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وزارة التجـــارة والصـــناعة

مركـز تحـديث الصناعـة
INDUSTRIAL MODERNISATION CENTRE

Egypt-PV
نظم الخلايا الشمسية الصغيرة

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مشـــروع نظـــم الخلايـــا الشمسيـــــة الصغيـــرة

دليل المواصفات و الإشتراطات الفنية

Technical Requirements & Specs Guideline

May 2018

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Background

The Grid-Connected Small-Scale Photovoltaic Systems project "Egypt-PV" aims to remove the barriers to increased power generation by small, decentralized, grid-connected PV systems in residential, commercial, industrial, tourism and public buildings sector. The project has been financed by the Global Environment Facility (GEF) and United Nations Development Programme (UNDP) acts as the GEF Implementing Agency. The project was executed by Industrial Modernization Centre (IMC) of the Ministry of Industry and Foreign Trade, which will assume the overall responsibility for the achievement of project results as UNDP's Implementing Partner

Scope and purpose

The scope of this document is to provide a guideline for tendering grid connected small-scale PV systems. These guidelines have been prepared for the benefits of miscellaneous departments and sectors buildings in Egypt. The document is considered as a guiding document, so it is generic and can be tailored as per end user needs, but still it includes the minimum acceptance requirements for optimum performance grid connected PV systems.

Legal framework within the Egyptian context

There are many applications for solar PV, either on-grid or off-grid. This document focuses on the on-grid PV plants. The on-grid PV plants injects energy units (kWh) to the grid, these energy units' consumption and production are differentiated and the consumer pays the net metered value.

Net Metering: Net Consumption (kWh) – Net Produced from PV system (kWh) = Value of electricity to be paid by consumer, for more information, data are available here: http://egyptera.org/Downloads/journal/2017/periodical_book5.PDF

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Rooftop installation requirements

The PV panels require a shadow free area, the required shadow free area for installing systems is about 10 ~ 12 m^2 per kWp. This number includes provision for clearances between solar PV array rows. The solar panels may be installed on the roof of the building with a south facing tilt angle that varies from 25º till 33º. The variation in the tilt angle doesn't affect much the system yield like the panel orientation do, so it's much advisable that panels face SOUTH direction. The installed PV plants shall be cleaned sufficiently, regarding its erection area, i.e. installing PV plant in desert area will require more cleaning rather than in urban areas. On the other hand, its life time should be considered also, i.e. 1-year lifetime will require a piece of cloth and clean, 3 years will have required rinsing panels with water, while 7 years' lifetime may require chemical materials to clean the panels.

The PV solar inverter is from grid-connected type, as any electronic device it requires to be installed in a place away from dust, air, and rain. Moreover, it should be placed in an accessible and safely placed.

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1 INTRODUCTION

In the framework of the cooperation protocol which was signed between the ..... and the ..... for implementing a number of projects within the context of Grid-Connected Small-Scale Photovoltaic Systems "Egypt – PV" The ..... hereinafter referred to as the "Owner" intends to acquire Photovoltaic (PV) grid-connected system for ..... building at ..... city, as follows:

- .... KWp PV power system to supply the building internal lighting, connected to the building internal electrical Network through Grid Tie Inverter.

Tenderers are invited to submit their offers for the Supply, Installation and startup the PV system in accordance with the technical specifications of the required PV system (Part 1) in English and the special and general conditions (Part 2) in Arabic indicated later hereby.

Offers should be submitted to: .... City.

2 SITE AND LOCATION OF THE REQUIRED PV SYSTEM

The **.....** is located in ..... along ..... Street.

A Full layout of **.....** Head quarter building is shown in appendix (3) where the proposed locations for installing the PV system is as follow:

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3 Technical Specifications

3.1 General technical Requirements:

The general design requirements shall consider the following:

3.1.1 The PV power system will be designed to yield the maximum possible amount of energy on yearly average basis.

3.1.2 The PV support structure should be designed to a fixed tilt angle equal to the latitude angle of the site.

3.1.3 The overall system design and its components shall be commercially available and shall conform to acceptable commercial and international industry practice.

3.1.4 The installed system should be complaint with the Egyptian Distribution Grid Code and with the technical requirements, the regulations & safety procedures for connecting the PV systems to the electrical grid as per the regulations available on "Egyptera" website: **www.egyptera.org\renewables**

3.1.5 Tenderers are requested to provide their estimates of the system output energy in (kWh/year) and the expected produced electric energy by the system against corresponding different solar radiation values year round. All assumption should be stated in a way that allows calculations to be repeated. If specialized software is used,

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such software should be named and outputs provided (PVSYST or PVSOL)

3.1.6 **(1)**Ambient temperatures ranging from -5℃ to 65℃ degree Celsius and **(2)** relative humidity of up to 95%.

