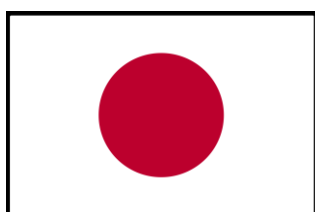


**Construction of Solar System for wastewater treatment and  
post treatment Plants in Rafah**  
**ITB No : PAL-0000048898**



*Empowered lives.  
Resilient nations.*

**Project: Construction of Solar System for wastewater treatment and  
post treatment Plants in Rafah**

**Bill of Quantity (BOQ)**

**June, 2018**

<b>Construction of Solar System for wastewater treatment and post treatment Plants in Rafah</b>					
<b>Item No.</b>	<b>Description</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit Rate US \$ (Numbers)</b>	<b>Total Amount US \$</b>
<b>Bill No (1): Photovoltaic Solar System works</b>					
	<p><b>General:</b></p> <ul style="list-style-type: none"> <li>• The system is designed to cover the total loads in Rafah Waste Water Treatment Plant and Reuse substation.</li> <li>• The system will be Grid Tie interactive connected PV System , which will allow power source options for 24 hours a day, 7 days a week. The system will import from the Utility grid when loads are being more than the generated from PV and supply surplus electricity to the Utility Grid when PV generates more than the loads, the Generator Set will enter the system in case of 'Utility Grid failure.</li> <li>• The contractor should prepare and Submit a complete documents and catalogues for overall the system and schedule for completing installation under the required consideration and what meet the internal electrical network at the facility/site.</li> <li>• The contractor should submit required documentation and System Manual (system design review, approval required, user manual, calculation sheets, and as built drawing...)</li> <li>• The contractor should make Cooperation and coordination with the relevant/responsible people through the stages of action and implementation.</li> <li>• The contractor should submit 2 years bank Maintenance Guarantee for the project.</li> <li>• The contractor should Carry out a periodic testing/maintenance of the systems for two years from the date of handover.</li> <li>• All PV modules and Inverters shall be from the same brand, type, nominal ratings, and clearly labeled.</li> <li>• The contractor should submit complete parts lists and specifications, and brand and country of origin for the overall system and individual components, including all electrical components, PV and mechanical components and other equipment required for installing the systems.</li> <li>• The contractor will maintain monthly visits during the maintenance period to carry out the necessary maintenance processes needed and respond promptly to any emergency needed to keep the system performance perfect.</li> </ul> <ul style="list-style-type: none"> <li>• Contractor shall submit full detailed shop drawings for all architectural, civil, electrical and a complete photovoltaic solar system works, including a single line diagram showing all the components of the PV system, DC and AC distribution boards, PV Arrays lay out and with connections and cables, wires cross section for all the system and voltage drop calculations to be approved by the Engineer before executing the work.</li> <li>• Contractor shall submit the catalogs of each component showing the requested specifications stated at the bill of quantity.</li> <li>• The contractor shall submit the Manufacture testing certificate, country of origin, certified characteristics, test performance curves, spare parts regular (as recommended by manufacturer , maintenance manuals and manufacturers warranty for all PV system components.</li> <li>• As-built drawings shall be submitted after handing over the work.</li> <li>• All junction boxes and DBs will be lockable type.</li> <li>• Upon completion of the installation, the contractor shall organize an on site training program 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.</li> <li>• 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.</li> <li>• All the following items include supply, install, commission and operate of the complete PV solar system.</li> </ul>				

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1	<p><b><u>PV Modules – 200 KwP:</u></b> Supply, install, connect and operate Mono Crystalline (Preferred) or Polycrystalline Photovoltaic Solar Modules with all material needed to have complete job ready for installing high quality PV modules with total arrays capacity to achieve 200 KWp or more. The item Includes supply, install &amp; connect the following:</p> <ul style="list-style-type: none"> <li>• DC String Combiner Boxes IP 65, to protect all the installed PV strings, each combiner box must protect up to 8 PV strings, the price includes cable glands, DC LTLs, 1000V DC Fuses, terminals, labels, ducts and Suitable frame of hot dip galvanized steel for installation for each box.</li> <li>• Solar DC cables appropriately sized to connect the PV solar panels together and to the combiner box and from combiner box to the inverter inputs directly to have a complete operational circuit with all needed materials ,conduits, pvc ducts, clamps and cable end terminations which shall be DC plug and socket connectors . The DC cables must be sized in accordance with the installation requirements applicable on site, the allowable voltage drop for DC cables for each string from the PV modules to the Inverter must be less than 1%.</li> <li>• The price includes all 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.</li> <li>• The contractor has to obtain 200kwp from PV system as minimum capacity. In case the proposed PV modules results in extra kwp than this is deemed to be accounted for the proposed ratio. Contract will be pay only 200kwp.</li> <li>• Contractor must submit all the required warrantees and certificates for each PV solar panel from manufacture.</li> </ul> <p>All works and materials must be according to the drawings, specifications and supervisor engineer instruction's and approval.</p>	KWp	200		
2	<p><b><u>Inverters – 200 KW:</u></b> Supply, install, connect and operate DC/AC grid tie 3-phase inverters with data communication unit with Ethernet connection .The inverters must be suited to any PV module configuration, and depending on the system design and installation proposed and for the future extended also. The DC max power input rating should be equal or more than 200 KW of the PV modules capacity at standard test condition. The inverter unit shall be suitable for indoor and outdoor installations with IP65. The inverter AC nominal power output rating must be equal or greater than 200 KW compatible with the AC loads design. 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 n, DC side disconnecter device, Graphic Display, DC surge arrestor type 2, Multistring capability, DC input voltage up to 1000 V DC ) to ensure max availability. Total inverters capacity must be divided at least <b>8 inverters</b> or more. The unit rate includes:</p> <ul style="list-style-type: none"> <li>• Supply, install, connect and operate (Communication unit (monitoring device) with power supply inside water proof IP 65 box for system monitoring, recording data and controlling PV system compatible with the inverters, with all needed materials, DC &amp; Ac power supply unit, interface modules, data &amp; communication cables and pvc pipes to connect all inverters and other devices and main inverter to the monitoring system. The price includes an ethernet device with cables and modem router in both sides Or using a WIFI bridge complete units with all connections needed to complete and connect the monitoring system to Ethernet.</li> <li>• The contractor has to obtain 200kw from PV inverters capacities as minimum. In case the proposed PV inverters capacity results in extra kw than this is deemed to be accounted for the proposed ratio. Contract will be pay only 200kw.</li> <li>• The contractor must submit manufacturer warranty for each inverter for a period not less than 5 years.</li> </ul> <p>All works and materials must be according to the drawings, specifications and supervisor engineer instruction's and approval.</p>	Unit	1		

