Annex 1-A

No.	Technical Specification	Offered Technical Specifications (Must be filled by Bidder) *Please Specify Technical Specifications in details below*
1	**Photovoltaic modules:**	
	• Solar Panel Wattage at STC: Shall be ≥ **250Wp** (Bigger watt size Solar PV module will be **preferred, (recommend 300Wp).**	
	• Type of PV Module: Higher cell efficiency **Poly Crystalline.**	
	• Module efficiency: **≥16%.**	
	• Max Power Voltage of each panel: **≥32Vdc.**	
	• Max. Power Current (A): **≥ 8 Amp.**	
	• No of cells in each panel: **60/72 per panel.**	
	• Total No of panels: **to be determined by the bidder based on the capacity of the system.**	
	• Total Wattage of solar PV Array: **1,200 Watt p**	
	• Preferred Arrangement of solar panels: **2 Series, 2 parallel of series 2** or **4 Series, 1 parallel of series.**	
	• Module frame: **Aluminum anodized** or **corrosion resistant material.** The anodizing Thickness shall be **15 micron or better.**	
	• Standards: Conform to **IEC 61215, IEC 61730** and **CE.** or equivalent. • PV modules to be used in a highly corrosive atmosphere (Coastal area etc.) must qualify salt mist corrosion testing **IEC 61701/ IS 61701.**	
	• Tolerance of maximum power rating: **±5%.**	
	• High transmittance glass: **minimum thickness of 3/4.0 mm.**	
	• System voltage: **≥1000Vdc.**	
	Junction box: **IP65** with sufficient at least **3/4 bypass diodes.** Highly heat-resistant bypass diode.	
	• Warranty : **Nominal power output 90% for 10 years, 80% for 25years.**	
	• Connection: **Weather proof DC rated MC4**	

	connector. Easier and secure, not allowing for any loose connections.	
	• Lead cable coming out as a part of the module: **≥ 4mm², length 900 /1000mm& weather proofed.**	
	• Temperature coefficient: **Less than -0.42%/°C.**	
	• Thermal coefficient of voltage: **Less than-0.3/ C⁰.**	
	• With Normal operating temperature coefficient (NOTC): **45 ±2°C.**	
	• Operational Temperature: **-40 ~ +85°C**	
	- Resistant of **water, abrasion, hail impact, humidity&** other environment factor for the worst situation at site and **water drainage** structure. Suitable encapsulation and sealing arrangements to protect the silicon cells from the harsh environment.	
2	**Mounting structure For PV Panels** The PV modules shall be mounted on fixed metallic structures having adequate strength and appropriate design, which can withstand the load of the modules and high wind velocities. The support structure shall be hot dip galvanized steel or aluminum.	
	• Angle of orientation: When installation Panel tilt angle **South – South West** orientation with a fixed tilt **angle 15 - 30 degrees.**	
	• Structural material: **hot dip galvanized steel** or **aluminum** alloy.	
	• Hot dip galvanized: **≥ 80 micron galvanization thickness**	
	• Minimum **clearance** of the structure from the roof level should be **300 to 500 mm.**	
	• Wind velocity withstanding capacity: **150 km / hour.**	
	• Engineering Drawing:	

	• Bolts, nuts, fasteners, panel mounting clamps: **Stainless steel** • Mounting arrangement for elevated structures: The elevated structure has to be Securely anchored to the supporting surface. Concrete foundations of appropriate weight and depth for elevated structures mounted directly on the ground; Bolted with anchor bolts of appropriate strength for elevated structures mounted. • 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. • 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 Inspector.	
3	**DC Junction boxes / PV Combiner boxes** These combiner boxes are equipped with **touch DC fuse-holders, DC fuses, reverse protection diodes, lightning induced DC surge arresters** and **load disconnect switches**. Combiner boxes are installed near their PV arrays (that is, in the weather), and require appropriate outdoor ratings. Installations are expected to last at least the lifetime warranty of PV modules (about 25 years), so installing durable, long-lived equipment that will stand up to the environment in which it is placed is critical. Combiner boxes should be Corrosion resistance, Durable, Rust proof, Abrasion resistant, durability, reliability, lockable door, Longer service life, Sun shields (Available for top, sides, and door).	
	• **6 String** Solar Power Combiner. **6-String PV Enclosure**	
	• Each String Continuous Duty Rated up to **500Vdc.**	
	• High-Voltage Protection: Each String with **high-voltage fuses, over-voltage & over-current**	

	protection	
	• Anti-backflow **diodes & anti-reverse protection.**	
	• **Circuit breaker output control: ≥60 Amp Circuit Breakers**	
	• Protection **class IP65 for outdoor with waterproof, dustproof, rustproof, salt fog proof.**	
	• Includes Output cable Glands &**Safety Labels.**	
	• Includes **SPD Lightning/Surge** Protection Module **(500V). Lightning arrester** for both poles.	
	• Max Input/ Output Voltage Rating: **up to 500 Vdc.**	
	• Operational Environment Temperature: **-30 C° ~ +60C°.**	
	• Cooling Method: **Natural Cooling.**	
	• Dimension: **as required.**	
	• Double Flanged Door Opening, Rain Drip Lip, Back Panel and Mounting Tab ...etc.	
4	**ON/OFF GRID Hybrid Solar Inverter**	
	• Type: **ON/Off Grid hybrid Solar Inverter single Phase with isolated transformer or transformerless High frequency.**	
	• **Built-in MPPT solar controller.**	
	• Rated Continuous Output power: **3000 Watt.**	
	• Power factor: **>0.8 lag. &**THD: **<3%.**	
	• Output Wave Form: **Pure Sine wave.**	
	• Inverter Efficiency: **>85%.**	
	• Output Voltage: 2line (230VAc **±5%**) .	
	• Output Frequency: **50Hz±3.**	
	• Battery System Voltage: **24volte.**	
	• Solar Charge Controller Type: - **MPPT smart charging . MPPT. Boost and Float, Smart Charger multi stage (plus) Suitable for AGM, OPZV battery.**	