3.1.7 Personnel safety during installations, operational and maintenance of the system after the start of operation shall be an integral part of the system design. The tenderer shall define in his offer the required human safety rules both before and after the system commissioning and normal operation. However, the tenderer shall be fully responsible for his workmen during installation.

3.1.8 **The tenderer must submit approved and valid acceptance test certificates for major components, mainly PV modules and Inverters** and must be in compliance with the specified IEC standard requirements or others as the case would be.

3.1.9 The system warranty period shall be at least **five** years during which the supplier shall replace defective component at his own cost and risk; however longer guarantee periods may be specifically specified for some components.

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3.2 PV MODULES

3.2.1 The specifications of the PV modules shall be indicated in the tenderer's technical offer documents containing at least the following: -

- PV Module manufacturer.
- PV modules Model.
- PV Module type (mono or poly).
- Open circuit voltage (Voc).
- Short circuit current (Isc).
- Voltage at maximum power point (V_{mpp}).
- Current at maximum power point (I_{mpp}).
- PV Module Surface area and weight.
- Current, voltage and power temperature coefficient.
- Connected diodes; e.g. bypass diodes and blocking diodes.
- Certificates of modules' testing and quality
- Country of origin
- Year of obtaining the IEC certificate
- Name of testing lab issuing the certificate

Considering the following specs:

Type	Mono or poly crystalline silicon type
Efficiency	≥ 16%
Fill factor	≥ 71.5%
Degradation warranty	Panel output (Wp) capacity to be ≥ 90% of design nominal power after 10 years

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	and ≥ 80% of design nominal power after 20 years.
Module frame	Non-corrosive and electrolytically compatible with the mounting structure material
Junction box	Thermo-plastic, IP 65, UV resistant
Module minimum rated power	≥ 260 Wp
Tagging data	a) Name of the manufacturer of PV Module b) Name of the Manufacturer of Solar cells c) Month and year of manufacture (separately for solar cells and module) d) Country of origin (separately for solar cells and module) e) I-V curve for the module f) Imp, Vmp and FF for the module g) Unique Serial No and Model No of the module h) Date and year of obtaining IEC PV module qualification certificate i) Name of the test lab issuing IEC certificate j) Other relevant information on traceability of solar cells and module as per ISO 9000 standard
Power output rating	To be given for standard test conditions (STC). I-V curve of the sample module shall be submitted.
Compliance with standards and codes	IEC 61730 and IEC 61215 and 61727 and ASTME1171and TUV for safety or equivalent
Panels warranty period	At least 10 years

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3.3 SUPPORT STRUCTURE

3.3.1 The support Structure shall be designed for simple mechanical and electrical installations. It shall support PV modules at a given orientation, absorb and transfer the mechanical loads to the ground properly. The support structure shall be designed to a tilt angle equal to the site latitude and installed due south.

Considering the following specs:

Wind velocity withstanding capacity	Up to 50 meters per second m/s (180 km/hr.) for a period of 15 minutes; and 35 m/s (126 km/hr.) for extended periods of time
Structure material	The structure shall be corrosion resistant and made from either hot dip galvanized steel with a minimum galvanization thickness of 120 microns or treated aluminum alloy (anodized, oxidized, etc.). Lighter structures are preferable.
Mounting arrangement for metal sheet roofs	Mounting directly on the sheet metal, ensuring stability and wind withstanding capacity, or penetrating the sheet metal and fixing to the sub-structure, ensuring that the roof remains water proof and ensuring stability and wind withstanding capacity.
The method of fixation	Up to the tenderer's discretion, however, fixation method should be neat and appealing as the unit will be a showcase. Overall care should be taken to provide an appealing system with neat wiring and connections.
Bolts, nuts, fasteners, panel mounting clamps	Stainless steel SS 304

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Installation	The structures shall be designed for simple mechanical on-site installation. There shall be no requirement of welding or complex machinery at the installation site.
Access for panel cleaning and maintenance	All solar panels must be accessible from the top for cleaning and from the bottom for access to the module junction box.
Panel tilt angle	North – south orientation with a fixed tilt angle of 25 - 35 degrees ,south facing.

- The prospective Installer shall specify installation details of the solar PV modules and the support structures with lay-out drawings and array connection diagrams. The work shall be carried out as per the designs approved by the Customer.

3.4 ISOLATION SWITCH AND FUSES

The system must contain an isolation switch which can isolate the PV system from the building electrical network. The isolation switch shall be mounted near the building electric grid connection point.

