Item No.	Description	Unit	Quantity	Unit Rate US $	Amount US $
Bill No (1)					
Photovoltaic Solar System works					
The system will be New PV System, which will be connected to the proposed PV Hybrid System which is currently under implementation. • The inverters of the new PV solar system should be compatible with the proposed hybrid system where the contractor must provide a manufature certificate that the inverter will be integrated with the proposed fuel saver controller. • Contractor shall submit Detailed shop drawings for all architectural, civil, electrical and the complete photovoltaic solar system works, including (single line diagram, Equipment Layout inside room, PV distribution panels, DC & AC distribution bards, PV arrays lay out and cross section of the cables and wires...etc.) for the new PV system to be approved by the Engineer before commencement of the works. • Contractor shall submit catalogs of each component with all certified calculation sheets and testing results for the requested specifications stated in Bill of Quantity. • The contractor shall submit the Manufacture testing certificate, country of origin, certified characteristics, test performance curves, regular spare parts (as recommended by manufacturer , maintenance manuals and manufacturers warranty for each components of the system. • Contractor must provide detailed calculation of cross section of DC & AC, drop voltage must be not more than (1%). • Contractor must provide detailed calculations of Shadow and the appropriate site for the panels according to calculations. • Contractor must provide detailed calculations of dead load and wind load tests for mounting structure and PV array. • As-built drawings, written settings parameters and operation and maintinance operation manual shall be submitted after handing over the work. • The programming should be by a certified technician by the original manufacture. • The winner contractor should start to operate and program all the component of the system in the presence of the UNDP and the Turkish Palestinian Friendship Hospital representatives. • Upon completion of the installation, the contractor shall organize an on site training program for operation and maintinance purpouse involving nominated employer's staff. Such a program shall be carried out during the commissioning phase. The cost of the training shall be deemed to have been included in the tendered rates. • Written settings' parameters shall be submitted before the programming and must be approved by the supervision team. • The price includes all builders' works, making good and reinstatement including necessary materials and workmanship as well as removal of unwanted materials to dump sites approved by the engineer to complete the job successfully. • The price inculdes supply and paint the installed steel structure with one coat of primer and two coats of silver paint with approved painting materials by the engineer. • All system components should be USA, European or Japan manufactured standards.				

Item No.	Description	Unit	Quantity	Unit Rate US $	Amount US $
1.1	**Section 1** **Photovoltaic Works** Supply, install, test and commission the following PV system complete with all needed accessories and needed materials to complete the work successfully as per specification, drawings and engineers instruction. • The items include conduits, connection boxes, electrical boards, controls, wires, connectors, clamps, bolts, and connecting the cables to switchboards. • All the electrical works shall be executed according to Standards, drawings, specifications and supervisor engineer instructions. • The system should have all equipment and accessories to be controlled and monitoring through (Ethernet). • All components of the system should be surge protected and solid grounded • All AC circuit breakers should be of Eaton type (not less than 15 kA). As drawing • All DC Circuit breakers/Fuses with Fuse Holder should be double Pole. • Nominal 20KA/40KA AC surge Protection type is Eaton • All PV Surge protection should be class 2 Nominal/Maximum Discharge Current: 20/40KA with main Voltage 1000VDC 2Pole+1Earth European made Eaton, ABB, Mersen. • The contractor should connect the AC output power of PV system to the proposed PV solar system which is currently under implementation as shown in the attached drawings. The work includes making any required configuration according to the Engineer instruction. PV-Array module: Supply, install, test, and commission PV Array module, the modules peak power must be at least 650Wp and approved by the supervisor Engineer before installation. Specification: •PV modules must be from top 10 rating of manufacturers for 2022 • Module Efficiency at STC not less than 20.9% • Module Fill Factor not less than 75% • Type is MONO PERC Module . (Must submit calculations to prove efficiency). • Monofacial Solar Panel. • Maximize the light absorption area • Operating Module Temperature -40 °C to +85 °C. • Maximum System Voltage at least 1000/1500 V DC (IEC) • Frame : Anodized Aluminum Alloy • Front cover 3,2 mm tempered glass • Junction Box IP68 rated (3 bypass diodes at least) • Better shading tolerance • lower hot spot temperature • High PID resistant • ISO 9001 Quality Management System. • ISO 61701 resistance to corrosion from salt mist • ISO 14001 Environment Standard. • IEC 61215 & IEC 61730 Application class A certification. • OHSAS 18001 Occupational Health and safety standards. • Connectors are standard MC4, Cables, clamps, and accessories.				