	• **power factor : not less than 3 Kw with ≥**		
	• Solar Charge Current: 60A or more (recommend 80A)		
	• AC Charge Current: 30A or more		
	• Max Open circuit Voltage (Vdc): To be specified by bidder • MPPT Efficiency not less than 95%		
	• Max solar PV panels array capacity (Wp): **Not less than 1,500W.**		
	• System Operating Modes/Priority: **Solar>Grid>Battery by default (Auto mode). Can be configured to set priority rates of charging from solar panel.**		
	• Ambient temperature considered : **-20°C to 50°C or better.**		
	• Relative Humidity: **>90% Non-Condensing.**		
	• Operation Temperature Range: **- 20C°≈ 50C°.**		
	• Protection of Enclosure (Body): Indoor with **IP20 or better.**		
	• Cooling: **Heat sinks, Fins (extended surfaces) and Fans with temperature sensors. Intelligent Variable Speed Fan Operation.**		
	• Programmable multiple operation mode: **OFF-Grid, ON-Grid), with backup battery.**		
	• Hybrid Support main/generator input.		
	• Directly power from PV to loads.		
	• Intelligent battery management charge stage		
	• Surge : 2 time capacity rate		
	• Perfect Protection: DC & AC overload, Under-voltage, Short-Circuit, Overcharge, Over discharge, Over-temperature, etc.		
	• Display: LCD display + LED status indicator.		
	• Display content: PV status, battery capacity, AC input voltage, AC output voltage, Load, running status, etc.		
	The solar input capacity, output power capacity, batteries system voltage, interfacing, display, etc in the inverter; The inverters must be Programmable parameters.		

5	**Batteries Bank :**	
	- Normal allows range voltage of batteries bank (V): **24Vdc**	
	- Capacity of batteries bank (AH): **24v-150AH-c10**	
	- Number of batteries: **To be determined by the bidder based on system design requirement.**	
	Specifications for each battery: • Sealed construction.	
	• Battery voltage : **12v or 2v.**	
	• Maintenance- Free Operation (**VRLA**).	
	• Weight: heavier batteries. Heavy-Duty Grids, lead plates thick.	
	• Production Date: must be not more than 6 month manufacturing.	
	• Wide Operating Temperature Range: **(-20C^0 ≈ +60/50C^0)**.	
	• Suitable **Charging / Discharging Current rate** according to solar PV array & loads (Inverter capacity) /as system design.	
	• Low self-discharge: less than **5% per month**.	
	• **Battery type : AGM or OPZV**.	
	• Cycle performance: **not less 1600 Cycle @ 50 % DOD**.	
	• Terminations: **Screw Type**.	
	• Applications: **solar system applications**.	
	• Normal Operation Temperature: not less than 25C^0 (recommend 35C^0 high Temperature battery).	
	• Standards: Conforms to **IEC 60896, IEC 60079, CE,** and all standards & certificates &**Success stories** (or previous projects where this product was used) which related.	
	• Service life design: **not less than 5 years.**	
	• Container & Cover: **Acid-resistant ABS resin.**	

6 Battery Rack:

- Should be **closed type** cabinets to use for placing batteries and in an efficient manner.
- Provide adequate ceiling clearance for ventilation and maintenance.
- Should be **Convenient, Easy to clean, Durable, Rust proof, Abrasion resistant, durability, reliability, lockable door (Key lock), Longer service life, Sturdy and Rigid design, excellent in finishing and smooth edges.**

Battery Rack should be **smooth finishing** standards and is available

- in **suitable sizes** as per the system requirements (batteries).
- Consist of shelves, **ventilation fans** available in **220V AC.**
- Standard **ventilation holes** are punctured on all sides including floors of shelves.
- The clearance of place **floor and ceiling** of first shelve should not be **less than 20 cm / as required.**
- Stable base: The weight should be **distributed** on all loading substrates.

7 AC Distribution Board (ACDB)

The inverter output will be connected to the existing AC Distribution Board (DB). The contractor will verify the compliance of the existing AC DB with EU standards and if needed adapt the ACDB for integration of the solar system.

All switches and the circuit breakers, connectors should conform to **IEC 60947, part I, II and III.**

All **indoor** equipment will have protection of **IP52 or better.** All **outdoor** panels will have protection of **IP65** or better.

All the devices / equipment like change over, circuit breakers, etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under harsh environmental conditions.

The AC Distribution board shall consist of the following items:

Item	Description	Quantity
AC	- MCB type.	1

Item	Description	Quantity

	Circuit Breaker	- Voltage:220 VAC. - Rated frequency: 50 Hz - Breaker capacity : 10a - Utilization Category: B - No. of Poles: 2poles. - Quality: High quality international brand . - Ambient Temperature: 50C°		AC Circuit Breaker		1
	Manual Change Over	- MCB type. - Voltage: 220VAC. - Current: at least 60 Amp. - No. of Poles: 2poles. - Rated frequency: 50 Hz. - Quality: High quality international brand - Ambient Temperature: 50C° -	1	Manual Change Over		1
	The MCB shall be provided with a quick make- quick break type of switching mechanism which a definite speed of travel of moving contacts is ensured. All internal wiring shall be carried out with PVC insulated, stranded copper conductor, single core, **6-10 sq. mm.** or larger stranded copper wires. The enclosure shall be dust & vermin proof, Rust proof and Corrosion resistance with a degree of protection of **IP-52.**					
8	**Cables.**					
	Sections of cables between **array interconnections, array to combiner boxes, combiner boxes** to **inverter, inverter to batteries, batteries interconnections, inverter to ACDB**, etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum: o For DC cables, the maximum drop shall be limited to **3%**; o For AC cables, the maximum drop shall be limited to **2%.**					

Cables of appropriate size to be used in the system shall have the following characteristics:

- **Shall meet IEC 60227/IS 694, IEC 60502/IS1554 standards.**
- **Temp. Range: –10°C to +80°C;**
- **Voltage rating 600/1000V;**
- **Excellent resistance to heat, cold, water, oil, abrasion, UV radiation;**
- **Flexible;**
- **All conductors shall be copper;**

The outside PV cables: Flexible copper cables, recommended: flexible tinned copper stranded as IEC 60228 , **insulated** with a **special grade PVC or XPLE compound formulated** for **outdoor** use **(UV, weather protection)**.