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3	<p><b><u>PV Mounting structure:</u></b> Supply, install and fix Ground Mounted Solar Panels Structure from Hot Dip Galvanized Steel foundation suitable to the dimension of selected PV modules and PV numbers as per drawings, (price shall includes costs of loading the structure to the site) the unit rate includes the following features: The mounting structure should be single stack and uses fix hot dip galvanized steel angles foundations with painting three layers approved types with all testing including first layer galvanized prim. * The price also includes supply, install Suitable frame size from hot dip galvanized steel angles as per the detailed drawings for installation of the selected PV inverters, combiner boxes and monitoring unit box as per <b>details drawing No. (PV-12, PV -14).</b> The vertical supports of the frame to be fixed with concrete beams by means of Hot galvanized plate with 12cm*12cm*5mm(thickness) for fixing the PV mounting structure on the concrete foundation with anchor bolts embedded in the concrete beams. The mounting structures and the foundations must be designed structurally to be suitable to withstand all static loads (weight of modules, wind loads , weight of the devices and equipment's etc.) that might occur according to the Site conditions. the structure must have fixed inclination of the modules on 26-30 degree facing true south The mounting structure components are bonded together to guaranty potential equalization. • • The contractor has to obtain a complete PV structure to achieve 200kwp from the capacity of the PV system. In case the proposed structure of the selected PV modules results in extra kwp and frames than this is deemed to be accounted for the proposed ratio. Contract will be pay only 200kwp for PV structure.</p>	L.S	1		
4	<p><b><u>DC Earthing System:</u></b> Supply, install and test a complete grounding system from hot dip galvanized 30x3.5 mm steel sheet for the main earthing networks as per the attached drawings (<b>NO. PV-4</b>) with all needed earthing pits, inspection boxes IP65, complete sets of earth pits includes copper electrodes 15mm2 driven into ground, manholes with iron cover, earth joints, clamps, ducts, conduits and 50 mm2 flexible earthing copper wires and cables and all other materials required with excavations and backfilling according to the drawings (<b>NO. PV-4</b>), specification and engineer's instructions such that the maximum resistance shall not exceed 5 ohm. The unite rates include supply , install and connect the following: - Lightning Arrester electrodes with earthing wires to connect them together and to the earth electrodes as per detailed drawings (<b>NO. PV-8</b>) . - Earthing Cables to connect following components to be one loop (each panel together with the structure, All PV steel structure supports with all concrete bases for the PV plant, Lightning Arrester Electrodes, All metallic module frames, panel/array support structures, metal enclosures, panel boards, frames, ...etc). All grounding connections and terminations should be made accessible for routine inspections and maintenance as required.</p>	L.S	1		
5	<p><b><u>Earthing System for Electrical Room and AC Side:</u></b> Supply, install and test a complete grounding system (Continuous loop ) for (Electrical room, lighting poles, AC side of the Inverters,Ac distribution Boards ) including all required hot dip galvanized 30x3 mm steel bars for the room, water proof test boxes, earthing pits includes (copper electrodes 15mm2 driven into ground, manholes with iron cover, earth joints, clamps, ducts, conduits and 25 mm2 flexible earthing copper wires and cables to connect the Ac side of inverters, distribution panels, lighting poles according to the drawings , specification and engineer's instructions such that the resistance shall not exceed 2 ohms.</p>	L.S	1		

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6	<b><u>LIGHTING POLES:</u></b> Supply , Install and operate Hot dip galvanized Garden lighting Pole 3m Hight with hot Powder coating paintings , the work include supply and Install the following : - 1 horizontal arm two way. - 2 no. of LED lighting flood light IP65 - 150 W Matix Type. -3x2.5 mm2 XLPE cable inside 1 Inch flexible conduit for Luminaries. -Control box with 2 no. of 1x10 A m.c.b. -Steel base with casting B250 concrete foundations 60x60x60cm. - All needed Bolts ,Nuts ,Washers, IP 65 Boxes, Terminal connections, Accessories, & all needed reinforced cement All works must be According to drawings, specifications and supervisor Instructions.	Unit	6		
<b>Total Of Bill (1) - US\$</b>					