The cables from the array strings to the solar grid inverters shall be provided with DC fuse protection. Fuses shall have a voltage rating and current rating as required. The fuse shall have DIN rail mountable fuse holders and shall be housed in thermoplastic IP 65 enclosures with transparent covers.

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3.5 INVERTERS

3.5.1 The inverters shall be solar grid inverter that converts the DC power of the solar PV modules to grid-compatible AC power, capable of producing three phase true sine wave at an output of 400/230 volts with maximum ± 10% variation and nominal frequency 50 Hz in range of 48.5 – 51 Hz as a maximum limit, considering the following specs:

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Type	On-Grid Inverter
Total output power (AC)	To match solar PV plant capacity while achieving optimum system efficiency
Maximum power point (MPPT) tracking	Shall be incorporated
Number of independent MPPT inputs	1 or more based on number of strings
Operation AC voltage	Single phase 230V or Three phase 415V (+ 12.5%, -20%)
Power factor of the inverter	> 0.90 at nominal power
Total harmonic distortion (THD)	< 3%, and injected direct current shall be limited to 1% of the alternating current nominal value
Inverter isolation	Should be transformer less.
Built-in Protection	AC high / low voltage; AC high /low frequency. In addition to this, an adequate protection against short circuit and over loading
Anti-islanding protection	As per VDE 0126-1-1, IEC 60255.5 / IEC 60255.27; that will automatically disconnect the PV array on power down of the utility grid.
Maximum Inverter efficiency Weighted Inverter efficiency	≥ 98% ≥ 95%
Safety	The inverter shall be supplied with complete data sheets and shall comply with IEC 61727 and correspond to factor of safety IP 65 for outdoor mounting, IP 54 for indoor mounting
Safety compliance	IEC 62109-1, IEC 62109-2

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Display Type	LCD for data display. LCD / LED for status display
Display parameters to include	Output power (W), cumulative energy (Wh), Input DC voltage (V), Input DC current (A), Output AC voltage (V), Output AC frequency (Hz), Output AC current (A), cumulative hours of operation (h). Besides, an interface for troubleshooting and working settings

3.5.2 The warranty period of the inverter shall be at least 5 years.

3.6 DC COMBINER BOX

3.6.1 A DC Combiner Box shall be used to combine the DC cables of the solar module arrays with DC fuse protection for the outgoing DC cable(s) to the DC Distribution Box.

3.7 CABLING AND WIRING

3.7.1 All cables shall be supplied conforming to IEC 60227 & IEC 60502, Voltage rating: 1,000V DC considering the following specs:

For DC Cables	XLPE or XLPO insulated and sheathed, UV stabilized single core flexible copper cables shall be used. The power outdoor cabling shall be made of copper conductors with double sheath type HO7RNF inside XLPE or PVC pipes and inside cable tray, all complete with mounting and fixing accessories, junction and connection boxes as well as any needed additional accessories.
For AC Cables	For the AC cabling, PVC or XLPE insulated and PVC sheathed single or

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	multi-core flexible copper cables shall be used. Outdoor AC cables shall have a UV-stabilized outer sheath.
Voltage drop allowance	The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter, and from the solar grid inverter to the building shall not exceed 3.0%.
Ducting and Conduits	The DC cables from the solar PV module array shall run through a UV-stabilized PVC conduit pipe of adequate diameter with a minimum wall thickness of 1.5mm. Cables and conduits that have to pass through walls or ceilings shall be taken through a PVC pipe sleeve.
Cables Connectors	Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers.
Cables Sizing	All cables and conduit pipes shall be clamped to the rooftop, walls and ceilings with thermo-plastic clamps at intervals not exceeding 50 cm. The minimum DC cable size shall be 4.0 mm2 copper. The minimum AC cable size shall be 4.0 mm2 copper. In three phase systems, the size of the neutral wire size shall be equal to the size of the phase wires. PV wiring and cabling shall be rated at 125% of the rated operating DC/AC current of PV array at 25ºC cell temperature and 1000 W/m2 solar irradiance.
Cables Coloring	The following color coding shall be used for cable wires:

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	− DC positive: red (the outer PVC sheath can be black with a red line marking) − DC negative: black − AC single phase: Phase: red; neutral: black − AC three phase: Phases: red, yellow, blue; neutral: black − Earth wires: green & yellow
Labeling	All cables should be labeled referring the Inverter Number and the String Number, i.e. "I3-S4", means the cable connects the fourth string in the third inverter.
Cable Terminals	Cable conductors shall be terminated with tinned copper end-ferrules to prevent fraying and breaking of individual wire strands. The termination of the DC and AC cables at the Solar Grid Inverter shall be done as per instructions of the manufacturer, which in most cases will include the use of special connectors.

