structure, cabinets, vehicle charger, and cables must be grounded according to the Standard regulations of the electrical company and under the supervision of the Project Consultant	L.S.	1		
13	Supply and install the monitoring system through an Ethernet port with all needed accessories , the system must be capable of storing information, remote monitoring, daily/monthly and yearly reports, and graph display. The data of the solar radiation and temperature monitoring system should also be available on Remote	Ut.	1		



#	Item description	unit	Quantity	Unit price (Euro)	Total Euro
	Monitoring, all under the approval and supervision of the project engineer of employers and the Project Consultant				
14	Supply and installation of suitable protection against lightning by deploying the required capacity of a lightning arrester. according to the Standard regulations of the electrical company and under the supervision of the Project Consultant	Ut.	1		
15	Supply and installation of screen plant " TV screen" real-time monitoring system (data logger) with an online screen unit in the place appointed by supervised engineering, the TV Screen must be no less than 50" and more, according to the approval of the project engineer of employers and the Project Consultant	Ut.	1		
16	Supply and installation of a production meter for the system in AC DB or an Individual board with CB before and after meter, the cost including all connections, protection devices, meter board (<u>if installed</u>), and meter; all work must be approved and according to the distribution electrical company requirements .	Ut.	1		
17	Supply and installation bi-directional meter in the existing electrical panel of the building or a new individual panel (if there is no space in the existing board of the building). The cost includes all connections, protection devices in the board, meter board (<u>if installed</u>), and Bi-directional meter. All work must be approved and according to JDECO electrical company requirements	Ut.	1		
	Total				



3- project and warning board work cost:-

Item No.	Item description	unit	Quantity	Unit price (Euro)	Total Euro
18	Supply and install warning plates, which must be added in accordance with the electricity company or municipality in the area	L.S	1		
19	Prepare the necessary documents and get the permission of the electrical company(Jerusalem District Electricity Company – JDECo) to connect PV to the grid, including all necessary equipment to be installed to achieve this purpose and includes the connection fees.	L.S	1		
	Total				



SUMMARY TABLE

No.	Item	Cost in Euro (€)
1	Steelwork cost	
2	Electrical Components work cost	
3	project and warning board work cost	
GRAND TOTAL excluding VAT (Euro) =		
DISCOUNT % (if applicable) =		
FINAL TOTAL IN NUMBERS excluding VAT (Euro) =		
FINAL TOTAL IN WORDS excluding VAT (Euro):		

Authorized Signature:.....

Name and Title of Signatory:.....

Name of Bidder:.....

Address:.....



صندوق تطوير وإقراض الهيئات المحلية
Municipal Development & Lending Fund



Tel: _____ Mobile: _____

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*** ملاحظة: المشروع غير شامل ضريبة القيمة المضافة

**Supply and installation of 50 kW Hybrid Grid-tie solar
PV power plants on the rooftop of the Headquarters
MDLF Building in Ramallah - West Bank**



TECHNICAL SPECIFICATION

** The proposed projects shall be commissioned as per the technical specifications given below.

2.1 INTRODUCTION

The project aims to **supply and install a 50 kWp Hybrid grid-tie PV power plant on the rooftop of the headquarters of the MDLF building in Ramallah.**

The implementation under the supervision of a consultant, as promotion of innovative technologies, know-how transfer in the field of solar energy, especially photovoltaic energy, and covering the energy demand of the area, totally or partially, MDLF is the owner and contract manager of the project.

** EXPECTED RESULTS OF THE PROJECT

- Providing an On-grid PV solar system with a capacity of 50 kWp on the rooftop of the MDLF building in Ramallah - West Bank to supply electricity to the headquarters of the MDLF building.
- Reduce the energy demand from the local public electrical network, so the electricity bills of the MDLF building will be reduced.
- A sustainable, reliable, safe, and cost-effective electrical energy supply
- PV power Plant is tested, evaluated, and monitored using a monitoring, sensor, and data logging system with a site public demonstration & display and a remote monitoring website.