Cable routing/ marking:

- All cable/wires are to be routed in pipes and suitably **tagged** and **marked** with proper manner so that the cable **easily identified.**

Life Time:

- The cable should be so selected that it should be compatible **up to the life of the solar PV panels**, i.e. 20 years or more .
- Calculations of the current rating of the cables should be according to **IEC 60287.**

Cables to comply with :

- **IEC 60228 Conductors of insulated cables;**

IEC 60502 Power cables with extruded insulation;

Sizing and length of Cables:

1) Cables between array interconnections:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	single core/ Multi-core Colored	10 meters per System	6 sq. mm

Cables between array interconnections:

Description	Type	Length	Size

1) Array to combiner boxes:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	Multi-core Colored	10 meters Per String For each System	2×6 sq. mm

Array to combiner boxes:

Description	Type	Length	Size

1) Combiner boxes to inverter:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	Multi-core Colored	25 meters per System	2×25 sq. mm

Combiner boxes to inverter

Description	Type	Length	Size

2) Inverter to batteries:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated. • Multi-stranded flexible copper. • Indoor. • Heat resist.	Single – core Black color	2 meters per System	25 sq. mm
	Single – core Red color	2 meters per System	

Inverter to batteries:

Description	Type	Length	Size

3) Batteries interconnections:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated. • Multi-stranded flexible copper. • Indoor. • Heat resist.	Single – core colored	1 meters per System	25 sq. mm

Batteries interconnections:

Description	Type	Length	Size

	4) Inverter to ACDB: **Description** | **Type** | **Length** | **Size** AC cabling: • PVC. • Insulated and sheathed. • Multi-stranded flexible copper. • Outdoor. • Weather proof. | Multi-core Colored | 30 meters per System | 4×6 sq. mm	Inverter to ACDB: **Description** | **Type** | **Length** | **Size**
9	**Wiring Pipes.** PVC pipe minimum 50mm diameter (or as required) and above depending on No. of wires to be drawn, HMS grade (1 - 2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, inspection or non-inspection type Elbows, Tees, Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.	
	• Pipe type: **Rigid PVC conduits.**	
	• Thickness: 1.3mm to 2.0mm.	
	• Color: **white.**	
	• Size: **50 /70mm dia. / as required.**	
	• Smooth inner surface for easy wiring. • Flexibility for long radius bending. • Non Conductor of Electricity and prevent Electrical shocks. • High mechanical strength for buried and open application. • Non corrosive in nature and are immune to Chemical and Galvanic corrosion. • Do not support combustion and are self-extinguishing.	

10 Earthing & Grounding System:

The contractor shall provide the complete bonding & earthling of the neutral point of power system & non-current carrying metal parts of all electrical equipment & apparatus.

Each & every piece of electrical equipment & apparatus shall be connected to the main earth bus by means of branch main connection of earth continuity conductors.

All electrical equipment, except those operating at extra low voltages shall be provided with an earth terminal.

EARTH PIT DETAILS:

Copper earth rod of 35/50 sq. mm x 1000 mm buried in specifically prepared earth pit of 1.2 meters below ground level with **20 kg charcoal & salt** with alternate layers of charcoal & salt with 2 number of **50 mm dia. C class GI pipe** with **funnel** with wire mesh for watering &**brick masonry block** cover, heavy duty **cast iron cover** complete as per IS : 3043.

Necessary connections shall be done using **copper wire of 25 sq. mm** copper wire as per instructions of inspector connected to nearest switch gears as directed & duly tested by earth tester.

Pipe electrode shall be of 1.5 M long 50 mm dia. class C GI pipe. The GI pipes shall be provided with holes at regular intervals as per IS : 3043.

Each array structure and all metal casings of the panel etc. shall be earthed properly. And connected to ground hole including pure copper rod 50 sq.mm and adding salts and carbon.

RESISTANCE TO EARTH

The resistance of earthing system shall not exceed 1.0 ohm.

MATERIALS:

Item	Quantity
Copper earth rod of 35/50 sq. mm	**1 meter**
Charcoal & salt	**20Kg**
Copper wire of 25 sq. mm	**As per system requirement.**
C class GI pipe50 mm dia.	**2 × 1.5 meter**
Funnel	**1**
Cast Iron cover	**1**
Brick Masonry Block	**Suitable for earth pit**

Item	Quantity

After Sale Service & Warranty		
1	The PV modules will be warranted for a minimum period of 25 years from the date of supply. **(Output wattage should not be less than 90% at the end of 10 years and 80% at the end of 25 years).**	
2	The mechanical structures, electrical components including inverter and overall workmanship of the Solar System must be warranted for a minimum of **2 years.** Except the **batteries** should be warranted for **1 years.**	
3	**System Performance Should be Warranted for 1 Year with 80% Performance Ratio.**	
4	The contractor shall make arrangement to maintain a sufficient stock of essential **spares and consumable spare parts** to ensure proper maintenance of the system promptly. (Necessary maintenance spares for **five years** trouble free operation shall also be supplied with the system)	

Annex 1-B

1.2Kw Solar PV System Design (The Bidder must be Specify the below Categories)		
1	Single Solar PV Panel Output Power (W):	
2	Qty. of Solar PV Panels:	
3	Arrangement of Solar Panels:	
4	Total of Solar PV Capacity(W):	
5	Invert Operation Capacity (W):	
6	Inverter Battery Voltage System(Vdc):	
7	Mppt Voltage Range (Vdc) and Current (A):	
8	Max Solar Power Input (W):	
9	Single Battery Capacity(AH):	
10	Single Battery Voltage(V):	
11	Qty. of Batteries:	
12	Arrangement of Batteries:	
13	Total Storage Capacity(WH):	
14	Electrical & Wiring & Engineering Drawing and Details:	