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<b>Bill No (2): Electrical Works For Solar System</b>					
	<b>General:</b> <ul style="list-style-type: none"> <li>• The items in general shall also include conduits, connection boxes, controls, wires, connectors, clamps, bolts, and connecting the cables to switchboards and common electric network are included in the unit price.</li> <li>• Contractor shall submit shop drawings for all electrical works to be approved by the Engineer before executing the work.</li> <li>• As-built drawings shall be submitted after handing over the work.</li> <li>• All the electrical works shall be executed according to Standards, drawings, specifications and supervisor engineer instructions.</li> </ul> All installation shall be in accordance with : <ul style="list-style-type: none"> <li>• The drawings, specifications and instructions and demands of the engineer.</li> <li>• The electricity law and electrical code requirements of the BRITISH Standards.</li> <li>• The contractor should refer to the drawings , specifications and other Contract Documents .</li> <li>• The prices will be deemed to include for the full cost as described in all Documents.</li> </ul>				
1	<b>Lighting ,Switches &amp; Sockets:</b>				
1.1	Supply, install, connect and test Led lighting fixture 2x16w complete unit with AC LED tube lamp T8, 120 cm, 16W, 1600 Lummen, 160-260 Volt, more than 40000H Philips lamps, with PVC conduits, J.bboxes, fixing screws (Galv.) and wiring. (Type is GA'ASH or equivalent)	No.	3		
1.2	Ditto but round bulk head light Unit LED type 14W . (Type is GAASH or equivalent).	No.	2		
1.3	Supply, install connect and test single pole one way switch, 220v, 13A, complete with PVC conduits, J.bboxes, wiring, cover and all necessary accessories. (Type is Gewiss-Chourus or equivalent).	No.	1		
1.4	Ditto, but two way switch, one pole.(Type is Gewiss-Chourus or equivalent).	No.	2		
1.5	Supply, install connect and, testing single socket outlet 16A, 220v, 2p+E for flush or surface mounting, complete with PVC conduits, J.bboxes, wiring, and all necessary accessories. (Type is Gewiss-Chourus or equivalent)	No.	2		
1.6	Ditto,but double socket outlet . (Type is Gewiss-Chourus or equivalent)	No.	3		
1.7	Supply, install connect and, testing wall mounted telephone socket outlet 6 pin complete with PVC conduits, J.bboxes, 2 pairs cable (Teldor) from the location of telephone socket to the nearst sub-telephone box or telephone exchanger in the same socket's floor, and all necessary accessories (Type is Gewiss-Chourus or equivalent).	No.	1		
1.8	Supply, install connect and, testing internal complete computer sockets (single) with RJ45 cat 6 female connectors,cover, Oiginal Italian Gewiss (RJ45 Data Socket Cat6 (Product Code: GW20684)), connect it to the patch panel in the nearest switch with SFTP cables cat 6 teldor as shown in the network drawings, all sockets must be tested and labled(cables, sockets).(Type is Gewiss-Chourus or equivalent).	No.	1		
1.9	Supply, install and commission lionization smoke detector, the detectors shall be twin-chamber with latching electronic circuitry, two wire connectionall with all neccessery accessories needed to complete the job, pull boxes special wires and all necessary accessories (Type is TELEFIRE or equivalent) Note: All detectors and Alarm bells must be connected with the Existing Fire Alarm Panel.	No.	1		

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1.10	Supply, install, connect and test Led emergency lighting fixture with emergency back up power built in, for duration 1.5 hours. The price includes PVC conduits, J-boxes, fixing screws (Galv.) and wiring. (Type is GA'ASH or equivalent)	No.	1		
2	<b>Underground Ducts, Pipes, and Manholes</b>				
	Supplying & laying under ground PVC piping system for the under ground electrical network (90 cm depth). The work includes excavation, warning tapes, backfilling and compactions with all required civil works to finish the work according to specifications and demands of the supervising engineer. (the price include rearranging the site according to engineers instruction) as follow:				
2.1	1 No. 6" UPVC , SN8 Pipes for Power AC cables	L.M	15		
2.2	Ditto, but 4" PVC Pipes for Power AC cables	L.M	600		
2.3	Ditto, but 4" PVC heavy duty Flexible Conduit	L.M	20		
2.4	Ditto, but 2" PVC heavy duty Flexible Conduit for DC cables	L.M	200		
2.5	Ditto, but 1.25" PVC heavy duty Conduit.	L.M	200		
2.6	Supply and Instal electrical manhole 60 cm dia with (8 ton) cast iron cover or ring marked with the word Electrical Supply. Manhole must be externally coated for isolation and sealing. The price should include all excavation, fittings, leveling, connections, sealing, backfilling, etc.. All according to the relevant international standards, drawings, specifications, and Engineers instructions	No.	5		
2.7	Ditto but 80 cm dia with (8 ton) cast iron cover iron ring marked with the word Electrical Supply .	No.	6		
3	<b>CABLES</b>				
3.1	Supply and install underground double circuit cables XLPE copper 2x(3X150+70+1*70) inside UPVC pipes from proposed electrical control room to existing MDB as per drawings, specifications, GEDCO regulations and the engineer's instructions. The unit rate includes supply and install two UPVC SN8 pipes 6-inch one pipe along each cable and excavation works, backfilling with approved materials, compactions, warning tapes, clean sand, demolishing civil works and any other needed materials and workmanship to complete the job as per drawings specifications and the engineer's instructions.	L.M	60		
3.2	Supply, laying, connect and test of the following 0.6/1KV , XLPE copper cables with all needed terminals and accesories . The price includes laying inside PVC piping system for the under ground electrical network as per drawings as follows items:				
3.2.1	5x4mm2 N2XY XLPE copper cable.	L.M.	200		
3.2.2	3x4mm2 N2XY XLPE copper cable.	L.M.	55		
3.2.3	5x6mm2 N2XY XLPE copper cable.	L.M.	20		
3.2.4	(3X25+16)mm2+1x16 mm2 N2XY XLPE copper cable.	L.M.	550		
3.2.5	(3X35+16)mm2+1x16 mm2 N2XY XLPE copper cable.	L.M.	390		
3.3	Supply and install Protection for the cables on the steel poles the item includes installation of 2 cable Guard to protect the cables, with all needed for Fixing, accessories & Connection as per Specifications and Engineer Instructions. The price includes dismantling and remove the existing one on the steel pole.	Set	1		