2.2 TERMS OF EXECUTION

- ✓ **Timeframe:** The Start date of the contract is **immediate**. The overall term of execution of this contract is **spread over 2 months**, effective from the contract signature date. This includes the delivery of the equipment to the site, the installation of the equipment, the testing of the assembled systems, the training of personnel, and the handover. The awarded party has to have all deliverables completed and approved before/by the last working day of the contract period. Extensions, if deemed necessary, can only be granted through mutual agreement between the parties.
- ✓ **Branding Display:** All labeling related to the equipment's brand name, model, or other, has to be highly discreet and unobtrusive, and readable only from very near distances of less than 1m.



- ✓ **Replacement Parts:** All components that may be replaced during the product's lifetime need spare parts available at the Contractor. The spare parts need to be available for 2 years after the date of installation. Equivalent parts replacing the installed item can be proposed with the customer's approval.
- ✓ **Guarantees:** The supplied installations shall be tested, commissioned, and handed over in complete and in perfect operating condition and shall be covered under a defects liability (parts and labor) for a minimum period of **24 months** from the date of commissioning. This warranty covers all manufacturer/workmanship defects only.

Furthermore, all main components shall also have an individual warranty of defects in materials and workmanship and an operation and performance guarantee backed by the manufacturer for a minimum period as specified below:

- PV Modules: overall 25 years, of which 10 years on material and manufacturing faults and 25 years 80% power output warranty.
- Inverter: at least **10** years.

The Contractor must be available to answer any request that comes from the customer. The reply delay of the Contractor should be within one week.

The Contractor has a maximum of one month to replace any defective component.

It is understood that any alteration made to the product without the prior written approval of the Contractor will automatically cancel the remaining warranty period on the affected part.

2.3 TECHNICAL REQUIREMENTS

The objective of this tender is to supply and installation of all the components of the systems detailed in this tender: PV generators, inverters, steel structure, and auxiliary equipment on the rooftop of the existing building, and do all needed work to achieve this purpose, including civil work.



- The equipment furnished to these specifications must meet or exceed all requirements herein. Modifications of or additions to basic standard equipment of a smaller size or capability to meet these requirements will not be acceptable.
- The complete installation of the PV System is according to DIN VDE 0100-712 or comparable.
- Solar PV system shall consist of the following equipment/components for this location:-
 - Solar PV modules consist of a required number of Crystalline PV modules.
 - Grid interactive Power Conditioning Unit with Remote Monitoring System
 - Mounting structures
 - Distribution board.
 - Earthing and lightning protection.
 - Cables for connecting the solar PV system with the existing DB
 - Protective devices and necessary issues for connecting solar PV with the existing DB
- The Contractor shall provide all necessary components in this tender
- (it is mandatory) The Contractor shall avoid overvoltage by laying + and – cables in the DC circuit nearby with no big loops.
- The contractor must provide a full set of technical specifications for each solar photovoltaic system, including the following, but not limited to considering EDC's requirements, international and national standards and regulations, certification required for each part, operation, and maintenance supplier requirements.
- The overall system has to comply with:
 - IEC 60529 Degrees of protection provided by enclosures (IP Code);
 - IEC 61557-8 Electrical safety in low-voltage distribution systems up to 1000 V AC and 1500 V DC - Equipment for testing, measuring, or monitoring of protective measures;
 - IEC 60904 Photovoltaic Devices;



- IEC 62446 Grid-connected photovoltaic systems – Minimum requirements for system documentation, commissioning tests, and inspection.
- The complete installation of the PV System is according to DIN VDE 0100-712 or comparable.
- IEC 62305: lightning protection standard

** The work in this Tender includes:

- a. Carport steel structure and on the rooftop, the solar PV to be fixed on the steel structures, including all Civil work (on the ground if necessary)
- b. PV system works
- c. Connect the PV installations to the existing DB
- d. Coordination and follow-up of the connection of solar PV with the JDECO distribution company.

A. Civil work

General

- Site constraints for location shall be considered, and pre-installation site visits are required to collate space available, distances between sections, shading, special loads, etc.
- Price to include removal of site obstacles from the site if necessary, including any necessary rerouting of infrastructure works, such as trenching, conduits, etc.
- Coordination with the MDLF contact person to facilitate the work.