3.8 EARTHING AND LIGHTENING PROTECTION

3.8.1 The PV modules frames, array support structure, inverter, electric boxes, etc. shall all be earthed through ground copper rods of 50mm diameter and 3 meters' length to limit the earthing system resistance.

3.8.2 The contractor is committed to test and validate the effectiveness of the installed earthing system in an owner-approved testing lab such as the high voltage lab of the EEHC.

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The resulting test certificate will be part of the primary acceptance.

3.8.3 The earthing system of the PV system should be separated from the building earthing, and the contractor should consult the distribution company to approve the earthing system to facilitate the handover and grid interconnection process.

3.8.4 The earthing system resistance **should not exceed 5 ohms**.

3.8.5 The earth electrodes shall have a precast concrete enclosure with a removable lid for inspection and maintenance. The entire earthing system shall comprise non-corrosive components.

3.9 SWITCH BOARDS AND PROTECTION

3.9.1 Protection against "DC" overcurrent and overvoltage will be supplied with suitable ratings. The DC surge protection devices (SPDs) shall be installed in the DC distribution box adjacent to the solar grid inverter.

3.9.2 Protection against "AC" overcurrent, overvoltage and high temperature will also be supplied. Wall- mounted distribution panels should include fuses & circuit breakers and switches that are rated at 1.5 times of the rated load current. The AC surge protection devices SPDs shall be installed in the AC distribution box adjacent to the solar grid inverter.

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3.9.3 The system shall also be filled for protection against extreme voltage variation, over loading above indicated ranges and against extreme frequency variation and overheating.

3.10 AC DISTRIBUTION BOX (AC PANEL)

3.10.1 An AC distribution box shall be mounted close to the solar grid inverter. The AC distribution box shall be of the thermos-plastic IP65 DIN rail mounting type and shall comprise the following components and cable terminations:

- Incoming 3-core / 5-core (single-phase/three-phase) cable from the solar grid inverter
- AC circuit breaker, 2-pole / 4-pole
- AC surge protection device (SPD), class 2 as per IEC 60364-5-53
- Outgoing cable to the building electrical distribution board.

3.11 Caution Signs

3.11.1 In addition to the standard caution and danger boards or labels as per Egyptian Electricity Standards, the AC distribution box near the solar grid inverter, the building distribution board to which the AC output of the solar PV system is connected and the Solar Generation Meter shall be provided with a non-corrosive caution label.

3.12 REGULATIOS FOR NET METERING BASED ON PROJECT TYPE

The system should contain electric meters with digital display that keeps separate track of energy in both directions (to and from the electric grid). It must comply with technical specifications, requirements and procedure of the

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Electricity Distribution Company (.....), the tenderer will be responsible to follow up with the distribution company on the administrative procedure for connecting the system to the grid as per the relevant NET METERING regulation.

3.13 DATA ACQUISITION SYSTEM DAS

3.13.1 Suitable data acquisition should be provided to the system and accessible remotely for online monitoring.

3.13.2 Suitable number of input channels should be selected for measuring and later calculating the system and subsystem parameters and allowing monitoring system performance, such as: PV array current and voltages. Ambient temperature, solar irradiance on the tilted surface, PV instantaneous power, etc.

3.13.3 The system should log the data on circular overwrite manner every one year at least.

3.13.4 System data should be accessible with password, well arranged and informative.

3.13.5 Through the IDSC/owner domain, there should be the possibility to download the recorded data in a spreadsheet readable format for further analysis.

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3.14 DISPLAY SCREEN

3.14.1 3.14.1 The PV system shall include displaying system. "40" LED Display screen at the entrance of HQ building to display the following parameters:

3.4.1.1 System instantaneous Peak Power (for ....kW_p).

3.4.1.2 Daily Total energy generation.

3.4.1.3 Accumulated energy generation since commissioning.

3.4.1.4 The avoided amount of greenhouse gas emissions due to the usage of the PV system with respect to the accumulated energy.

4 Documentation

a) The Installer shall supply the following documentation:
b) System description with working principles.
c) System single line diagram.
d) Solar PV array lay-out.
e) Routing diagram of cables and wires.
f) Data sheets and user manuals of the solar PV panels and the solar grid inverter.
g) A system operation and maintenance manual.
h) Name, address, mobile number and email address of the service center to be contacted in case of troubleshooting, failure or complaint.
i) Warranty cards.
j) Maintenance register.
k) A work method statement

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5 SPARE PARTS LIST

The tenderer shall submit in his offer the recommended spare parts for different system components based on his previous experience with similar systems, the spare parts list should include at least 2% of the total supplied modules and 5% of the total supplied fuses of both the AC and DC connection.

