

## 1. PV Modules

Item	Description		
These Panels should include the following features:			
1	Made from mono crystalline silicon		
2	minimum 320 Wp		
3	STC efficiency not less than 17 %		
4	Front cover is tempered solar glass		
5	Frame material is galvanized steel structure		
6	Exposed to a Flash Test		
7	Junction box is IP 65 or higher		
8	PV panels have a max. DC system voltage of 600V or more		
9	PV Panels have factory-pre mounted DC connectors of MC4 or H4 type on min. 80 cm DC solar cable		
10	PV Panel manufacturer is certified according to ISO 9001 and ISO 14001		
11	According to IEC 61215, IEC 61730 and ANSI/UL 1703 and TUV Safety class II certifications, certified by a reputable independent testing institute (e.g. UL, TUV, KEMA or the like).		
12	Potential Induced Degradation (PID) certificate, according to IEC 62804		
13	10-year warranty against defects from design, material or workmanship, 25-year linear power output warranty for min. 80% power output after 25 years, 90% after 10 years		
14	PV cells should be of grade A		
15	Third party bankruptcy right should be provided		
16	minimum space between photovoltaic modules for all sides are 0.5cm		
For OFF grid system			
1	PV modules should be connected to produce an Open Circuit Voltage of about $V_{oc}$ =90VDC ,		
2	Voltage at Maximum Power point about $V_{mmp}$ =72V		
3	Current at max power point about $I_{mmp}$ =42A .		
4	Peak Power : 2000Wp		
5	In addition to the hereafter specifications		

## 2. Off Grid Inverter

Item	Description		
Inverter should include the following features; the inverters must be protected from direct sunlight and from direct impact of rainfall.			
1	1phase, 0.4KV, 50Hz, sinusoidal output.		
2	min. 3 kW or greater		
3	AC output range 180 V – 280 V		
4	Transformer less		
5	Adjustable displacement power factor		
6	Suitable for outdoor mounting (IP 65).		
8	Max THD<3%.		
9	Wide Dc input range, max. DC voltage is min. 900V and the DC voltage ripple (peak) <1.5%.		
10	Noise Level<50 dB (A).		
11	The inverter includes DC string fuses or electronic DC string fuses for DC reverse current protection, a load-break DC disconnect, DC surge arrestors (surge protection devices) Type II, terminals for all incoming DC string cables		
12	Multilingual LCD display with interface display (text line/graphic).		
13	Ground fault monitoring.		
14	integrated DC-sensitive RCD certified to DIN VDE 0126-1-1		
15	Peak inverter efficiency > 97%, European efficiency > 96,5%		
16	Provided with integrated DC load-break disconnect		
17	Compatible with industry-standard monitoring and GSM data communication systems (e.g. Meteocontrol, Fat Spaniel) or similar system provided by the inverter manufacturer		
19	Conforming to, AS 3100 , IEC 62109,EN61000-6 DIN V VDE V 0126-1-1:2006-02, according to IEC 60529 and VDE AR-N-4105		
20	Protection class (according to IEC 62103) / overvoltage category (according to IEC 60664-1)		
21	Number of MPP not less than trackers 2 ( A:2; B:2)		

### 3. Monitoring System

Item	Description		
	Local Remote Monitoring System which Monitor the following and transfer data to an password-protected internet-based portal where data can be retrieved remotely and saved on existing local TDECO and PEA servers:		
1	Detailed data about energy and power production, Data must be recorded as 15-minute mean values		
2	DC input current and Voltage (total and per string)		
3	Inverter AC Voltage, Current, P.F, Real and reactive Power output.(Total and per inverter)		
5	Web Box (data logger, ftp server)		
6	Cabling, switchboards with electrical equipment		
7	Remote monitoring software		
8	System must automatically provide alarm messages via E-Mail and/or SMS in case of inverter breakdown, loss of AC power, unusually low power production		
9	The software should has the ability to produce daily and monthly reports and trends (graphs) and can be exported to excel sheet		

### 4. Digital kWh meter

Item	Description		
1	The kWh meter should have an accuracy of 0.5% or better		
2	The kWh meter has a S0 digital interface for monitoring by the Remote Monitoring System		

### 5. Solar Batteries

Item	Description		
1	This block consists of 16 battery cells each specified as follows :		
2	* Type : Lead Acid with electrolyte solution		
3	* Nominal Cell Voltage : 2VDC		
4	* Ampere Hour Capacity : 875Ah at 10 Hour Discharge Rate Ampere Hour		
5	* Efficiency : > 90%		
6	* Watt Hour Efficiency : >82%		
7	* Self Discharge Rate:< 3% of C10/ Month @25°C		
8	* Cycling Stability: > 1100 Cycle		

9	* Water Consumption: < 5Cm3 /Ah-Year (Operating Ambient Temperature (-10 to+45°C)		
10	* Connectors: Appropriate Connectors for internal connection of the 24 cells in series have to be submitted with the battery cells.		
11	* Racks for installing the battery cells or an appropriate container have to be delivered with.		
12	* In addition two hydrometers for measuring the gravity of the electrolyte solution and all		
13	* accessories and tools necessary for installing and connecting the battery block with the Charge Regulator as well as the appropriate electrolyte solution with the complete battery manual Have to be also delivered.		
14	* Number of Requested Battery Cells : 16		