Annex 2-A

No.	Technical Specification	Offered Technical Specifications (Must be filled by Bidder) *Please Specify Technical Specifications in details below*
1	**Photovoltaic modules:**	
	• Solar Panel Wattage at STC: Shall be ≥ **250Wp** (Bigger watt size Solar PV module will be **preferred, (recommend 300Wp).**	
	• Type of PV Module: Higher cell efficiency **Poly Crystalline.**	
	• Module efficiency: **≥16%.**	
	• Max Power Voltage of each panel: **≥32Vdc.**	
	• Max. Power Current (A): **≥ 8 Amp.**	
	• No of cells in each panel: **60/72 per panel.**	
	• Total No of panels: **to be determined by the bidder based on the capacity of the system.**	
	• Total Wattage of solar PV Array: **1,200 Watt p**	
	• Preferred Arrangement of solar panels: **2 Series, 2 parallel of series 2** or **4 Series, 1 parallel of series.**	
	• Module frame: **Aluminum anodized** or **corrosion resistant material**. The anodizing Thickness shall be **15 micron or better.**	
	• Standards: Conform to **IEC 61215, IEC 61730** and **CE.** or equivalent. • PV modules to be used in a highly corrosive atmosphere (Coastal area etc.) must qualify salt mist corrosion testing **IEC 61701/ IS 61701.**	
	• Tolerance of maximum power rating: **±5%.**	
	• High transmittance glass: **minimum thickness of 3/4.0 mm.**	
	• System voltage: **≥1000Vdc.**	
	Junction box: **IP65** with sufficient at least **3/4 bypass diodes.** Highly heat-resistant bypass diode.	
	• Warranty : **Nominal power output 90% for 10 years, 80% for 25years.**	
	• Connection: **Weather proof DC rated MC4**	

	connector. Easier and secure, not allowing for any loose connections.	
	• Lead cable coming out as a part of the module: **≥ 4mm², length 900 /1000mm& weather proofed.**	
	• Temperature coefficient: **Less than -0.42%/°C.**	
	• Thermal coefficient of voltage: **Less than-0.3/ C^0.**	
	• With Normal operating temperature coefficient (NOTC): **45 ±2°C.**	
	• Operational Temperature: **-40 ~ +85°C**	
	- Resistant of **water, abrasion, hail impact, humidity&** other environment factor for the worst situation at site and **water drainage** structure. Suitable encapsulation and sealing arrangements to protect the silicon cells from the harsh environment.	
2	**Mounting structure For PV Panels** The PV modules shall be mounted on fixed metallic structures having adequate strength and appropriate design, which can withstand the load of the modules and high wind velocities. The support structure shall be hot dip galvanized steel or aluminum.	
	• Angle of orientation: When installation Panel tilt angle **South – South West** orientation with a fixed tilt **angle 15 - 30 degrees.**	
	• Structural material: **hot dip galvanized steel** or **aluminum** alloy.	
	• Hot dip galvanized: **≥ 80 micron galvanization thickness**	
	• Minimum **clearance** of the structure from the roof level should be **300 to 500 mm.**	
	• Wind velocity withstanding capacity: **150 km / hour.**	
	• Engineering Drawing:	

	• Bolts, nuts, fasteners, panel mounting clamps: **Stainless steel** • Mounting arrangement for elevated structures: The elevated structure has to be Securely anchored to the supporting surface. Concrete foundations of appropriate weight and depth for elevated structures mounted directly on the ground; Bolted with anchor bolts of appropriate strength for elevated structures mounted. • 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. • 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 Inspector.	
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	• **6 String** Solar Power Combiner. **6-String PV Enclosure**	
	• Each String Continuous Duty Rated up to **500Vdc.**	
	• High-Voltage Protection: Each String with **high-voltage fuses, over-voltage & over-current**	

	protection	
	• Anti-backflow **diodes & anti-reverse protection.**	
	• **Circuit breaker output control: ≥60 Amp Circuit Breakers**	
	• Protection **class IP65 for outdoor with waterproof, dustproof, rustproof, salt fog proof.**	
	• Includes Output cable Glands &**Safety Labels.**	
	• Includes **SPD Lightning/Surge** Protection Module **(500V). Lightning arrester** for both poles.	
	• Max Input/ Output Voltage Rating: **up to 500 Vdc.**	
	• Operational Environment Temperature: **-30 C° ~ +60C°.**	
	• Cooling Method: **Natural Cooling.**	
	• Dimension: **as required.**	
	• Double Flanged Door Opening, Rain Drip Lip, Back Panel and Mounting Tab ...etc.	
4	**ON/OFF GRID Hybrid Solar Inverter**	
	• Type: **ON/Off Grid hybrid Solar Inverter single Phase with isolated transformer or transformerless High frequency.**	
	• **Built-in MPPT solar controller.**	
	• Rated Continuous Output power: **3000 Watt.**	
	• Power factor: **>0.8 lag. &**THD: **<3%.**	
	• Output Wave Form: **Pure Sine wave.**	
	• Inverter Efficiency: **>85%.**	
	• Output Voltage: 2line (230VAc **±5%**) .	
	• Output Frequency: **50Hz±3.**	
	• Battery System Voltage: **24volte.**	
	• Solar Charge Controller Type: - **MPPT smart charging . MPPT. Boost and Float, Smart Charger multi stage (plus) Suitable for AGM, OPZV battery.**	

	• **power factor : not less than 3 Kw with ≥**	
	• Solar Charge Current: 60A or more (recommend 80A)	
	• AC Charge Current: 30A or more	
	• Max Open circuit Voltage (Vdc): To be specified by bidder	
	• MPPT Efficiency not less than 95%	
	• Max solar PV panels array capacity (Wp): **Not less than 1,500W.**	
	• System Operating Modes/Priority: **Solar>Grid>Battery by default (Auto mode). Can be configured to set priority rates of charging from solar panel.**	
	• Ambient temperature considered : **-20°C to 50°C or better.**	
	• Relative Humidity: **>90% Non-Condensing.**	
	• Operation Temperature Range: **- 20C°≈ 50C°.**	
	• Protection of Enclosure (Body): Indoor with **IP20 or better.**	
	• Cooling: **Heat sinks, Fins (extended surfaces) and Fans with temperature sensors. Intelligent Variable Speed Fan Operation.**	
	• Programmable multiple operation mode: **OFF-Grid, ON-Grid), with backup battery.**	
	• Hybrid Support main/generator input.	
	• Directly power from PV to loads.	
	• Intelligent battery management charge stage	
	• Surge : 2 time capacity rate	
	• Perfect Protection: DC & AC overload, Under-voltage, Short-Circuit, Overcharge, Over discharge, Over-temperature, etc.	
	• Display: LCD display + LED status indicator.	
	• Display content: PV status, battery capacity, AC input voltage, AC output voltage, Load, running status, etc.	
	The solar input capacity, output power capacity, batteries system voltage, interfacing, display, etc in the inverter; The inverters must be Programmable parameters.	