6 DRAWINGS AND CATALOGUES

The tenderer shall include in his tender adequate engineering drawings and circuit diagrams, single line diagrams and full detailed drawings. Components specifications shall be supported by catalogues containing full technical description and certification of values indicated.

7 SYSTEM DESIGN AND TIME SCHEDULE

7.1 The tenderer shall indicate his overall system design configuration and the owner shall have the right to ask for and require any explanations.

7.2 In addition, the tenderer shall indicate in his offer his proposed implementation time schedule.

8 TRAINING

Theoretical and practical training program will be developed and conducted by the contractor for this project. This training program will be on-the-job-training (OJT) at the project site.

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9 SYSTEM PRIMARY ACCEPTANCE

9.1 The owner will visually check all system components and connections and may ask for modification if inconvenience is found.

9.2 The contractor will test the functionality of the system components, measure the system parameters in front of the owner and the owner has the right to propose additional non-destructive test conditions, if he believes so is needed, to double check the system response. Tests are to be conducted by the contractor under the contractor's responsibility.

9.3 The equipment that will be used in the testing can be provided by the contractor or by other side that is approved by the owner.

9.4 Any non-conformity revealed during the testing should be corrected to the mentioned specifications in the tender under the contractor's account and responsibility.

9.5 In order to guarantee the long term system performance, an agreement between the contractor and the owner will be made. Ensure that the owner trained-personnel will carry out the regular routine maintenance according to the contractor's specifications.

9.6 Having the tests successfully implemented, the system should run automatically for two weeks under observation. Having not encountering any problem in the system operation during the two weeks; the primary acceptance will be completed successfully.

10 SYSTEM FINAL ACCEPTANCE

10.1 The owner will monitor system performance and output for 2 years during which accumulated energy output will be recorded. At the end of the 2 years guarantee period

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the total accumulated system energy output should be equal or be above the tenderer estimated yearly energy yield multiplied by 2.

10.2 In case that the accumulated energy output is less than the figures (earlier given by the tenderer in his offer) by a maximum of 5%, the owner will consider that the tenderer has complied with the requirements and accept the system, hence release and return the final guarantee. If the total measured accumulated output is less than the estimated figures (given by the tenderer in his offer for the 2 years) by more than 5%. Hence the owner will have the right to deduct a percentage from the final letter of guarantee proportional to the percentage decrease in the measured value compared to the estimated one. The percentage decrease in the measured accumulated 2 years' yield shall be limited to 15% (i.e. equivalent to less than 85% output), then the owner shall have the right to liquidate and confiscate the final letter of guarantee. However, the time at which the utility power is down will not be included within the system operation time and the calculated accumulated output.

11 OFFER PREPARATION

The hereinafter requirements shall apply to the PV system. The tenderer/bidder shall submit a complete offer for both required systems including the following items in the following order and in separate sections:

11.1 A statement from the bidder explaining his situation and approach towards the supply and installation of the main items required in the tender (e.g. briefing for: system component listing, warrantee, guarantee, training period, maintenance contract period, the offer total page number, comments, nay reservations should also be clearly stated her, etc.).

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11.2 Detailed system design besides defining the main features and functionality of all system components, dimensional layout, etc.

11.3 Clear project time schedule, indicating the main milestones actions of the schedule.

11.4 Technical specifications of the main system components such as PV, performance guarantee for the supplied PV modules, inverter, etc.

11.5 System performance guarantee.

11.6 Certifications for the main system components.

11.7 Proposed system acceptance testing.

11.8 Proposed training program.

11.9 Spare parts list.

11.10 A simple financial feasibility study (Includes payback period, IRR, based on a forecasted tariff price in the next 5 years in the point of view of the company)

11.11 Previous experience of PV projects in general and in Egypt. In particular projects where the same offered type of PV modules was used; defining the nature of application and the project size.

11.12 The project assigned-staff experience regarding their relevant training and experience in similar projects, special attention should be given to the project manager who will supervise the potential contract implementation.

11.13 The required legal document of the company specified in part II of this documents, **in particular the certificate of company accreditation issued by the new and renewable energy authority (NREA), and being listed in the Egypt-PV project guiding list.**

11.14 Every offer is expected to follow this order and to use an obvious partition between every section along with an index in the beginning.

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11.15 Every page in the offer should be numbered at the bottom-right corner place from the beginning to the end.