1.1.1 Danger board

Danger boards should be provided as and where necessary; boards shall be provided in the solar area, charger, DC board, inverters, and AC DB.



B. Solar system work:

B.1 Solar Photovoltaic module:

- Modules deployed must use an identification tag. The following information must be mentioned in the tag used on each module (This can be inside or outside the laminate, but must be able to withstand harsh environmental conditions):
 - ✓ Name of the manufacturer of the PV module
 - ✓ Type and model of the module
 - ✓ Country of origin
 - ✓ Panel power capacity: short-circuit current, open circuit voltage, rated voltage, rated current
 - ✓ Maximum system voltage
 - ✓ Unique Serial No of the module
 - ✓ Other relevant information on the traceability of solar cells and modules as per ISO 9001 and ISO 14001
- PV modules must be composed of silicon cells in mono- or poly-crystalline. Other technologies, such as amorphous silicon, multi-junction in thin layers or polymers, are not accepted.

The PV modules used must qualify for the latest edition of the IEC PV module qualification test or equivalent BIS standards, Crystalline Silicon Solar Cell Modules IEC 61215/IS14286. In addition, the modules must conform to IEC 61730 Part 2- requirements for construction & Part 2 – requirements for testing, safety qualification, or equivalent IS.

- a) For the PV modules to be used in a highly corrosive atmosphere throughout their lifetime, they must qualify for IEC 61701/IS 61701



- b) The total solar PV array capacity should not be less than the allocated capacity (kWp) and should comprise solar crystalline modules of power ranges around 600 Wp. Module capacity less than 600 watts should not be accepted.
- c) Protective devices against surges at the PV module shall be provided. Low-voltage drop bypass diodes that prevent any possibility of the electrical circuit inside the module being broken due to the partial shading of a cell shall be provided.
- d) The module frame shall be made of corrosion-resistant materials, preferably having anodized aluminum.
- e) The bidder shall carefully design & accommodate the requisite number of modules to achieve the rated power in his bid for each location. The contracting authority shall allow only minor changes at the time of execution.
- f) The modules shall be made of a series connection of at least 120 cells. Special attention shall be paid to the structure, and any minimum flexion of the modules shall be avoided to limit the appearance of hot spots in the future.
- g) Another general requirement for the PV modules and subsystems shall be the following:
 - I. The rated output power of any supplied module shall have a tolerance of +/- 3%.
 - II. The peak-power point voltage and the peak-power point current of any supplied module and/or any module string (series-connected modules) shall not vary by more than 2 % from the respective arithmetic means for all modules and/or for all module strings, as the case may be.
 - III. The module shall be provided with a box with either provision of an external screw terminal connection or sealed type, and with an arrangement for the provision of the bypass diode. The box shall have a hinged, weatherproof lid with captive screws and cable gland entry points or may be of a sealed type and IP-68 rated
 - IV. IV curves at STC should be provided by the bidder.
 - V. The efficiency of the solar modules shall be larger than 20%.



- All PV modules must be of the same type (same peak power, same technology, and same Manufacturer).
- The string junction boxes must be sufficiently large to allow possible electric cable interconnections of a minimum 10 mm²; they must be perfectly damp-proof (IP 68) and impenetrable by insects and dust.
- **Warranty on the PV modules:** - Overall 25 years of which **10 years on material** and manufacturing faults, and 25 years 80% performance output warranty.
- **A datasheet of the PV module** must be provided.
- An identified label must be provided for each panel showing: the inverter number, string number, and panel number. The label must be made of a good material that can handle the weather.

B.2 Array structure:

➤ Orientation for optimum yield

To optimize the PV generator's production concerning the estimated load, it is necessary to fulfill the following requirements:

- The tilt angle and azimuth of the modules have been established to optimize production to the needs. the tilt will be according to the declination of the steel structure suggested in the location and design, and the direction of solar PV will be in the south.
- Shadow of the PV modules from obstacles should be minimized over the whole day, and there shall be no shadows in a period of ± 4 h w.r.t. Solar noon.
- A shadow partially blocking off a photovoltaic cell may cause hot spots and loss of almost the whole production of this module, significantly reducing the performance of a complete string.
- The surface for fitting photovoltaic modules to structures shall be perfectly flat in order not to induce mechanical stresses on securing the modules. Moreover, there shall be accessibility to perform periodical cleaning and inspection.
- PV module must be facing south on the rooftop of the suggested steel structure.