5	**Batteries Bank :**	
	- Normal allows range voltage of batteries bank (V): **24Vdc**	
	- Capacity of batteries bank (AH): **24v-150AH-c10**	
	- Number of batteries: **To be determined by the bidder based on system design requirement.**	
	Specifications for each battery: • Sealed construction.	
	• Battery voltage : **12v or 2v.**	
	• Maintenance- Free Operation (**VRLA**).	
	• Weight: heavier batteries. Heavy-Duty Grids, lead plates thick.	
	• Production Date: must be not more than 6 month manufacturing.	
	• Wide Operating Temperature Range: **(-20C^0 ≈ +60/50C^0)**.	
	• Suitable **Charging / Discharging Current rate** according to solar PV array & loads (Inverter capacity) /as system design.	
	• Low self-discharge: less than **5% per month**.	
	• **Battery type : AGM or OPZV**.	
	• Cycle performance: **not less 1600 Cycle @ 50 % DOD.**	
	• Terminations: **Screw Type.**	
	• Applications: **solar system applications.**	
	• Normal Operation Temperature: not less than 25C^0 (recommend 35C^0 high Temperature battery).	
	• Standards: Conforms to **IEC 60896, IEC 60079, CE,** and all standards & certificates **&Success stories** (or previous projects where this product was used) which related.	
	• Service life design: **not less than 5 years.**	
	• Container & Cover: **Acid-resistant ABS resin.**	

6 **Battery Rack:**

- Should be **closed type** cabinets to use for placing batteries and in an efficient manner.
- Provide adequate ceiling clearance for ventilation and maintenance.
- Should be **Convenient, Easy to clean, Durable, Rust proof, Abrasion resistant, durability, reliability, lockable door (Key lock), Longer service life, Sturdy and Rigid design, excellent in finishing and smooth edges.**

Battery Rack should be **smooth finishing** standards and is available

- in **suitable sizes** as per the system requirements (batteries).
- Consist of shelves, **ventilation fans** available in **220V AC.**
- Standard **ventilation holes** are punctured on all sides including floors of shelves.
- The clearance of place **floor and ceiling** of first shelve should not be **less than 20 cm / as required.**
- Stable base: The weight should be **distributed** on all loading substrates.

7 **AC Distribution Board (ACDB)**

The inverter output will be connected to the existing AC Distribution Board (DB). The contractor will verify the compliance of the existing AC DB with EU standards and if needed adapt the ACDB for integration of the solar system.

All switches and the circuit breakers, connectors should conform to **IEC 60947, part I, II and III.**

All **indoor** equipment will have protection of **IP52 or better.** All **outdoor** panels will have protection of **IP65** or better.

All the devices / equipment like change over, circuit breakers, etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under harsh environmental conditions.

The AC Distribution board shall consist of the following items:

Item	Description	Quantity
AC	- **MCB** type.	**1**

Item	Description	Quantity

	Circuit Breaker	- Voltage:220 VAC. - Rated frequency: 50 Hz - Breaker capacity : 10a - Utilization Category: B - No. of Poles: 2poles. - Quality: High quality international brand . - Ambient Temperature: 50C°		AC Circuit Breaker	1
	Manual Change Over	- MCB type. - Voltage: 220VAC. - Current: at least 60 Amp. - No. of Poles: 2poles. - Rated frequency: 50 Hz. - Quality: High quality international brand - Ambient Temperature: 50C° -	1	Manual Change Over	1
	The MCB shall be provided with a quick make- quick break type of switching mechanism which a definite speed of travel of moving contacts is ensured. All internal wiring shall be carried out with PVC insulated, stranded copper conductor, single core, **6-10 sq. mm.** or larger stranded copper wires. The enclosure shall be dust & vermin proof, Rust proof and Corrosion resistance with a degree of protection of **IP-52.**				
8	**Cables.**				
	Sections of cables between **array interconnections, array to combiner boxes, combiner boxes to inverter, inverter to batteries, batteries interconnections, inverter to ACDB**, etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum: o For DC cables, the maximum drop shall be limited to **3%**; o For AC cables, the maximum drop shall be limited to **2%.**				

Cables of appropriate size to be used in the system shall have the following characteristics:

- **Shall meet IEC 60227/IS 694, IEC 60502/IS1554 standards.**
- **Temp. Range: –10°C to +80°C;**
- **Voltage rating 600/1000V;**
- **Excellent resistance to heat, cold, water, oil, abrasion, UV radiation;**
- **Flexible;**
- **All conductors shall be copper;**

The outside PV cables : Flexible copper cables, recommended: flexible tinned copper stranded as IEC 60228 , **insulated** with a **special grade PVC or XPLE compound formulated** for **outdoor** use **(UV, weather protection)**.

Cable routing/ marking:

- All cable/wires are to be routed in pipes and suitably **tagged** and **marked** with proper manner so that the cable **easily identified.**

Life Time:

- The cable should be so selected that it should be compatible **up to the life of the solar PV panels**, i.e. 20 years or more .
- Calculations of the current rating of the cables should be according to **IEC 60287**.