11.16 **Tables specifying system component information are attached (appendix [1]). It should be filled-in with all required information.** The "page number" column in the table is referring to the document page number in the tenderer's offer from which this particular information was collected. Also this particular information I the document should be highlighted in the main document body with a highlighter pen.

11.17 The financial form in appendix [3] is to be filled and included in the financial envelope.

11.18 The required specifications according to the/m tables besides the tenderer text represent the minimum requirements; however, any additional data and information deemed necessary and/or useful by the tenderer should also be added.

***Technical and financial offer shall be submitted as hard copies, other related documents (Datasheets, certificates, etc..) should only submitted as softcopy to reduce paper printing**

12 EVALUATION CRITERIA AND AWARDING OF THE TENDER

12.1 TECHNICAL EVALUATION

The Evaluation of Technical offers will be done in two stages as follow:

a. **An initial screening** of the technical proposals to check their conformity with basic tender conditions (Such as, but not limited to, Legal documents for the Tenderer/ Consortium, Certificates from international laboratories stating that PV modules and Inverters are complying with the specified IEC standards, Degradation factor of the

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PV modules and the system, Performance of the PV modules, Supporting structure material, Technical information provided by catalogue and Schematic diagram for Each system, etc.). **The tenderers, whom will not fill the attached tables in appendix (1) appropriately with clear and sufficient information, would be subject to possible elimination in the initial screening.**

b. Only for the successful tenderers who passed the Basic tender conditions, the Owner will cross check the amount of electric energy expected to be produced by the system according to the tenderer data and information.

12.2 FINANCIAL EVALUATION

Price envelopes will be opened for the Successful Technical offers. The Owner will cross check the total price of the PV system according to the tenderer data and information (e.g. the price of each PV system component, each system total price, the operation and maintenance cost, etc.).

13 AWARD OF THE TENDER

13.1 THE TECHNO-COST

For any efficient project, quality and cost are always linked. In order to link the technical assessment to the financial assessment; the "techno-cost" for each offer will be calculated. To deduce the Techno-cost, the total indicated cost in the financial offer will be divided by the

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score of the technical offer. For example, for cost (x) and technical score 80%, the Techno-cost will be (x/0.8). As well, the final assessment will also be based on the total expected amount of electric energy in kWh over the expected life time of the system, during 20 years.

The successful tenderer will be the one offering the best quality PV components & systems features and the least kWh price over the expected life time of the system.

13.2 EVALUATION CRITERIA

The following evaluation criteria are meant to assess the compliance to the tender requirements besides the quality and the functionality of the mentioned items. In case any of the required items are not provided in the offer, it may result in the rejection of the offer.

S	Evaluation Criteria for ....KWp PV System	Max Points
1	PV Modules	25
2	Inverter	15
3	Cabling and wiring	5
4	Earthing and lightening protection	5
5	Switch board and protection	5
6	Array support structure	10
7	Display screen	5
8	Spare parts	5
9	System design	10

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10	Overall system guarantee	5
11	Drawing and catalogues	2
12	Company previous experience	3
13	Project assigned-staff experience	3
14	Offer preparation	2
Total		100

13. TESTING.

13.1 Testing shall be performed at approved laboratory as required to ensure the proper and complete installation of all components Required testing equipment shall be in good operating condition and shall be properly maintained and calibrated. Upon completion of testing and checking of each item of equipment, any necessary maintenance and protection shall be carried out, written documentation shall be maintained for all checking and testing results.

13.2 PV modules tests.

13.2.1 PV modules must qualify enclose test reports according to IEC standard. Additionally, performance of PV modules at standard test condition must be tested in accordance with IEC 61215 and IEC 62446.

13.2.2 Crystalline silicon photovoltaic (PV) array - On-site measurement of current voltage characteristics shall be in accordance with IEC 61829.

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13.3 **Inverter tests**.

13.3.1 Each inverter shall be subjected to a production test in accordance with IEEE 1547.

13.3.2 The contractor shall certify that the equipment has been tested and passed the design test as described in IEEE1547.

13.4 **Test reports**.

The contractor shall-submit certified test data of all testing performed, in accordance with IEC 60904 part 1 prior to shipment of the equipment.

Testing shall be performed a required to ensure the proper and complete installation of all components. Required testing equipment shall be in good operating condition and shall be properly maintained and calibrated. Upon completion of testing and checking of each item of equipment, any necessary maintenance and protection shall be carried out. Written documentation shall be maintained for all checking and testing report.