➤ Support Structure

- The support frames shall be fixed on the ground according to the suggested drawings, and the solar PV system will be installed on the rooftop of the steel structure with a separate frame, depending on the final design (a steel structure should be designed after consultation with the MDLF).
- Particular attention should be given to wind loads on the PV generators and their structures so that they withstand winds of up to 120 km/h.
- The contractor must provide **static proof for the complete steel structure**.
- Modules shall be mounted on non-corrosive support structures
- The steel base must be implemented in each existing rooftop base, which allows for the solar PV frame to be fixed on the base with screws
- The frames and leg assemblies of the carport and array structures shall be made of hot-dip galvanized. Galvanization coating shall be as per IS 4759 or equivalent standards.
- All fasteners shall be of Stainless steel - SS 304 (Nut, fasteners & bolts)
- Structural material shall be corrosion-resistant and compatible with the materials used in the module frame, its fasteners, nuts, and bolts. Aluminum structures can also be used that can withstand the wind speed of the respective wind zone (for example: using aluminum alloy 6105 T5 for rails). Necessary protection against rusting needs to be provided either by coating or anodization.
- Supporting structures, including module Mounting Structures, shall have to be adequately protected against all climatic conditions and made of corrosion-resistant materials
- No welding allowed on the structure (maybe in some cases after the approval of the project engineer)
- Clamp material should be anodized aluminum alloy.



- Clamp must fulfill the requirement of "positive-fitting and friction-locked connections" using interlocking retaining clamps (bolts with nuts) to be suitable for all framed modules.
- PV clamps are to be used in between modules (mid-clamp) and the clamps used at the end of rails (end-clamp)
- Provisions shall be made to prevent electrochemical corrosion between the structures and the rooftop base on the one hand, and the structures and photovoltaic modules on the other. The negative conductor should be connected to the earth electrode, as this arrangement will reduce the electrochemical degradation of the electrode and other metallic parts.
- Outdoor generator wiring and associated components are exposed to UV, wind, water, and other environmental conditions. Wiring and components should be fit for this purpose and built in such a way as to minimize exposure to detrimental environmental effects. Particular attention is drawn to the need for the prevention of water accumulation in cable/module supports.

B.3 PV generator String Combiner board & DC distribution board

To provide protection and performance monitoring for photovoltaic systems, string combiners and/or DC distribution boards will be installed between the PV modules and the inverter.

- a) One string combiner for each array, and one fuse holder for each string
- b) The string Combiner will be installed outside with dimensions: 300*400*210 mm or more if necessary, the mounting brackets must be from stainless steel
- c) The combiner is to be provided in the PV array for the termination of connecting cables.
- d) The combiner must have protection class II (total insulated): IP68, UV resistance (made of polycarbonate material), and IEC 62208 Hinged door with an EPDM rubber gasket to prevent water entry.



- e) Both boards shall be made of Coated Aluminum /cast aluminum alloy with full dust, water & vermin-proof protection.
- f) All wires/cables must be terminated through cable lugs. The DBs shall be such that input & output termination can be made through suitable cable glands.
- g) All outdoor panels must have the protection of IP68.
- h) The string board shall have High-quality Suitable capacity Metal Oxide Varistors (MOVs) /SPDs, and suitable Reverse Blocking Diodes. (see attached drawing)
- i) Suitable markings shall be provided in boards for easy identification, and the cable ferrules must be fitted at the cable termination points for identification.
- j) Protection and disconnecting means shall be provided according to the drawings to isolate the PV generator from the grid-dependent inverter and to allow maintenance and inspection tasks to be carried out safely.
- k) The main DC distribution board will be installed outside near the inverters, with dimensions, based on the system capacity with coordination with the consultant, it can be 600*1000*210 mm or more
- l) The arrangement inside the box must be tidy and have enough space for all protection devices that are needed, must add a warning plate inside DBs to warn unauthorized people from trying to tamper with the devices.