Cables to comply with :

- **IEC 60228 Conductors of insulated cables;**

IEC 60502 Power cables with extruded insulation;

Sizing and length of Cables:

1) Cables between array interconnections:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	single core/ Multi-core Colored	10 meters per System	6 sq. mm

Cables between array interconnections:

Description	Type	Length	Size

1) Array to combiner boxes:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	Multi-core Colored	10 meters Per String For each System	2×6 sq. mm

Array to combiner boxes:

Description	Type	Length	Size

1) Combiner boxes to inverter:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	Multi-core Colored	25 meters per System	2×25 sq. mm

Combiner boxes to inverter

Description	Type	Length	Size

2) Inverter to batteries:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated. • Multi-stranded flexible copper. • Indoor. • Heat resist.	Single – core Black color	2 meters per System	25 sq. mm
	Single – core Red color	2 meters per System	

Inverter to batteries:

Description	Type	Length	Size

3) Batteries interconnections:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated. • Multi-stranded flexible copper. • Indoor. • Heat resist.	Single – core colored	1 meters per System	25 sq. mm

Batteries interconnections:

Description	Type	Length	Size

	4) Inverter to ACDB: Description: AC cabling; • PVC. • Insulated and sheathed. • Multi-stranded flexible copper. • Outdoor. • Weather proof. Type: Multi-core Colored Length: 30 meters per System Size: 4×6 sq. mm	Inverter to ACDB: Description Type Length Size
9	**Wiring Pipes.** PVC pipe minimum 50mm diameter (or as required) and above depending on No. of wires to be drawn, HMS grade (1 - 2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, inspection or non-inspection type Elbows, Tees, Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.	
	• Pipe type: **Rigid PVC conduits.**	
	• Thickness: 1.3mm to 2.0mm.	
	• Color: **white.**	
	• Size: **50 /70mm dia. / as required.**	
	• Smooth inner surface for easy wiring. • Flexibility for long radius bending. • Non Conductor of Electricity and prevent Electrical shocks. • High mechanical strength for buried and open application. • Non corrosive in nature and are immune to Chemical and Galvanic corrosion. • Do not support combustion and are self-extinguishing.	

10 Earthing & Grounding System:

The contractor shall provide the complete bonding & earthling of the neutral point of power system & non-current carrying metal parts of all electrical equipment & apparatus.

Each & every piece of electrical equipment & apparatus shall be connected to the main earth bus by means of branch main connection of earth continuity conductors.

All electrical equipment, except those operating at extra low voltages shall be provided with an earth terminal.

EARTH PIT DETAILS:

Copper earth rod of 35/50 sq. mm x 1000 mm buried in specifically prepared earth pit of 1.2 meters below ground level with **20 kg charcoal & salt** with alternate layers of charcoal & salt with 2 number of **50 mm dia. C class GI pipe** with **funnel** with wire mesh for watering &**brick masonry block** cover, heavy duty **cast iron cover** complete as per IS : 3043.

Necessary connections shall be done using **copper wire of 25 sq. mm** copper wire as per instructions of inspector connected to nearest switch gears as directed & duly tested by earth tester.

Pipe electrode shall be of 1.5 M long 50 mm dia. class C GI pipe. The GI pipes shall be provided with holes at regular intervals as per IS : 3043.

Each array structure and all metal casings of the panel etc. shall be earthed properly. And connected to ground hole including pure copper rod 50 sq.mm and adding salts and carbon.

RESISTANCE TO EARTH

The resistance of earthing system shall not exceed 1.0 ohm.

MATERIALS:

Item	Quantity
Copper earth rod of 35/50 sq. mm	**1 meter**
Charcoal & salt	**20Kg**
Copper wire of 25 sq. mm	**As per system requirement.**
C class GI pipe50 mm dia.	**2 × 1.5 meter**
Funnel	**1**
Cast Iron cover	**1**
Brick Masonry Block	**Suitable for earth pit**

Item	Quantity

After Sale Service & Warranty		
1	The PV modules will be warranted for a minimum period of 25 years from the date of supply. **(Output wattage should not be less than 90% at the end of 10 years and 80% at the end of 25 years).**	
2	The mechanical structures, electrical components including inverter and overall workmanship of the Solar System must be warranted for a minimum of **2 years.** Except the **batteries** should be warranted for **1 years.**	
3	**System Performance Should be Warranted for 1 Year with 80% Performance Ratio.**	
4	The contractor shall make arrangement to maintain a sufficient stock of essential **spares and consumable spare parts** to ensure proper maintenance of the system promptly. (Necessary maintenance spares for **five years** trouble free operation shall also be supplied with the system)	

Annex 2-B

1.2Kw Solar PV System Design (The Bidder must be Specify the below Categories)		
1	Single Solar PV Panel Output Power (W):	
2	Qty. of Solar PV Panels:	
3	Arrangement of Solar Panels:	
4	Total of Solar PV Capacity(W):	
5	Invert Operation Capacity (W):	
6	Inverter Battery Voltage System(Vdc):	
7	Mppt Voltage Range (Vdc) and Current (A):	
8	Max Solar Power Input (W):	
9	Single Battery Capacity(AH):	
10	Single Battery Voltage(V):	
11	Qty. of Batteries:	
12	Arrangement of Batteries:	
13	Total Storage Capacity(WH):	
14	Electrical & Wiring & Engineering Drawing and Details:	

Annex 3-A

No.	Technical Specification	Offered Technical Specifications (Must be filled by Bidder) *Please Specify Technical Specifications in details below*
1	**Photovoltaic modules:**	
	• Solar Panel Wattage at STC: Shall be ≥ **250Wp** (Bigger watt size Solar PV module will be **preferred (recommend 300Wp**).	
	• Type of PV Module: Higher cell efficiency **Poly Crystalline.**	
	• Module efficiency: **≥16%.**	
	• Max Power Voltage of each panel: **≥32Vdc.**	
	• Max. Power Current (A): **≥ 8 Amp.**	
	• No of cells in each panel: **60/72 per panel.**	
	• Total No of panels: **to be determined by the bidder based on the capacity of the system.**	
	• Total Wattage of solar PV Array: **1,800 Watt p.**	
	• Preferred Arrangement of solar panels: **3 or4 Series, ≥3 parallel of series.**	
	• Module frame: **Aluminum anodized** or **corrosion resistant material.** The anodizing Thickness shall be **15 micron or better.**	
	• Standards: Conform to **IEC 61215, IEC 61730** and **CE.** or equivalent. • PV modules to be used in a highly corrosive atmosphere (Coastal area etc.) must qualify salt mist corrosion testing **IEC 61701/ IS 61701.**	
	• Tolerance of maximum power rating: **±5%.**	
	• High transmittance glass: **minimum thickness of 3/4.0 mm.**	
	• System voltage: **≥1000Vdc.**	
	Junction box: **IP65** with sufficient at least **3/4 bypass diodes.** Highly heat-resistant bypass diode.	
	• Warranty : **Nominal power output 90% for 10 years, 80% for 25years.**	
	• Connection: **Weather proof DC rated MC4** connector. Easier and secure, not allowing for	