Item No.	Description	Unit	Quantity	Unit Rate US $	Amount US $
	The unit rates include supply, install & connect the following: • Water proof PV combiner boxes IP65 for each PV Inverter Strings , including 1000V (DC double pole Fuses, DC double pole surge arrestors, bus bars, terminals, PVC ducts to be fixed under the PV modules, supports, clamps & labels. • Seperated Water proof boxes IP65 for PV earthing system including all earthing bus bars to combining all earthing cbles come from all roof top parts of the pv system . • Each PV Panel should be grounded with 6 mm2 cu pvc cable. • Solar DC cables appropriately sized to connect the PV solar modules together and to the combiner box and from combiner box to the grid inverters directly to have a complete operational circuit with all conduits, clamps, hot galvanized cable trays with covers along the DC cable routing and cable end terminations which shall be DC plug and socket connectors. The cable tray is of type Opo, Baks or equivalent, including all the accessories, with thickness not less than 1 mm and galavanized holders/legs not less than 20 cm height with a 2 mm thickness 10x10 cm galvanized steel base above silica stone. The DC cables must be sized in accordance with the installation requirements applicable on site, the allowable voltage drop for DC cables between PV Arrays and grid inverter less than 1%. • The unit rate includes solving all the obstacles that might be faced at the site including making good of any damages and handing over the site at the same condition at the site acquiaition.The price includes retesting Leakage for the whole roof before starting works and after completion of installation of PV system and making good of any damages to insulation membrane if occurred.The contractor will be responsible for dismantling, removing and re-installing existing electrical and mechanical equipment in other places and operate them successfully with all needed new materials and workmanship, to provide the required space for installing the PV modules structure as well as removal of unwanted materials to dump sites approved by the engineer to complete the job successfully. • Contractor must submit all the required certificates for each PV solar panel as well as manufacturer warrantee as recommended by manufacturer. All works and materials must be according to the drawings, specifications and supervisor engineer instructions and approval.	Kwp	143		
1.2	**PV Inverter:** Supply, install, test, and commission DC/AC pure sine wave on grid Inverter Specifications: • Power Rated power 25 KW Input (DC): • Max. input voltage 1,000 VDC • Min. input voltage / initial input voltage 150 V / 188 V Output (AC): • Rated power (@ 230 V, 50 Hz) 25,000 W • Max. apparent AC power 25,000 VA • Nominal AC voltage 220 / 380 V 3 / N / PE; 230 / 400 V 3 / N / PE; • Nominal AC voltage range 180 V – 280 V • AC power frequency / range 50 Hz, 60Hz / -6 Hz ... +5 Hz • Rated grid frequency / rated grid voltage 50 Hz / 230 V • Max. output current 36.2A •Max. efficiency 98.3% • Power factor at rated power 1 • Adjustable displacement power factor 0 overexcited, 0 under exited • Phase conductors / connection phases 3/3 • Integrated with DC surge arrestor (SPD type 2). • Min. efficiency 98% • Must include all necessary data cables. Type : SMA STP 25,000 or approved equivelant. The unit rates include supply, install & connect the following: • All AC power cables appropriately sized in accordance with the installation requirements and to connect the On-Grid inverters to the PV AC distribution board with all needed conduits, clamps, hot galvanized trays and cable terminations end. The allowable voltage drop for AC cables between inverters and PV AC distribution board less than 1%. • The inverters must include the safety and communication management devices such as (cutting edge grid management functions, integrated plant control, Ground fault and grind monitoring, DC reverse polarity protection , DC side disconnector device, Graphic Display, DC surge arrestor type 2, Multistring capability, DC input voltage up to 1000 V DC) to ensure max availability. • The contractor must submit manufacturer warranty for each inverter as recommended by manufacturer. All works and materials must be according to the drawings, specifications and supervisor engineer instruction’s and approval.	No.	6		