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4	<b>SUB MAIN DISTRIBUTION BOARD FOR PV SYSTEM (PV-MDB)</b>				
4.1	Supply, install and commission Sub Main Distribution Board (PV-MDB) with 30% free space, the panel made of hot galvanized steel sheet and frame 2mm thick, painted with anti-static primer paint and 2coats of final polyester paint . As required by the engineer. The panel should be factory assembled c/w pvc coated and includes cu bus bars of adequate sizes and all other doors, accessories and civil works that may needed to complete the job and hand over in operable conditions trenches, power and control wires, terminals bus bars neutral bus bar, earthing bus bar ducts, supports, labels and numbers and all necessary accessories to complete the work. According to Standards, drawings,GEDCO specifications and supervisor engineer instructions. (Type is EATON MOELLER or equivalent). Note: the contractor must submit shop drawing and take the approval from engineer before installation. The size of the panel will be determined after the approved shop drawings submitted from the contractor and that all internal components were agreed upon. The panel size must achieve at least 30% free space . The following items must be installed inside the panel as follows:	Set	1		
4.2	<b>Remote Operator Unit in the Existing MDB:</b> Supply, install and commission Remote Operator Unit (motorize type) For remote switching use of size 3 Molded Case Circuit Breaker NZMN3 , the price includes supply , install all needed ACU control units, timers , relays and protections U.V.R, fuses , ...etc. with wiring and observation components to operate this unit remotely for operation and connection of the main MCCB. Also the price includes removing and reinstalling the MCCB with all needed fabrications, modifications to the existing MDB, wiring connections and all required materials and workman ship to complete the job. (Type is <b>NZM3-XR208-240AC</b> EATON MOELLER or equivalent).	Set	1		
4.3	Supply and install AC Surge Arrestor protection type 2 at the incoming feeder 3- phase 40KA including connection to the ground with flexible 25 mm2 yellow/green cable. The system shall protect the switch panel against the lightning shocks. (Type EATON or equivalent).	No.	1		
4.4	Supply and install LTL fuses 3x63A/100A,( JEAN MUELLER or equivalent)	Set	1		
4.5	Supply and install Digital multimeter, with LTL fuse3x36/6A and 3 CT's as per the drawings .( EPM-04 or equivalent)	Set	1		
4.6	Supply and install three Signal indication lamps R S T with resistance 220V,with LTL fuse3x36/6A	Set	1		
4.7	<b>3-Phase Digital Bidirectional KWH Meter in the Existing MDB:</b> Supply,install,connect and operate 3-phase Digital Bidirectional Kwh meter (Smart Meter),with all CT's , antennas inside box , data cables, wires, ducts and any other material needed to remote operate and have a complete job . Also the price includes dismantling and removing the existing meters and delivered to GEDCO. (Type is <b>Holley</b> or approved Type By GEDCO. )	Unit	2		
4.8	<b>3-Phase Digital KWH Meter:</b> Supply,install,connect and operate 3-phase digital KWH meter, with all CT's and any other material needed to have a complete job ,The KWh meter has monitoring LCD with all needed data & interface cables to connect with the Monitoring System. (Type is <b>Schneider Electric PM3200</b> or equivalent)	Unit	2		
4.9	Supply and install MCCB with Isc=50 KA , . (Type is ETON MOELLER NZMN3-AE630 or equivalent).	NO.	1		



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4.10	Ditto, but Molded Case Disconnect Switches, . (Type is ETON MOELLER N3-4-A630 or equivalent).	NO.	1		
4.11	Ditto but , Miniature Circuit Breaker MCB 4X63A. (Type is MOELLER FAZ B 63/4 or equivalent).	NO.	8		
4.12	Ditto but , Molded Case Circuit Breaker NZMB1-4-A40	NO.	2		
4.13	Ditto but , Molded Case Circuit Breaker NZMB1-4-A63	NO.	2		
4.14	Ditto but , Miniature Circuit Breaker MCB 2X32A. (Type is MOELLER FAZC32/2 or equivalent).	NO.	3		
4.15	Ditto but , Miniature Circuit Breaker MCB 3X40A. (Type is MOELLER FAZC40/3 or equivalent).	NO.	1		
4.16	Miniature Circuit Breaker MCB 3X32A. (Type is MOELLER FAZC32/3 or equivalent).	NO.	2		
4.17	Ditto but , Miniature Circuit Breaker MCB 3X16A. (Type is MOELLER FAZC16/3 or equivalent).	NO.	2		
4.18	Ditto but residual current circuit breaker ELCB 4X63/0.03A. (Type is Moeller or equivalent).	NO	8		
4.19	Supply, install and commission 3 ph Contactor 4 pole - 400 A, for remote controlling of the the existing and new PV system panels. the price includes supply , install all needed ACU control units, timers , relays and protections U.V.R , ...etc. with wiring and observation components to operate this unit remotely. (Type is EATON MOELLER or equivalent). <b>(Optional)</b>	Set	1		
4.20	Supply, install and operate External Lighting control unit the item includes, 24 h timer, photocell, selector switch and mcb's and contactor with all needed materials to complete the job as per drawings and engineer instructions. (Type is Moeller or equivalent).	Unit	1		
5	<b>Sub-Distribution Board (SDB)</b>				
5.1	Supply and install Plastic-board 24 CB capacity. the price includes neutral and earthing bubars,terminals with all necessary accessories and material to hand over clean and tested in operating conditions. (Type is HAGAR or equivalent)	NO.	2		
5.2	Supply and install Miniature Circuit Breaker MCB 1X32A. (Type is MOELLER FAZC32/1 or equivalent).	NO.	1		
5.3	Ditto, but Miniature Circuit Breaker MCB 1X16A. (Type is MOELLER FAZC16/1 or equivalent).	NO.	2		
5.4	Ditto, but Miniature Circuit Breaker MCB 1X10A. (Type is MOELLER FAZC 10/1 or equivalent).	NO.	2		
5.5	Ditto but residual current circuit breaker RCB 2X40/0.03A. (Type is Moeller or equivalent).	NO	1		
<b>Total Of Bill (2) - US\$</b>					