B.4 AC distribution panel board

- a) The AC Distribution Board (DB) shall control the AC power from the inverters and should have the necessary surge arrestors. Interconnection from the AC DB to the mains at the Bus bar while in grid-tied mode.
- b) All switches, circuit breakers, and connectors should conform to IEC 60947, parts I, II, and III/ IS60947 part I, II, and III.
- c) The AC DB shall be metal-clad, totally enclosed, rigid, air-insulated, cubical type suitable for operation on three phases, 415 volts, 50 Hz.
- d) The DB shall be designed for a minimum expected ambient temperature of 45 degrees Celsius, 80 percent humidity, and dusty weather.



- e) All indoor panels will have the protection of IP54 or better. All outdoor panels must have IP68 protection.
- f) All the 415 AC volts devices/equipment, like bus support insulators, circuit breakers, SPDs, .. etc., mounted inside the MDB shall be suitable for continuous operation and satisfactory performance under the following supply conditions:

Variation in supply voltage	+/-10%
Variation in supply frequency	+/-3 Hz

B.5 Three-phase Hybrid grid-tie inverter

- As the PV array produces direct current electricity, it is necessary to convert this direct current into alternating current and adjust the voltage levels to match the grid voltage. Conversion shall be achieved using an electronic Inverter and the associated control and protection devices.
- The inverters shall also house MPPT (Maximum Power Point Tracker), an interface between the Solar PV array & the Inverter, and the Inverter output should be compatible with the grid frequency.
- The inverters must have the ability to switch to batteries from the utility grid if not within the specified conditions
- Protection against overvoltage is not required to be supplied if already included in the hybrid Grid-dependent inverter.
- When the inverters are located in outdoor environments, the enclosure should be at least IP 68. Inverters have to be installed according to their environmental protection rating and ambient temperature range.
- The hybrid Grid-dependent inverter requirements should also include the following:
 - Inverters must have enough independent MPP Input
 - Output power control from a third device (read and write capabilities)



- Utility-interactive photovoltaic inverter system
- The inverter's brand must be "EU origin" or equivalent.
- Three-phase output voltage 3/N/PE; 400 VAC according to existing feeder type.
- Frequency 50HZ (+5 HZ, -6 HZ)
- Maximum efficiency/European efficiency 98.1% / 97.8% or higher
- Protection class according to IEC 62109-I and IEC 60529 & Overvoltage category according to IEC 62109-1/AC:III, DC: II.
- Inverters' topology is transformerless.
- The inverters must integrate with the "Optitrac Global Peak" operation management system or be comparable to ensure that even in partially shaded plants, the inverter can almost completely use the energy offered by the PV modules.
- Inverter has self-consumption of 4.8 W (Standby consumption)
- The inverter has LED indicators for status, fault, and communication.
- The inverter must include communication based on Ethernet standards (WLAN, Speed wire /Web connect as interface communication) to allow for data exchange between the inverter and portal, which allows for monitoring PV systems and visualizing and presenting PV system data.
- The inverters must contain ground fault monitoring and grid monitoring
- The inverters must contain DC reverse polarity protection / AC short circuit current capability, and an All-pole-sensitive residual-current monitoring unit.
- Inverter with DC connector, which achieves high performance and maximum quality on the panel side (e.g. SUNCLIX DC connectors).
- A Built-in meter and data logger to monitor plant performance through an external computer shall be provided, and any accessories needed for that purpose must be provided in this tender.
- Inverter locations will be installed in coordination with a consultant and distribution company.
- To be taken into account, hybrid inverters installation as close as possible to the electrical MDB, depending on signal wiring requirement (point-to-point interconnection max length)



- The cable cross-section requirement from the grid-dependent inverters to the AC DB of the system and from the AC DB to the existing DB in the location.
- The inverters must be suitably tagged (Identified label: inverter number) and marked properly by a good-quality ferrule or by other means so that the inverter connection is easily identified.