	any loose connections.	
	• Lead cable coming out as a part of the module: **≥ 4mm², length 900 /1000mm& weather proofed.**	
	• Temperature coefficient: **Less than -0.42%/°C.**	
	• Thermal coefficient of voltage: **Less than-0.3/ C⁰.**	
	• With Normal operating temperature coefficient (NOTC): **45 ±2°C.**	
	• Operational Temperature: **-40 ~ +85°C**	
	- Resistant of **water, abrasion, hail impact, humidity&** other environment factor for the worst situation at site and **water drainage** structure. Suitable encapsulation and sealing arrangements to protect the silicon cells from the harsh environment.	
2	**Mounting structure For PV Panels** The PV modules shall be mounted on fixed metallic structures having adequate strength and appropriate design, which can withstand the load of the modules and high wind velocities. The support structure shall be hot dip galvanized steel or aluminum.	
	• Angle of orientation: When installation Panel tilt angle **South – South West** orientation with a fixed tilt **angle 15 - 30 degrees.**	
	• Structural material: **hot dip galvanized steel** or **aluminum** alloy.	
	• Hot dip galvanized: **≥ 80 micron galvanization thickness**	
	• Minimum **clearance** of the structure from the roof level should be **300 to 500 mm.**	
	• Wind velocity withstanding capacity: **150 km / hour.**	
	• Engineering Drawing:	

	• Bolts, nuts, fasteners, panel mounting clamps: **Stainless steel** • Mounting arrangement for elevated structures: The elevated structure has to be Securely anchored to the supporting surface. Concrete foundations of appropriate weight and depth for elevated structures mounted directly on the ground; Bolted with anchor bolts of appropriate strength for elevated structures mounted. • 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. • 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 Inspector.	
3	**DC Junction boxes / PV Combiner boxes** These combiner boxes are equipped with **touch DC fuse-holders, DC fuses, reverse protection diodes, lightning induced DC surge arresters** and **load disconnect switches.** Combiner boxes are installed near their PV arrays (that is, in the weather), and require appropriate outdoor ratings. Installations are expected to last at least the lifetime warranty of PV modules (about 25 years), so installing durable, long-lived equipment that will stand up to the environment in which it is placed is critical. Combiner boxes should be Corrosion resistance, Durable, Rust proof, Abrasion resistant, durability, reliability, lockable door, Longer service life, Sun shields (Available for top, sides, and door).	
	• **6 String** Solar Power Combiner. **6-String PV Enclosure.**	
	• Each String Continuous Duty Rated at **up to 500Vdc.**	

	• High-Voltage Protection: Each String with **high-voltage fuses, over-voltage & over-current protection.**	
	• Anti-backflow **diodes & anti-reverse protection.**	
	• **Circuit breaker output control: ≥60 Amp Circuit Breakers**	
	• Protection **class IP65** for **outdoor with waterproof, dustproof, rustproof, salt fog proof.**	
	• Includes Output cable Glands &**Safety Labels.**	
	• Includes **SPD Lightning/Surge** Protection Module **(500V). Lightning arrester** for both poles	
	• Max Input/ Output Voltage Rating: up to 500 **Vdc.**	
	• Operational Environment Temperature: **-30 C° ~ +60C°.**	
	• Cooling Method: **Natural Cooling.**	
	• Dimension: **as required.**	
	• Double Flanged Door Opening, Rain Drip Lip, Back Panel and Mounting Tab ...etc.	
4	**ON/OFF GRID Hybrid Solar Inverter**	
	• Type: **ON/Off Grid hybrid Solar Inverter single Phase with isolated transformer or transformerless High frequency.**	
	• **Built-in MPPT solar controller.**	
	• Rated Continuous Output power: **4000 Watt.**	
	• Power factor: **>0.8 lag. &**THD: **<3%.**	
	• Output Wave Form: **Pure Sine wave.**	
	• Inverter Efficiency: **>85%.**	
	• Output Voltage: (230VAc **±5%**) .	
	• Output Frequency: **50Hz±3.**	
	• Battery System Voltage: **48volte.**	
	• Solar Charge Controller Type: **MPPT. Boost and Float, Smart Charger multi stage (plus) Suitable for AGM OPZV battery.**	

	Power factor : not less than 4 Kw with ≥ 0.8	
	• Solar Charge Current: 60A or more • Programmable charging current	
	• AC Charge Current: 30A or more	
	• Max Open circuit Voltage (Vdc): 140-145Vdc – or more	
	• Max solar PV panels array capacity (Wp): **Not less than 3,000W.**	
	• System Operating Modes/Priority: **Solar>Grid>Battery by default (Auto mode). Can be configured to set priority rates of charging from solar panel.**	
	• Ambient temperature considered : **-20°C to 50°C or better.**	
	• Relative Humidity: **>90% Non-Condensing.**	
	• Operation Temperature Range: **- 20C°≈ 50C°.**	
	• Protection of Enclosure (Body): Indoor with **IP20 or better.**	
	• Cooling: **Heat sinks, Fins (extended surfaces) and Fans with temperature sensors. Intelligent Variable Speed Fan Operation.**	
	• Programmable multiple operation mode: **OFF-Grid, ON-Grid, with backup battery.**	
	• Hybrid Support main/generator input.	
	• Directly power from PV to loads.	
	• Intelligent battery management charge stage	
	• Surge : 2 time capacity rate	
	• Perfect Protection: DC & AC overload, Under-voltage, Short-Circuit, Overcharge, Over discharge, Over-temperature, etc.	
	• Display: LCD display + LED status indicator.	
	• Display content: PV status, battery capacity, AC input voltage, AC output voltage, Load, running status, etc.	
	The solar input capacity, output power capacity, batteries system voltage, interfacing, display, etc in the inverter, The inverters must be Programmable parameters	