Item No.	Description	Unit	Quantity	Unit Rate US $	Amount US $
1.3	**Mounting Structure Unit:** Supply and install PV Modules Mounting structure(unit) as the following Specifications: • Double Hot Galvanized steel structure G115 (50µm) at least consist of all needed steel shapes type (SHS,RHS) with thickness not less than 3 mm consists of profile 80X60X3 mm to installed for each leg (traces systems) and connected with profile 60x60x3 mm, suitable to the dimension of selected PV modules and PV numbers according to international standard and supervisor engineer. • Double Hot Galvanized steel profile 60X40X3 mm to be installed under the PVs and suitable to the dimension of selected PV modules and PV numbers according to international standards and supervisor engineer(all bolts is Nirosta steel). • The distance between traces should not exceed 2 meters. • The mounting structure will be a solid grid at a fixed inclination of 30 degrees. • The lowest Hight of the PV panels should be at least 1.2 Meter. • The mounting structure components are connected together to guarantee potential equalization. • The PV array and mounting structure is earthed separately according to internationally standard to obtain 2 Ohm at most. • Most Legs of the PV Panels structure must installed by concrete base B250, 30cmX30cmX30cm . •The structures may be install in 1 and/or 2 or /and 3 or/ and at maximum 4 rows according to site and supervisor engineer. Each group of PV panels should include safety ladder with roof for cleaning and maintenance. • All Structures should be installed and distributed above the roof according to site and supervisor engineer. • Clamps for mounting the selected PV modules • The contractor should submit shopdrawings with calculation sheets to the mounting structures and the foundations , which must be designed structurally to be suitable to withstand all static loads (weight of modules, wind loads at speed of 120 km/hr, weight of the devices and equipment etc.) that might occur according to the site conditions. The mounting structure components are connected together to stabilize the structure. The calculations and study must submitted after being approved by a consultation office. The item includes galvanized thickness test (50 µm) for the steel structure by an approved testing lab in accordance with the Engineer instruction.	L.S	**1.00**		
1.4	**3-Phase Digital Meter (KWH meter)** Specifications: • Voltage Input: 50V to 330 VAC Per phase. • Frequency range: 45Hz to 65Hz • Met the following : • IEC62053-22 class 0.5s • IEC622053-21 Class 1 • IEC622053-23 Class 2 • Price includes supply, install and test. Type: Schneider PM 3250 or equivalent.	No.	1		
1.5	**AC Earthing System:** Supply, install, connect and operate complete independent earthing system for PV solar system, must be separated from the main earthing system to obtain 2 ohm max resistance.the item includes (all required copper electrodes 19mm2 driven into ground to achive the resistance low than 2 ohm, manholes with iron cover and its internal diameter is 60cm, earth joints, clamps, ducts , conduits and flexible cables 35mm2 from main E-B.B of PV-MDB-AC OUT to the testing box of AC, to the electrodes to complete the system.The item includes all civil works, removing and re-installing tiles with excavations and backfilling and all other civil works to retrieve the existing site state and to complete the job as specifications and supervisor engineer instruction's.	L.S	1		
1.6	**DC Earthing System:** Supply, install, connect and operate complete independent earthing system (PV modules , pv array structureand pv cable tray with seperated main earthing cable to earthing combiner box for each array groups)for PV solar system, must be separated from the main earthing system to obtain 2 ohm max resistance.the item includes (all required copper electrodes 19mm2 driven into ground to achive the resistance low than 2 ohm, manholes with iron cover and its internal diameter is 60cm, earth joints, clamps, ducts , conduits and 50mm2 from main E-B.B of combiner box to the testing box of DC system to the electrodes to complete the system.The item includes all civil works, removing and re-installing tiles with excavations and backfilling and all other civil works to retrieve the existing site state and to complete the job as specifications and supervisor engineer instruction's.	L.S	1		
	TOTALS - Section 1 - Photovoltaic Works				