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<b>Bill No (3): Civil Works</b>					
	<b><u>General Notes:</u></b> 1- Complete detailed shop drawings should be delivered to the Engineer to take his approval prior the commencement of work. Samples of all materials shall also be delivered to the Engineer to take his approval, 2-All works and installations listed here below should be carried out, tested and commissioned by specialized responsible skilled labours in full coordination with engineering office , all in accordance with drawings, specifications and relevant standards, and the instruction of the Engineer. The Engineer has the right to reject any component of the work not complying with the specifications and the terms of the contract. 3- The contractor shall submit detailed implementation work plan and method of statement Coordination with the engineer .				
3.1	<b>EARTHWORKS - Leveling &amp; Excavation Works:</b>				
	Notes: Contractor shall take into consideration that all – direct and indirect works and expenses required for the completion of Earth works items' Prices. Excavation item shall include the removal of any buried structure not to be part of the proposed construction, including transport of excavated, surplus material and buried structure (not to be part of the proposed construction) to a location approved by the engineer or his representative outside the site, workmanship and any where else, needed, all according to drawings, specifications, conditions and directed instructions by the Engineer. the following will be in the items prices but not limited to: Contractor shall take into consideration that all – direct and indirect works and their relevant expenses required for proper implementation of the project including temporary facilities, fencing, securing utilities (water, wastewater, telephone and electricity systems) as well as making access to project implementation location area is running safely without disturbance. The contractor will be accountable for all necessary equipment, materials and activities to assure the safety of people within the vicinity, where an approved safety plan will be prerequisite to initiating activities along with installing all required components and materials necessary for safety of workers, project team as well as people at the project. All relevant costs are deemed to be included in the unit price in addition to the required re-instatement works needed to bring the original facilities to its original status before addition of temporary works. 1. Shore up the sides of excavation and take all precautions to keep the adjacent buildings and existing infrastructure utilities (sewage, water, electricity, telecommunication and pavement works) safe. And repair any damage that may occur in the site. 2.The cadastral survey and leveling of existing status at grids. And the contractor should get Approval of Bench mark and leveling network before excavation works. 3. Safety precautions to protect neighbor utilities and persons. 4. All required Tests should be accommodated by an approved lab. 5. Laying out the buildings coordinates to be carried out by professional surveyor using total station device. 6.Price includes leveling and backfilling from surplus clean sand (Safia) from site to make up level around buildings up to the top of external ground beams levels. 7.All the above mentioned and following specifications is part of the contractor obligations. 8. Quantities of Excavation shall be measured according to the elements' dimensions mentioned in the drawings 9. The Price for excavation includes Cleaning the site and demolishing and removal of any existing structures. Debris material shall be disposed off to approved site as directed by the Engineer.				

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	10. Back-filling item should be in layers (25cm max. each & compaction test 98%). Prices shall include supply, water, compaction, transporting, testing and any needed workmanship and material, all according to drawings, specifications, conditions and as directed by the Engineer. 11. Cleaning the site and removing all debris, surplus unwanted materials and rubbles to approved dump site. 12. All existing Material dismantled must be transferred to places as specified by the supervisor Engineer				
3.1	Leveling for site (any type of soil) to the required levels, the area shall be suitable for the PV module according to drawing as approved shopdrawings by supervisor engineers, the price includes removal of any obstacles, trees, unwanted materials to approved dump site, also the price including preparing shopdrawing, surveying works, compaction (the compaction should not be less than 98% of MDD) and required tests before concrete foundation of the PV Module structure.	m2	6000		
3.2	<b>Concrete Works:</b>				
	<p>Rates of Concrete Works shall include:-</p> <ol style="list-style-type: none"> <li>1. All form works and shuttering (new lumber for shuttering painted by special oil (fuel or burnt oil is not accepted) in any form, shape and size. Making chamfered and curved edges, allowing for and making grooves and sleeves and using Tie Rods (Batant) for concrete walls; removal of forms and cleaning of all exposed tie wires and rods. Steel forms must be used in shuttering the external decorations.</li> <li>2. Supplying, Casting, vibrating and curing as per specifications.</li> <li>3. Approved additives and admixtures.</li> <li>4. Developing new Concrete Job Mix Designs, Sampling, testing and providing test results certificates, storing and saving of samples.</li> <li>5. Painting of exposed surfaces of underground reinforced concrete elements with two coats of hot bituminous paint (75/25) after primer layer, the strokes of each layer to be opposite to each other.</li> <li>6. Preliminary installations for Electrical, plumbing and floor drainage in floor slabs including final floor slab.</li> <li>7. Compaction and testing under the foundation, ground beams, ground slabs and Apron. the compaction should not be less than 98% of MDD.</li> <li>8. All works according to specifications, drawings and supervisor engineer instructions</li> <li>9. Supply, fabricate and fix reinforcement steel (<math>f_y = 410 \text{ N/mm}^2</math>) for all the structural elements according to drawings and engineer's instructions for any grade, size and length as detailed in the drawings, storing on site including cutting, bending and fixing in position and providing all tying wires, spacers, shop drawings, testing and bar bending schedules. All works according to specifications, drawings and supervisor engineer instructions</li> <li>10. In rehabilitation works, supply fabricate and fix steel dowels to the existing concrete using special materials. In case of lapping with existing steel reinforcement, rates will include cleaning rust and treatment with special materials</li> <li>11. In case after excavation the new columns locations and relevant footings coincide with the existing ones, the contractor will make modification to adapt implementation to the existing conditions and deemed to include in his rates relevant costs accordingly.</li> <li>12. The unit price includes demolish and removal of any required elements to complete the work according to the new design.</li> <li>13. All rehabilitation works will include the necessary excavation, backfilling with clear sand to the design level, extra steel reinforcement and concrete to be applied in layers if necessary in addition to the necessary special materials and accessories.</li> </ol>				