## 6. Charge Regulator

Item	Description		
1	Input voltage range : 50-100VDC		
2	Output Voltage Range: 48-64VDC		
3	Nominal Power : 3000W		
4	Efficiency: > 92%		
5	Control : MPPT, Over Charge and Deep Discharge Protection of the battery block		
6	Input Protection : Against Over Voltage and Miss Poling		
7	Output Protection : Against Over Load and Short Circuit		
8	Operating Temperature at Full Load : -10- 45°C		

## 7. DC&AC Cables

Item	Description		
All cables should include the following features:			
1	UV-resistant, resistant against water and oil		
2	Minimum 4 kV AC test voltage (50 Hz, 1 minute)		
3	Halogen-free cables		
4	Approved for a temperature range of -40°C-120°C (max. copper wire temperature)		
5	Flame retardant		
6	life expectancy greater than 25 years		
7	According TUV, VDE & UL Approved.		
8	DC cable: Double insulated, single core, rated DC voltage 1000V min		
9	AC cable: Double insulated, multi- core, rated AC voltage 0.6/1 kV		
10	DC cables should be inserted in conduits that buried 70 cm at least under finished base course		
11	AC cables should be inserted in conduits that buried 100 cm at least under finished base course		

## 8. Mounting Structure

Item	Description		
The mounting structures for the PV panels should include the following features:			
1	The mounting structure is made of hot deep galvanized steel		
2	The mounting structure uses concrete strip foundations		
3	The bases of the mounting structure should be made of M12 steel or more and implanted in concrete bases of 60 cm depth with 60*60 cm width. The distance between two bases of the structure legs should not be more than 2 meters. All the bases should joint then with a mattress of concrete using a net of steel.		
4	The mounting system provides a fixed inclination of the modules between 25 and 30 degrees		
5	The mounting structure components are bonded together to guarantee potential equalization		
6	The mounting structure is earthed according to internationally accepted standards		
7	Bidder can prove that the mounting structures and the foundations thereof are structurally suitable to withstand all static loads (weight of modules, wind loads , snow load etc) that might occur according to the Site conditions		
8	The mounting structure uses standardized profiles with Plastic profile cover and mounting clamps for mounting the PV modules		
9	Hot-galvanized steel profiles 60*60*2.7 .		
10	PV galvanized steel structure is tested by mechanical consultant according to ASCE 7-10 (IBC 2012)standard		
11	the Model Geometry will be checked using SAP2000 or similar software		
12	Design of connections, bearing plates and stability of foundation will be checked		

## 9. Electrical Panels

Item	Description
<b>All Cabinets should include the following features:</b>	
1	no access from the rear
2	Cabinets shall be made of 2mm hot coated or galvanized steel; dust and vermin proof with protection degree IP65 at least
3	30% surplus space
4	Main supply lines enter from bottom
5	include all structural elements required in order to install the switchboard including all bus bars , terminals , wiring , bolts ,clamps, etc.
6	The switchboard
7	10 mm <sup>2</sup> earthing wire shall be installed
8	Cabinets shall be wall-mounted and of front door opening type
9	This Electrical panel should be type tested according to IEC439-1
<b>DC Electrical panel are inclusive followings:</b>	
1	Appropriate switches.
2	Serge protection devices for DC protection, against reverse current, S.C current with separate earthing bus bar.
3	Outing and incoming cables.
4	Bus bars and their coupling unit and casing spaces for cables.
5	Cable clamps/terminals and cable shoes, as required to form a complete unit.
6	All shall be in accordance specification, and the codes of practice and highest prevailing standards of engineering.
<b>AC Electrical panel are inclusive followings:</b>	
1	Appropriate Three phase switches.
2	Serge protection devices for AC protection, against reverse current, S.C current with separate earthing bus bar.
3	Outing and incoming cables.
4	Bus bars and their coupling unit and casing spaces for cables.
5	Cable clamps/terminals and cable shoes, as required to form a complete unit.
6	All shall be in accordance specification, and the codes of practice and highest prevailing standards of engineering.
7	Indication Lamps rating 220V for the three phases.
8	Ampere meter rating (0-1000A) with transformer.
9	Voltmeter rating ( 0 - 1000V)

## 10. Earthing (grounding) System

Item	Description		
1	The earthing system should be according to internationally accepted standards.		
2	Individual earthing system included copper rods, copper wires, copper connectors, cable shoes, glands and accessories to complete job.		
3	The earthing system should <u>not be connected to the Grid earthing or Surge protection system.</u>		
4	The system resistance should be less than 2 ohm from any location .		
5	copper rods could be 19mm diameter 1.5 m covered by painted concrete manholes ,that installed (3-10) meters distance between each other, connected as ring by 75mm <sup>2</sup> non-insulated copper wire to be connected to main grounding copper bus- bar .		
6	Each photovoltaic AL frame should be connected to the galvanized steel structure with 10 mm <sup>2</sup> earthing wire at least		
7	The mounting structure should be connected with 16 mm <sup>2</sup> earthing wire at least to main earth bus-bar		
8	Each electrical panels or any metal equipment should be connected to the 10 mm <sup>2</sup> earthing wire at least		
9	Each inverters should be connected to the 10 mm <sup>2</sup> earthing wire at least		
10	It should be 16 mm <sup>2</sup> at least earthing wire from earth bus bar		
11	Potential equalizer should be installed in each string; every earthing cable will be connected to that equalizer.		
12	Electrodes should be covered using concrete manholes		
13	Pointed Ground Rod, Compression Coupler for Pointed Rods		