Item No.	Description	Unit	Quantity	Unit Rate US $	Amount US $
2	**Section 2** **Electrical Board** Supply, install and commision all Electrical distribution board including all circuit breakers as will be approved in the shopdrawngs. Electrical cables shall be assembled and tested accordance to IEC Standards. The following conditions must be observed: - Cabinet (Enclosure): The panel shall be surface- mounted or floor standing enclosure with IEC designation appropriate for the location where it will be installed, and according to supervisor engineer's instructions. - Frame Type is EATON or equivalent, in which the panels have to include inner plates of thickness not less than 1.5 mm to cover and protect the busbars and connections. - Live conductors and terminals shall be concealed behind the plates. - The enclosure shall have a hinged door with latch and lock and shall have the necessary partitions, supports, and wiring gutters. - The contactor shall submit shop-drawings. - At the completion of the project, a neatly printed or typed directory listing the panel and circuit identities shall be mounted inside the door. - Degree of Protection not less than IP30. -The panel shall have 3 phase buses, a neutral bus insulated from the cabinet, and a ground bus. busbars shall be copper and ampere calculation must be at 65C degree, with ampere and voltage ratings according to the breakers, as followed by engineering standards. The ground bus shall be similar to a neutral bus and shall have a good ground connection to the cabinet, a removable bond to the neutral bus, clamp type lugs for the ground cable in each supply conduit, and connections for a ground cable in each load conduit. - Spare space not less than 30% -The work includes indication lamps and all necessary accessories needed. The works should be completed according to drawings, specifications and demands of the supervisor engineer with all necessary civil and electrical works and handing over clean, tested operating andconditions.				
2.1	Solar Power Main Distribution Board (PV-MDB-NEW), that combines the PV inverters output, as in the attached drawing . The panel size shall include but not limited to the followings:	Unit	1		
2.2	Supply, install M.C.C.B 4x400A . Type Eaton NZMN3-4-AE400 or approved equivalent.	No.	1		
2.3	Supply and install 3(CT's 400/5) with LTL fuse 3x32/6A (Type is ENTES or equivalent).	No.	1		
2.4	Suuply, install Surge protection device of 40KA short circuit capacity to secure the over all system (data and power) against lightnings and surges strikes, including connecting the device to earthing system, LTL 3X100/63A and all needed accessories. Type EATON or equivalent.	No.	1		
2.5	Supply and install 3 Indication Lamps R-S-T the item includes Triple poles Fused Switch Eaton (LTL) 6/10A With HRC fuses and test push button.	No.	1		
2.6	Supply, install MCB 3X50A. (Type is Eaton FAZ-B50/4 or equivalent).	No.	9		
	TOTALS - Section 2 - Electrical Board				
3	**Section 3** **Cables and Conduites** Supply, install and connect of the following XLPE CU cables with all required electrical and civil works including PVC ducts, hot galvanized cable trays with covers along the cable routing . The cable tray is of type Opo, Baks or equivalent, including all the accessories, with thickness not less than 1 mm and galavanized holders/legs not less than 20 cm height with a 2 mm thickness 10x10 cm galvanized steel base above silica stone. with all accessories and angles supports for the routing of the cables from New PV distribution board to Existed Main PV distribution board. Cable must be fixed properly with using plastic clamps with labeling. All works must be according to specifications, instructions, and demands of the supervising engineer. as follows:				
3.1	XLPE((3x185)+95+95)mm2. Type is Synergy or equivalent.	L.M.	70		
	TOTALS - Section 3 Cables and Conduites				

Item No.	Description	Unit	Quantity	Unit Rate US $	Amount US $
4.1	**Section 4** **DATA and Programing** • Connect and Operate the new Pv System to be compatible with the proposed hybrid PV system, to monitor , record data and controll new PV system with all needed materials, work including program and connect to the proposed Fuel save controller to control and monitor the new inverters . The item Includes Supplying, installing, testing and commission all of DATA system works as per drawings, specifications, and engineer's instructions. The price includes all necessary junction boxes,rack,power supply,1kva/1kw smart ups,wires, conduits, labeling , connectors and connecting all cables to switch boards . the price includes 16 ports network switch (type is Cisco or equivelant), S/FTP Outdoor cat 7a data cable between PV inverters and from the new pv solar system to the proposed PV solar system and all needed to be fully operation and integration between two systems. All installation shall be in accordance with : The drawings, specifications and instructions of the Engineer.	LS	1		
4.2	Supply, install and commission Wireless Unit according to specification and engineers instructions with all required cables , junction boxes conduits and all necessary accessories (Type is airMAX GigaBeam 60 GHz Radio or equivalent).	No.	2		
	TOTALS - Section 4 - DATA and Programing				
5.1	**Section 5** **MISCELLANEOUS** Supply, install, test and commissioning Air conditioning 18000 Btu, 220 VAC, inverter Type. The contractor should submit a catalogue to be approved by engineer, type is Tornado or equivalent, the Air conditioning should working on alternate with timer 24 H Hager type and contactor 3p, 32 A, Moeller type, all parts are European made.	No.	1		
5.2	Relocate the existing lightning protection Pulsar to be 5 meter above the top point of solar panels steel structure , the item includes reconnect the existing copper cable with the same cable cross section as per standards and engineer instructions , and item includes all needed accessories such as new mast, fixing brackets and supports to complete the job successfully	Ls	1		
	TOTALS - Section 5 MISCELLANEOUS				

Summary

Item	Description	Total (Us $)
1	Section 1 - Photovoltaic Works	
2	Section 2 - Electrical Board	
2	Section 3 Cables and Conduites	
1	Section 4 - DATA and Programing	
2	Section 5 - MISCELLANEOUS	
	VAT(0%)	
	TOTAL	

Total in numbers .....

Total in letters .....

Name of the contractor ……..……...

Authorized signature ……...……..

Signature and Sealing…….

Title ……..…….

Telephone…….

Fax …….

Mobile …….