1.1.2 Safety and Communication

1. **Safety Standards:**
 - Compliance with IEC 61851, UL 2202, or equivalent standards.
2. **Protection Features:**
 - Overcurrent, short-circuit, overvoltage, undervoltage, and thermal protection.
3. **User Interface:**
 - LCD or touch screen for monitoring and control.
4. **Communication Protocols:**
 - OCPP (Open Charge Point Protocol) 1.6/2.0 for network integration.
 - Ethernet, Wi-Fi, 4G, or RS485 for connectivity.

Compatible Battery Specs for 25 kW Hybrid Inverter

- **Type:** Lithium-ion
- **Voltage:** 150 – 750 V DC
- **Capacity:** 50 kWh (expandable to 200 kWh)
- **Charge/Discharge Current:** 100 A max
- **DoD:** 95%
- **Cycle Life:** ≥ 6000 cycles @ 80% DoD
- **Communication:** CAN / RS485
- **IP Rating:** IP65



B6. Data Acquisition System / Plant Monitoring

A Data Acquisition System shall be provided for the solar PV plant.

- i. Data Logging Provision for plant control and monitoring, time and date-stamped system data logs for analysis with a high-quality, suitable TV screen (with specifications suitable for work and plant operation). Metering and instrumentation to display the system parameters and indicate status must be provided.
- ii. The following parameters are accessible via the operating interface display in real-time separately for solar power plants:
 - a) AC Voltage.
 - b) AC Output current.
 - c) Output Power
 - d) Power factor.
 - e) DC Input Voltage.
 - f) DC Input Current.
 - g) Time Active.
 - h) Time disabled.
 - i) Time Idle.
 - j) Power produced



- iii. PV array energy production: Digital Energy Meters to log the actual value of AC/ DC voltage, Current & Energy generated by the PV system provided. The Energy meter along with CT should be of 0.5 accuracy class and it will be installed in DB.
- iv. Computerized AC energy monitoring shall be in addition to the digital AC energy meter.
- v. The data shall be recorded in a common worksheet chronologically and date-wise. The data file shall be MS Excel compatible. The data shall be represented in both tabular and graphical form.
- vi. All instantaneous data shall be shown on the TV screen.
- vii. To monitor the system performance, a 50" LED TV must be provided and mounted in a place that will be selected by the contracting authority and it can be at the entrance of the municipality, the TV must have all the needed specifications for this type of work, and the content of the display should be precisely defined.
- viii. Provision for Internet monitoring and download of data shall also be incorporated.
- ix. Software for a centralized Internet monitoring system shall also be provided for download and analysis of cumulative data of all the systems.
- x. Remote Monitoring and data acquisition through Remote Monitoring System software at the owner's location with the latest software/hardware configuration and service connectivity for online/real-time data monitoring/control, complete to be supplied and operation and maintenance/control to be ensured by the supplier.

B7. Protections System



The protection level of the electric installations is important for human, facility, and equipment safety reasons.

The most important factors are described below:

- Electrical isolation material from the equipment.
- Overvoltage protection device characteristics.
- Appropriated earthing system.
- Grid islanding

The system should be provided with all necessary protections like earthing, Lightning, and grid islanding as follows:

B.7.1 LIGHTNING PROTECTION

The entire space occupied by the PV array shall be suitably protected against lightning by deploying the required capacity of a lightning arrester.

Lightning protection should be provided as per IEC 62305 standards (DIN VDE 0185305-3 Part 5). The protection against induced high voltages shall be provided by the use of metal oxide varistors (MOVs) and suitable earthing such that induced transients find an alternate route to Earth.

B 7.2 Overvoltage protection device

Regarding the overvoltage protection devices installed in the facility, they must follow the international standard IEC 61643-11. The PV power plants shall be provided with lightning and overvoltage protection. The source of overvoltage can be lightning, atmospheric disturbances, etc.

Damage caused by over-voltage is ultimately due to the failure of insulation between live parts or between live parts and the earth. Over-voltage protection intends to equalize all exposed metallic sections of an installation to a common potential during the event of an



over-voltage. Equipotential bonding is therefore required as an important over-voltage protection measure and shall be done by recognized standards or acceptable state-of-the-art procedures.