<b>Construction of Solar System for wastewater treatment and post treatment Plants in Rafah</b>					
<b>Item No.</b>	<b>Description</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit Rate US \$ (Numbers)</b>	<b>Total Amount US \$</b>
3.2.1	Supply and cast ready mix reinforced concrete B (250) kg/cm2 for <b>PV mounting foundation</b> including reinforcement (as per drawings), The price includes excavation , leveling, and compacting the soil beneath the foundation to 98% of MDD of sub-grade and backfilling with selected materials from excavation required level with all required works including supplying and laying polythene sheets with 200 micron thickness under the foundation.	m3	90		
3.2.2	Supply and cast Plain concrete B 200 below control room foundations , supports, anchor blocks, benching, slopes or like. Works shall include supplying and laying polythene sheets with 200 micron thickness .The price includes excavation , leveling, and compacting the soil with all required works as per specifications and drawings and supervisor Engineer instructions	m3	0.5		
3.2.3	Supply and cast ready mix reinforced concrete B (250) kg/cm2 for <b>control room foundations</b> including reinforcement (as drawings ), The price includes excavation , leveling, and compacting the soil beneath the foundation to 98% of MDD of sub-grade and backfilling with selected materials from excavation around the foudation and ground beams up to concrete ground slab levels , with all required works including supplying and laying polythene sheets with 200 micron thickness under the foundation.	m3	1.6		
3.2.4	Supply and cast ready mix reinforced concrete B250 kg/ cm2 for suspended hollow block slab 25 cm thick , including the reinforced steel, drop and inverted beams, hollow cement block 40*25*17, and all other materials needed to finish the work as per specifications and drawings.drainage, electrical, air conditioning, mechanical ducts & workmanship with all required works as per Engineer instructions.	m2	25		
3.2.5	Ditto but for Ground beams , works including supplying and laying polythene sheets with 200 micron thickness under the beam.	m3	2		
3.2.6	Ditto but for lintels and sills.	m3	1		
3.2.7	Ditto but B (250) kg/cm2 for ground slab (10cm - under tiles or without tiles) including reinforcement (1T8mm @ 20cm in both directions), leveling, and compacting the soil beneath the slab to 98% of MDD of sub-grade with all required works including supplying and laying polythene sheets with 200 micron thickness under the slab.	m2	28		
3.2.8	Ditto but B300, for columns and column necks	m3	1.5		
3.3	<b>Block Works:</b>				
	The price include: 1- supplying hollow cement block from good and approved factory in perfect dimension and build it in good manner with a compressive strength 35 kg/cm2 for hollow block. This item will include cement mortars, reinforced concrete infill (B250) between columns & block walls (10-20 cm wide) with 1Ø8mm/40cm horizontally and 2Ø8mm vertically according to drawings, pipes encasement, false columns 20x20 cm/4.0m among the parapet wall with 4Ø12mm and bituminous paper between block work and drop beams & all requirements needed to finish the works according to the drawings, specification and to the supervision engineer instructions.				
3.3.1	Supply and build hollow cement blocks 40x20x20cm.	m2	50		
3.4	<b>Plastering Works</b>				
	All works must be according to drawings, specification and engineer instructions. Rates shall include:				
3.4.1	Supply and make internal plastering 13 mm thick for ceiling,walls and soffits. The work includes rough primer nail rendering to form a key with (mix 1:1) cement sand, second layer 13mm: Base-Coat "Rendering" with (1:3:0.25) cement: sand mortar: lime and third layer: Finishing Coat with (1:4:0.50) cement: sand mortar: lime. Works include all materials needed to finish the works according to specifications , drawings and supervisor engineer's instructions	m2	90		

<b>Construction of Solar System for wastewater treatment and post treatment Plants in Rafah</b>					
<b>Item No.</b>	<b>Description</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit Rate US \$ (Numbers)</b>	<b>Total Amount US \$</b>
3.4.2	Supply and make external plastering 20mm thick to walls with four faces : the first is the rough nail rendering (mix 1:1) cement sand; the second is 5mm thick mortar (mix 1: 2) cement:sand, the third is the undercoat 13mm (mix 1: 3 :0.25) cement:sand:lime, the forth is two coats of Tyrolean finish (mix 1: 3) white cement to fine aggregate (Quartz) and all is according to specifications, drawings and supervisor engineer's instructions	m2	90		
3.5	<b>Painting Works:</b>				
	1-All the painting materials used should be approved and tested by approved local laboratory and have the final approved from the supervisor engineer. 2- The surface must be dry and clean before painting. 3- All painting works should provide the required coverage. 4- All paint works must be according to specifications , drawings and supervisor engineer instructions. 5- Contractor shall take into consideration that all – direct and indirect works and expenses required for the completion of the coming items are included in the unit price. 6-Smoothen surfaces of existing plastering before the Commencement paint				
3.5.1	Supply and Paint the internal walls and ceiling with one coat primer and at least two coats of approved supercrile as specifications, drawings and supervisor engineer instructions.	m2	90		
3.5.2	Supply and Paint, external walls with one coat of Pendrole primer and at least two coats of External quality of white and colored emulsion (Weather Shield) or equal approved as specification and drawings including the maintenance of the existing tryolyne (Rashga) if needed.	m2	90		
3.6	<b>Metal works:</b>				
	The item include supplying white aluminum windows section 7000 with two rails, with min. wall thick 1.25mm(be approved by representative engineer ) as frame, glass 4 mm thick, fironmongery , accessories and hard ware as per specification and drawings. -Steel work should be Paint with two coats of oil paint & one primer (polyzinc).				
3.6.1	Supply and fix aluminum window, overall size 140x120cm.	No	1		
3.6.2	Supply and install galvanized metal door 100x 220 cm (type DS1) with new double sheet (2-mm) complete with frame, the bottom of door must be louver type as per drawings, ironmongery, for electrical room. The price shall include painting with two coats and base coat and union type lock or equivalent, all according to Drawings, Specifications and instructions of the Engineer.	No	1		
3.6.3	Ditto but two leaves door 160x 220 cm (type DS2 )	No	1		
3.6.4	Supply and fix galvanized steel protection for windows over all size 140x120 cm as per drawings , Fixed on walls by steel plate ties, painting with oil paint, all according to drawing, specification and engineer instructions.	No	1		
3.7	<b>Tiles &amp; site works:</b>				
	All works must be according to drawings, specification and engineer instructions. Rates shall include : 1. Samples for approval and all the required tests. 2. Cleaning, mechanical polishing and pointing using grout. 3.Insulation works under ceramic floor tiles for upstairs bath rooms and kitchens using primer coat, two hot bitumen coats (75/25) 4. Plastic angle beads for ceramic wall tiles and Aluminum angle for ceramic of walls at the corners and top and sides of ceramic edges. 5. Local marble must be Grade (A) free cracks and clay flaws. 6. Measuring the stockpiled quantities of tiles and obtaining the engineer approval prior to shipment to the site. 7.Transporting and carefully handling the stored quantities to the site.				