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14. References

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2. - د/انهار حجازي – كراسة طرح "مبادرة شمسك يا مصر" – وحدة ترشيد الطاقة - مركز دعم و اتخاذ القرار – مجلس الوزراء - 2015

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Part-II

APPENDICES

Appendix (1): System Component Information Tables

1. Photovoltaic Modules (Main offer☐ Alternative offer ☐

S	Item	Description	Page No
1	Type		
2	Model		
3	Module Max Power		
4	Country of origin		
5	Efficiency		
6	Power temperature coefficient		
7	Origin of test certificates		
8	Distance between PV rows (cm)		
9	Shadowing duration (hour/year, or %) according to the distance between rows and columns designed by the tenderer		
10	Modules total number		
11	Number of strings in the system		
12	Expected net yield on-field (KWh/year)		
13	System Performance Ratio		
14	PV module guarantee period		

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2. Modules Support Structure (Main offer □Alternative offer □

S	Item	Description	Page No.
1	Type		
2	Material		
3	Max withstood wind speed		
4	Guarantee period		

3. Cables (Main offer □Alternative offer □

S	Item	Description	Page No.
1	Type (both for AC or DC)		
2	Model		
3	Type of insolation		
4	Country of origin		
5	Expected overall voltage drop		
6	Guarantee period		

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4. Inverter (Main offer ☐Alternative offer☐)

S	Item	Description	Page No.
1	Type		
2	Model		
3	AC power		
4	Number of output phases		
5	Country of origin		
6	Efficiency		
7	Start-up voltage		
8	Power factor		
9	Inverter grid isolation type		
10	Number of MPPT		
11	Automatic or manual protection against islanding		
12	Environmental type of protection		
13	Origin of test certificates		
14	Total number of inverters		
15	Guarantee period		

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5. Data Acquisition System (Main offer ☐ Alternative offer ☐)

S	Item	Description	Page No.
1	Type		
2	Model		
3	Country of origin		
4	Ability to connection and display on the owner & IDSC sites on the net		
5	Measures to be displayed		
6	Calculation to be displayed		
7	Guarantee period		

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6. Display Screen (Main offer ☐ Alternative offer ☐)

S	Item	Description	Page No.
1	Type		
2	Model		
3	Screen area (in inches)		
4	Data to be displayed on the screen		
5	Guarantee period		

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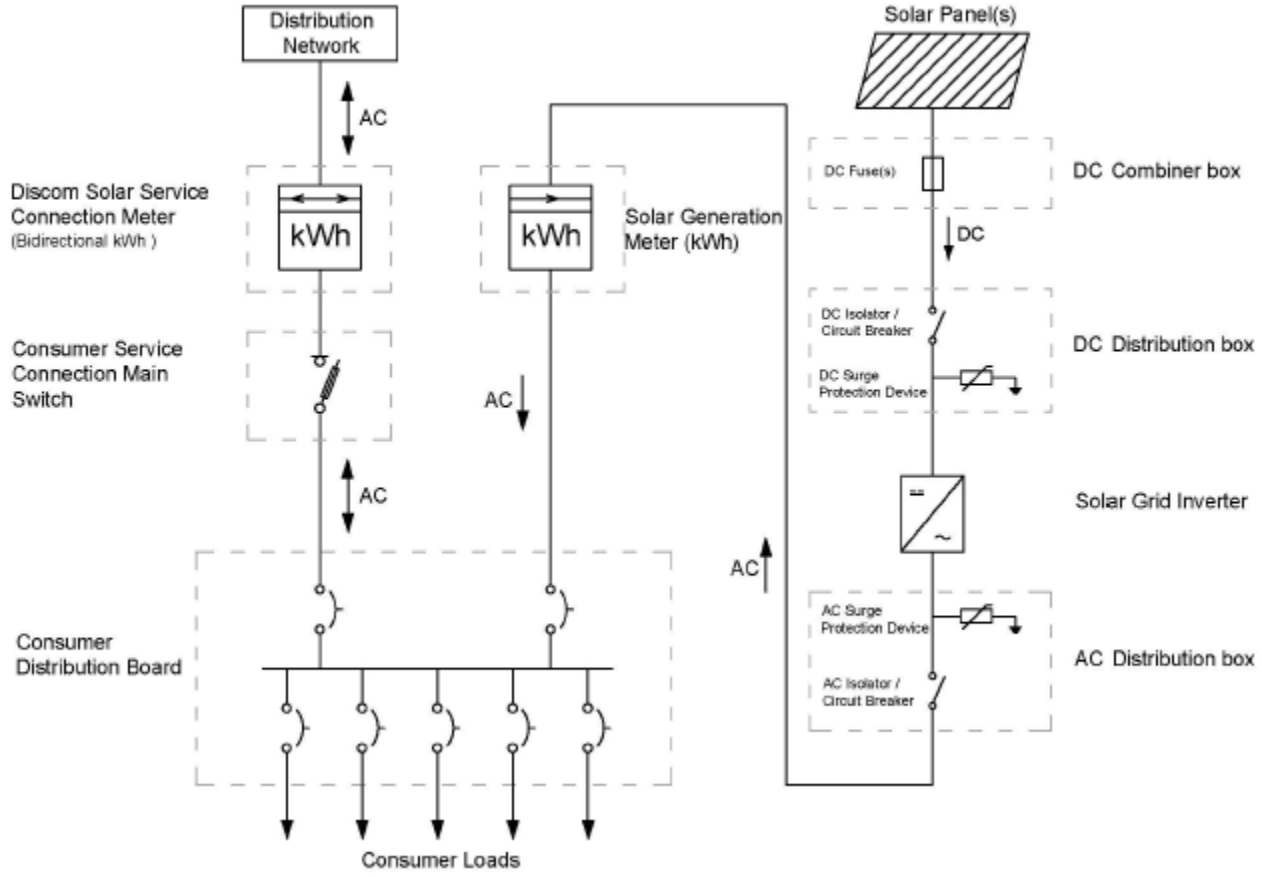
Appendix (2): Typical wiring diagram for grid-connected solar PV system