To avoid the formation of wiring loops between earthed conductors and DC cabling, equipotential bonding conductors should run parallel and as close as possible to the DC cabling. It is also recommended to branch the bonding conductor to run parallel with all the DC cabling branches.

B7.3 EARTHING PROTECTION

The objective is to verify that the earth connection to which all relevant components of the installation are bonded, and which will also protect the new distribution installation with differential switches.

Bidders are requested to check the ground resistivity before installing the earthing system so that the resistivity value is within the acceptable range of the distribution company, if not the soil must be treated to get the required resistivity value (this process – IF NEEDED- is included in this tender), To install the earthing system: Connect metallic



chassis of all electronic equipment and PV structure with 25 mm² ground wire. The SPD (Surge Protection Device) shall also be grounded.

Each array structure of the PV array should be grounded properly as per IEC Standard 60364. In addition, the lightning arrester should also be earthed inside the array site.

Earth Resistance shall be tested in the presence of a consultant and, when required, after grounding by a calibrated earth resistance tester. All equipment should also be grounded properly.

Maximum earth resistance shall be defined as per the local electricity company requirements (in general, the earth resistance shall not be more than 4 ohms- JDECO is a reference). It shall be ensured that all the earthing points are bonded together to make them at the same potential (for example, when more than one earthing box for the DC side, all earthing points (boxes) must be connected to the same equipotential point.

There should be two separate grounding systems: AC & DC grounding.

B8-1 Grid Islanding

- In the event of a power failure on the electric grid, it is required that any independent power-producing inverters attached to the grid turn off in a short period. This prevents the DC-to-AC inverters from continuing to feed power into small sections of the grid, known as “islands.” Powered islands present a risk to workers who may expect the area to be unpowered, and they may also damage grid-tied equipment. The PV system shall be equipped with islanding protection. In addition to disconnection from the grid (due to



islanding protection) disconnection due to under and over-voltage conditions shall also be provided.

- A manual disconnect 4-pole isolation switch connecting the PV system with the grid would have to be provided at the utility end to isolate the grid connection by the utility personnel to carry out any maintenance. This switch shall be locked by the utility personnel

B 9 - Cables

- For this tender, it is considered that the PV generator will be ground mounted and the Grid-dependent inverters will be installed outdoors/indoors, as will be necessary.
- The cable cross-section from the PV generator to the DC combiner, and the cable cross-section from the DC combiner to the DC board, and from the DC board to the grid inverter, and from the AC PV system to the vehicle charger, and the existing DB of the building. All these cables shall be determined by both the minimum current capacity and the maximum voltage drop requirements. The larger cable size obtained from these two criteria shall be applied.
- The DC PV cables shall have a voltage rating of at least $1.2 V_{OC\ pvg}$ that in this case is not a major requirement since ELV has been chosen for safety reasons; have a temperature rating higher than $40\ ^\circ\text{C}$ above ambient temperature; be UV-resistant, or the cables be installed in UV-resistant conduit; water resistant and it is recommended that they be flexible (multi-threaded) to allow for thermal/wind movement of modules.
- All cables must be protected by laying them in trenches under the supervision and direction of a consultant.
- Cable Routing/ Marking: all exposed cables/wires are to be routed in the trench and suitably tagged and marked properly by a good quality ferrule or by other means so that the cable is easily identified. The cable trench must have the following specifications:



- Conduits/concealed cable trenches shall be provided for all DC/exposed over-ground cabling. Conduits/concealed cable trench shall be adequately secured to the steel structure of the system
- All cable trenches shall be powder-coated steel or GI or equivalent
- These cables should be clamped using PVC straps for horizontal and vertical runs. Fabricated aluminum clamps may be used at regular intervals.
- The relative position of the cables, laid on the cable trench, shall be preserved, and the cables shall not cross each other
- The cables shall not be laid in such a fashion that one cable crosses over the other. Proper spacing shall be left between two cables as mentioned in the drawing
- These cables should be clamped using PVC straps for horizontal and vertical runs. Fabricated aluminum clamps may be used at regular intervals.
- The Cable should be selected so that it is compatible with the life of the solar PV panels i.e., 25 years.
- Cables shall be fully tested (both type and routine test) as per the specification laid under International standards. In particular following tests shall be done at the site.
 - a. Insulation resistance test.
 - b. Continuity test
- The ratings given are approximate. Bidder to indicate size and length as per the system design requirement. All the cables required for the plant are provided by the bidder. Any change in cabling sizes if desired by the bidder/is approved after citing appropriate reasons. All cable schedules/layout drawings are approved before installation.
- The size of each type of DC cable selected shall be based on minimum voltage drop; however, the maximum drop shall be limited to 1%.
- The size of each type of AC cable selected shall be based on the minimum voltage drop; however, the maximum drop shall be limited to 2 %



B 10- DATA ANALYSIS AND EVALUATION

After one year of operation, the project will be assessed by Employer engineers using technical data downloaded from the data logger. The results of the assessment will be shared with the Contractor.

C. Integration of PV Power with Grid

The output power from PV would be fed to the inverters, which convert DC produced by the PV array to AC and feed it into the main electricity grid after synchronization. In case of grid failure, or low or high voltage, the solar PV system shall be out of synchronization and shall be disconnected from the grid.

The connection point is critical to ensure the proper operation of the PV Power Plant. The PV connection point will be located under the supervision of the consultant team engineers.

Electrical work for the adaptation of the existing main panel or the construction of a new electrical panel has to be included by the bidders in the proposal.

1.1.3

1.1.4

D. Deliverable, Commissioning, Documentation and Training

The following list presents the required deliverables to complete project implementation. These are inclusive of all man-power, tools or machinery, storage or transport, needed for the supply and installation of these deliverables:

Deliverable 1: Installation shop drawings (as-built drawing), including, steel structures of solar PV system, electrical mechanical, and civil works drawings (one hard copy and one soft copy,



in PDF and AutoCAD formats, on DVD); Technical Report (describing final solution and sizing); Detailed Planned Schedule of works; The simulations done (in PVSyst or similar) to calculate the energy output; A letter certifying the requirements on warranties and standards. (By the awarded tenderer)

The awarded tenderer must provide a full set of technical specifications for the steel structure, and solar photovoltaic system, including the following but not limited to, considering EDC's requirements, international and national standards and regulations, certification required for each part, operation and maintenance supplier requirements.

Warranties for materials must be provided as follows:

- Warranty for Modules - overall 25 years, of which 10 years on material and manufacturing faults, and 25 years 80% power output warranty
- Warranty for Inverters – 10 years
- On the rest of the components, back-to-back warranties from vendors.
- Defect Notification Periods for Specific Materials:

Deliverable 2: Bill of lading of the Goods or delivery of all goods to a warehouse or to the site in Palestine. (By the awarded tenderer)

Deliverable 3: Installation of steel structures and complete PV power plants (including the employer's supplied energy management system) with all components needed for their interconnection to the existing installation, including cables, protective devices, instrument transformers, meters, and all distribution company requirements, as well as the operation, configuration, and all related performance testing. (By the awarded tenderer) and the contractor shall provide a verification test report: After completing the installation, certain verification and acceptance tests shall be performed before the PV plant enters into operation.

The Contractor shall instantly fix any malfunction resulting from the test and repeat the test.

Deliverable 4: Warranty of good performance and maintenance is to be performed by the awarded contractor for two years. the contractor will provide all required maintenance services



during the warranty period for all equipment: repairs, service, preventive maintenance, and spare parts during the period of guarantee. (By the awarded tenderer)

All interventions carried out must be recorded in the logbook and certified by the Consultant

- ✓ The date and the hour of the intervention ,
- ✓ The tasks carried out,
- ✓ The measures carried out and their interpretation regarding the performance over time.

The awarded party must remain at the disposal of the client/beneficiary for at least one month after handover to answer any technical or non-technical questions, and to be present on site when the client/beneficiary performs their functional tests to check that all technical requirements have been fulfilled.