<b>Construction of Solar System for wastewater treatment and post treatment Plants in Rafah</b>					
<b>Item No.</b>	<b>Description</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit Rate US \$ (Numbers)</b>	<b>Total Amount US \$</b>
3.7.1	Supply and install terrazzo floor tiles size 25cmx25cmx2.5cm (with marble chips) laid on 2cm mortar bed and 5 cm thick sand bed and the price including terrazzo skirting of same kind and color of the floor tiles 25cmx7cm x1cm thick laid on 1 cm mortar	m2	20		
3.7.2	Supply and install granite marble (grade A) first class(Rozabitta type)3cm thick, laid on 2cm mortar bed for and 5cm sand bed for edges of main entrance, including landing of main entrance. size 25 cm wide x 3cm thick for windows sills laid on 2 cm thick mortar bed as approved by the engineer.	m.r	10		
3.7.3	Supply and lay well graded , round edge,(1" to 2") gravel for the places between PV mounted areas (corridors) according the drawings with 20cm thick , the price includes all testing, excavation, leveling, compaction before installation the gravel to 98% in accordance to specification and engineer instructions.	m3	600		
3.8	<b>Roofing works</b>				
	<p>(1) Rates for foam concrete/ cement and mortar work shall include:</p> <ol style="list-style-type: none"> <li>1. Supply and storage of cement.</li> <li>2. Supply and storage of aggregates and water,</li> <li>3. Mixing,</li> <li>4. Hacking concrete, applying cement slurry or raking out joints of block work to form key,</li> <li>5. Application to any surface,</li> <li>6. Finish to surface,</li> <li>7. Finish to falls and cross falls,</li> <li>8. Forming bays including joints,</li> <li>9. Finish to edges,</li> <li>10. Making good around steel sections, pipes, tubes, bars, brackets, outlets, and the like,</li> <li>11. Ends, intersections, ramps, and the like, on fillets,</li> </ol> <p>(2) Rates for waterproofing shall include for:</p> <ol style="list-style-type: none"> <li>1. Preparation of surface,</li> <li>2. Any area or width,</li> <li>3. Cutting in edges.</li> <li>4. Over laps, priming and treatment at the corners and floor drains.</li> <li>5. Testing for the roof with water</li> <li>6. Dressing over parapets and stub columns including forming groove to receive edge of plasticised bitumen membrane and sealing with elastic sealer.</li> </ol> <p>(3) Rates for roof sheets shall include:</p> <ol style="list-style-type: none"> <li>1. Side and end laps, Fittings including bolts, hook bolts, screws and washers,</li> <li>2. Sheets of any width or length.</li> </ol>				
3.8.1	Supply and cast foam concrete with fine aggregates for roof screeding of average thickness 8 cm as shown in drawing. The item will include making the angle fillet 5x5cm around the boundary of the parapet and around opening in roof if exists.	m2	21		
3.8.2	Supply and lay one layer of plasticized bitumen roofing membrane with chipping 4 mm thick, including priming concrete surface prior to laying, dressing into rain water outlets to form water proofing seal and cover the angle fillets. The rate include verticals parts skirting as per specification and drawings. <b>Note:</b> Measurement will be for the horizontal projection only.	m2	21		
<b>Total Of Bill (3) - US\$</b>					

<b>Construction of Solar System for wastewater treatment and post treatment Plants in Rafah</b>					
<b>Item No.</b>	<b>Description</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit Rate US \$ (Numbers)</b>	<b>Total Amount US \$</b>
<b>Bill No (4): Mechanical Works</b>					
4	Plumbing works				
	<p>(1) In general rates for plumbing works shall include for:</p> <ol style="list-style-type: none"> <li>Developing shop and as built drawings</li> <li>Cutting and forming all chases, recesses, holes, and the like,</li> <li>Pipe sleeves,</li> <li>Building of concrete and/or brick ducts in floors, walls ...etc.,</li> <li>Excavation, forming of trenches for services, concreting, bedding and back filling and ramming after laying,</li> <li>Fixing brackets, clips, holder bats, hangers, and the like,</li> <li>Temporary and final fixing,</li> <li>Nails, screws, bolts, nuts, washers, holes, plugs, sleeves and the like,</li> <li>Building in or cutting and pinning,</li> <li>Testing and drawings,</li> <li>Painting of pipes,</li> <li>All work of other trades in connection with plumbing work including all making good.</li> <li>Rates for manholes and pits shall include excavation, concrete, benching, plastering, backfilling and cover as per Drawings and Specifications,</li> <li>Rates for sanitary fittings, isolated taps and gullies shall also include all pipe work in connection therewith and connections thereto including connection to the nearest manhole or gully and to the cold water storage tank.</li> <li>Rates for pipe work including pipe work in frames to shading sheds shall include for: <ol style="list-style-type: none"> <li>Joints in the running length,</li> </ol> </li> <li>Nipples, connections, sockets, ferrules, couplings, back nuts, unions, and the like,</li> <li>Bends, elbows, tees, reducers, access doors, cleaning eyes, blank caps, stop valves, and the like,</li> <li>Welded joints and connections including grinding,</li> <li>Lagging and wrapping,</li> <li>Excavation, bedding and backfilling.</li> </ol>				
4.1	<p>Supply, Install, connect and test branded type water network pump station including two pumps and their motors Speroni, Dab, or equivalent pumps, complete with capacity <math>Q = 12 \text{ m}^3/\text{hr}</math> for each pump and head 30m. The price should include:</p> <ol style="list-style-type: none"> <li>2X1 1/2" Ball Valve</li> <li>1X1 1/2" Strainer</li> <li>2X1 1/2" Flexible Connections</li> <li>1X1 1/2" Check Valve</li> <li>1X2" Pressure gauges</li> <li>1X 20 lts 10 bar Membrane Pressure Tank with all its accessories and pressure switches and electrical folates with all required control cables and pump switches.</li> <li>Control Panel with main and sub-circuit breakers, contactors, Relays, overloads, adjustable under/over voltage relay, timers, volt and ampermeters, indication lambs, automatic-0-manual switches, with all needed protections etc.. to organize the operation of the pump according to the pressure switches, level switches or electrical floats and stops them when there is no water from the source. All according to the drawings, specifications, and Engineers instructions. The pump shall be connected to the proposed net work with all required accessories and fitting requierd to make the net work optionial .</li> </ol>	L.S	1		