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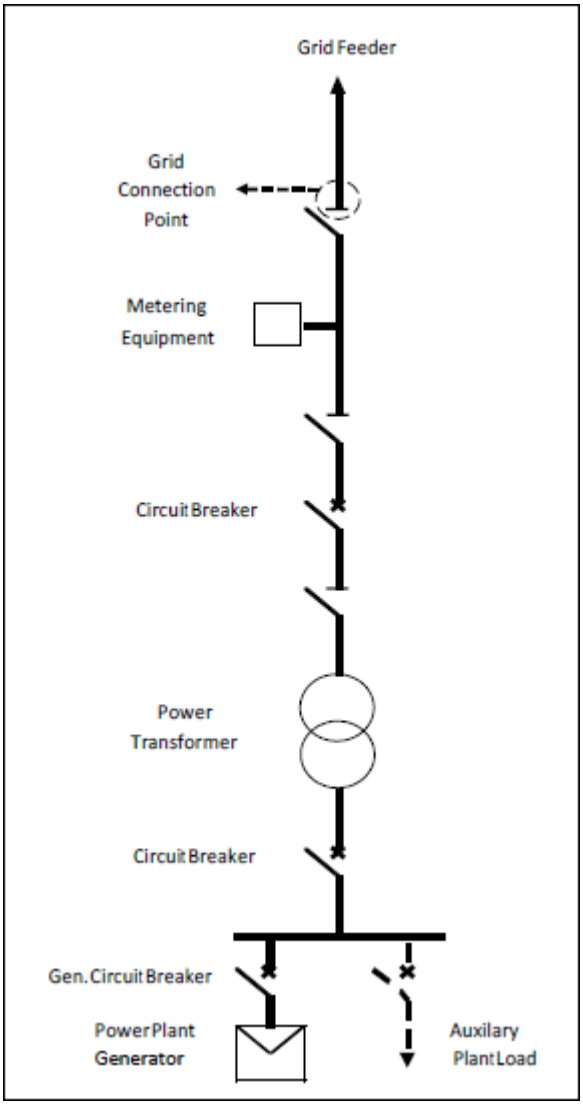
Appendix (3): Grid Connection point as per the Solar Energy Plants Grid Connection Code.



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Appendix (4): System components & Prices

Items **العناصر**	**Number of Units** عدد الوحدات	**Component Price** سعر الوحدة	**Total Price of each item**
1. PV Modules الخلايا الشمسية			
2. Inverters عواكس التيار			
3. Supporting structure هياكل التثبيت			
4. Cables الكابلات			
5. Switch Boards and protection أنظمة الحماية والفصل والتوصيل			
6. Net Metering عدادت القياس			
7. Data Acquisition System نظام عرض البيانات			
8. Spare parts قطع الغيار			
9. Others (Auxiliaries, printing and reporting, etc.) أخري (الملحقات، الطباعة، التقارير، غيرها)			
10. System installation تركيب النظام			
11. Operation and Maintenance during Warranty period التشغيل والصيانة خلال فترة الضمان (سنتين)			
12. Local taxes* الضرائب والدمغات			
Total System Price ***السعر الإجمالي للنظم***	* الضرائب والرسوم والتمغات المقررة، متضمنة الضريبة العامة على المبيعات		

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