<b>Construction of Solar System for wastewater treatment and post treatment Plants in Rafah</b>					
<b>Item No.</b>	<b>Description</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit Rate US \$ (Numbers)</b>	<b>Total Amount US \$</b>
4.2	Supply, Install, test, and Commision PVC 2 m3 water tanks to be connected to the main supply net work at (Waste water treatment plant ) and water pump at pump room ,with all requiered accessories and fitting requierd to make the net work opertional . The price must include all the valves, 0.5 m high (50*50/3mm) G .steel structure sub base mounted with 5 cm thick wood sub base , piping, vents, drains, limit switches, accessories, etc..and all the requirements to make the system fully operational according to the relevant international standards, Specification, Drawings, and Engineers instructions .	No.	2		
4.3	Supply, Install, connect and test cleaning (fire fighting type) spring loaded Hose Reel cabinets (80x80x30)cm, made of at least 1mm stainless Steel , with rubber hose (12bar) pressure, 25m length, Ø25mm, angle globe valveØ 1", Jet nozzle, conction form main water pipe, all according to specifications, drawings and engineers approval.	No.	4		
4.4	Supply and install approved (M.D.P.E )pipe dia.63mm (10bar ) Water Pipes , the price includes connection with existing pipe with all required fittings and couplings, the item includes excavation, backfilling with clean sand 30cm at the bottom of the pipe , and complete all excavation above the pipe and watering and compaction to reach to %95 to each layer, tracer tap , and all fittings and accessories according to drawings, technical specifications & engineer's instructions.	L.M	200		
4.5	Supply and install concrete manhole 60cm dia according to the depths and levels required and consists of precast concrete rings with compressive strength after 28 days 300 kg / cm 2 fabricated by approved company with cast iron cover (8 ton) 50cm dia, The price should include all excavation, fittings, leveling, connections, sealing, backfilling, B250 for foundation thickness 10cm bellow manhole base , etc.. and where the manholes are at least 40 cm deep from the bottom of the water line pipe inside the manhole , manhole contains the following: - one 2 " gate valve Haco have type or equivalent with all necessary for installation, installation of jack and placing of graft with appropriate gradient , All work according to the relevant international standards, drawings, specifications, and supervisor Engineer .	No.	7		
4.6	Supply, Install, test, and commission 4" UPVC Floor Drain for rain water , completed with collector with St. Steel strainer mesh for cover. the floor drain and Its installation should be according to the relevant international standards and with all connections vents and pipes 4" UPVC ,sn.4 to the nearst manhole according to Drawings, Specifications, and Engineers instructions.	No.	2		
4.7	<b><u>AC Air Condition:</u></b> Supply , install, test and commission air conditioning Inverter type Split Unit, composed of outdoor unit. filled with environment friendly refrigerant such as (R410, R407c,...) and COP not less than 3.5,Condensing unit shall be complete with Inverter compressor/s & air cooled condenser with fan, Well supported on hot galvanized steel base on the roof, indoor unit with plasma filter as indicated on drawings to be tights installed completed with all necessary supports, hangers, drain pipes from indoor unit to the ground floor drain, ( PVC Ø 0.75"), cupper pipes , sleeves, thermostat , Remote control , The price includes all aircondition power socket with lamp switch and all required electrical power cables 3*4 mm2 from SDB inside the room to the unit according to drawings and engineers approval. CAPACITY:(18000 BTU/HR). (Type is TORNADO or equivalent ) .	Unit	1		



<b><u>Construction of Solar System for wastewater treatment and post treatment Plants in Rafah</u></b>					
<b>Item No.</b>	<b>Description</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit Rate US \$ (Numbers)</b>	<b>Total Amount US \$</b>
4.8	Supply and install Manual (Dry Powder) wall mounted Fire extinguisher (6kg) all according to drawings, specifications, Engineer's instructions.	No	1		
<b>Total Of Bill (4) - US\$</b>					

<b>Construction of Solar System for wastewater treatment and post treatment Plants in Rafah</b>					
<b>Item No.</b>	<b>Description</b>	<b>Unit</b>	<b>Quantity</b>	<b>Unit Rate US \$ (Numbers)</b>	<b>Total Amount US \$</b>
<b>Bill No (5): Equipment's &amp; Tools Works For Solar System</b>					
	<b><u>General:</u></b> <ul style="list-style-type: none"> <li>• All works and installations listed here below should be carried out, tested and commissioned by specialized responsible contractor by coordination with UNDP &amp; PEA, all specifications and relevant standards, and the instruction of the Supervisor Engineer. The Engineer has the right to reject any component of the work not complying with the specifications and the requirement of the contract.</li> <li>• The contractor should provide (catalogues) to get the approvals by the Engineer before supplying the materials</li> <li>• All equipment will be installed must have manufacture guarantee not less than 2 years with all certificates test.</li> <li>• All the works shall be executed according to Standards, Catalogues, specifications and supervisor engineer instructions.</li> </ul>				
<b>Tools For PV Solar System</b>					
5.1	<b><u>PV PANEL TEST</u></b> Supply and test a PV panel test meter device ( <b>PROFITEST PVSUN PVs</b> for trouble shooting of the PV array to be used by PENRA staff. Voltage measurement: 0 ... 1000 V DC Current measurement (direct): 0 ... 20 A DC Insulation resistance measurement Measuring range: 0 ... 20 MΩ Test voltages: 250 V / 500 V / 1000 V DC Ground fault measurement: 0 ... 1000 V DC Testing for protective conductor continuity: 0 ... 10 Ω / > 200 mA	Unit	1		
5.2	<b><u>PV Insulation Tester</u></b> Supply and test a PV Insulation Tester device ( <b>Z100 PV Analyzer</b> ) Reference: Z100 PV Analyzer kit with accessories. Note: The Z100 PV Analyzer kit with accessories includes MC4 measuring Crocodile clip ground measuring lead, Shrouded banana safety measuring leads, Testing pins (red and black), Tone pickup inc. 9V battery, USB charger and USB cable. Also includes the Z100 PV Analyzer user manual.	Unit	1		
<b>Total Of Bill (5) - US\$</b>					

### Summary

Bill No.	Description	Total (Us \$)
1	PV works for RWWTP	
2	Electrical Works	
3	Civil Works	
4	Mechanical Works	
5	Tools & Equipment's	
	<b>TOTAL WORKS</b>	
	VAT(0%)	
	<b>TOTAL</b>	

Total in numbers .....

Total in letters .....

Name of the contractor .....

Authorized signature .....

Signature and Sealing.....

Title .....

Telephone.....

Fax .....

Mobile .....