5	**Batteries Bank :**	
	Normal allows range voltage of batteries bank (**V**): **48Vdc.**	
	Capacity of batteries bank (**AH**): 48V-150AH-c10	
	- Number of batteries: **To be determined by the bidder based on system design requirement.**	
	Specifications for each battery: • Sealed construction.	
	• Battery voltage: **12v or 2v.**	
	• Maintenance- Free Operation (**VRLA**).	
	• Weight: heavier batteries. Heavy-Duty Grids, lead plates thick.	
	• Production Date: must be not more than 6 month manufacturing.	
	• Wide Operating Temperature Range: **(-20C⁰ ≈ +60/50C⁰)**.	
	• Suitable **Charging / Discharging Current rate** according to solar PV array & loads (Inverter capacity) /as system design.	
	• Low self-discharge: less than **5% per month.**	
	• **Battery type : AGM or OPZV.**	
	• Cycle performance: **not less 1600 Cycle @ 50 % DOD.**	
	• Terminations: **Screw Type.**	
	• Applications: **solar system applications.**	
	• Normal Operation Temperature: **not less than 25C⁰ (recommend 35C⁰** high Temperature battery).	
	• Standards: Conforms to **IEC 60896, ,** and all standards & certificates **&Success stories** (or previous projects where this product was used) which related.	
	• Service design life : **not less than 5 years.**	
	• Container & Cover: **Acid-resistant ABS resin.**	

6 Battery Rack:

- Should be **closed type** cabinets to use for placing batteries and in an efficient manner.
- Provide adequate ceiling clearance for ventilation and maintenance.
- Should be **Convenient, Easy to clean, Durable, Rust proof, Abrasion resistant, durability, reliability, lockable door (Key lock), Longer service life, Sturdy and Rigid design, excellent in finishing and smooth edges.**

Battery Rack should be **smooth finishing** standards and is available

- in **suitable sizes** as per the system requirements (batteries).
- Consist of shelves, **ventilation fans** available in **220V AC.**
- Standard **ventilation holes** are punctured on all sides including floors of shelves.
- The clearance of place **floor and ceiling** of first shelve should not be **less than 20 cm / as required.**
- Stable base: The weight should be **distributed** on all loading substrates.

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7 AC Distribution Board (ACDB)

The inverter output will be connected to the existing AC Distribution Board (DB). The contractor will verify the compliance of the existing AC DB with EU standards and if needed adapt the ACDB for integration of the solar system.

All switches and the circuit breakers, connectors should conform to **IEC 60947, part I, II and III.**

All **indoor** equipment will have protection of **IP52 or better.** All **outdoor** panels will have protection of **IP65** or better.

All the devices / equipment like change over, circuit breakers, etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under harsh environmental conditions.

The AC Distribution board shall consist of the following items:

Item	Description	Quantity
AC	- MCB type.	1

Item	Description	Quantity

	Circuit Breaker	- Voltage:220 VAC. - Rated frequency: 50 Hz - Capacity : 16A - Utilization Category: B - No. of Poles: 2poles. - Quality: High quality international brand - Ambient Temperature: 50C°		AC Circuit Breaker		1
	Manual Change Over	- **MCB type.** - **Voltage: 220VAC.** - **Current: at least 60 Amp.** - **No. of Poles: 2 pole** - **Rated frequency: 50 Hz.** - **Quality: High quality international brand** - **Ambient Temperature: 50C°**	1	Manual Change Over		1
	The MCB shall be provided with a quick make- quick break type of switching mechanism which a definite speed of travel of moving contacts is ensured. All internal wiring shall be carried out with PVC insulated, stranded copper conductor, single core, **6-10 sq. mm.** or larger stranded copper wires. The enclosure shall be dust & vermin proof, Rust proof and Corrosion resistance with a degree of protection of **IP-52.**					
8	**Cables.**					
	Sections of cables between **array interconnections, array to combiner boxes, combiner boxes to inverter, inverter to batteries, batteries interconnections, inverter to ACDB,** etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum: o For DC cables, the maximum drop shall be limited to **3%;** o For AC cables, the maximum drop shall be limited to **2%.**			o		

Cables of appropriate size to be used in the system shall have the following characteristics:

- **Shall meet IEC 60227/IS 694, IEC 60502/IS1554 standards.**
- **Temp. Range: –10°C to +80°C;**
- **Voltage rating 600/1000V;**
- **Excellent resistance to heat, cold, water, oil, abrasion, UV radiation;**
- **Flexible;**
- **All conductors shall be copper;**

The outside PV cables : Flexible copper cables, recommended: flexible tinned copper stranded as IEC 60228 , **insulated** with a **special grade PVC or XPLE compound formulated** for **outdoor** use **(UV, weather protection)**.

Cable routing/ marking:

- All cable/wires are to be routed in pipes and suitably **tagged** and **marked** with proper manner so that the cable **easily identified**.

Life Time:

- The cable should be so selected that it should be compatible **up to the life of the solar PV panels**, i.e. 20 years.
- Calculations of the current rating of the cables should be according to **IEC 60287**.

Cables to comply with :

- **IEC 60228 Conductors of insulated cables;**
- **IEC 60502 Power cables with extruded insulation;**

Sizing and length of Cables:

1) Cables between array interconnections:

Description	Type	Length	Size
DC cabling; • **PVC.** • **Insulated and sheathed.** • **UV-stabilized.** • **Multi-stranded flexible copper.** • **Outdoor.** • **Weather proof.**	**single core/ Multi-core Colored**	**10 meters** per System	**6 sq. mm**

Cables between array interconnections:

Description	Type	Length	Size

2) Array to combiner boxes:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	Multi-core Colored	10 meters Per String For each System	2×6 sq. mm

Array to combiner boxes:

Description	Type	Length	Size

3) Combiner boxes to inverter:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	Multi-core Colored	25 meters per System	2×16 sq. mm

Combiner boxes to inverter:

Description	Type	Length	Size

4) Inverter to batteries:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated. • Multi-stranded flexible copper. • Indoor. • Heat resist.	Single – core Black color	2 meters per System	35 sq. mm
	Single – core Red color	2 meters per System	

Inverter to batteries:

Description	Type	Length	Size

5) Batteries interconnections:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated. • Multi-stranded flexible copper. • Indoor. • Heat resist.	Single – core colored	1 meters per System	35 sq. mm

Batteries interconnections:

Description	Type	Length	Size

	6) Inverter to ACDB: Description / Type / Length / Size AC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof. Multi-core Colored 30 meters per System 4×6 sq. mm	Inverter to ACDB: Description / Type / Length / Size
9	**Wiring Pipes.** PVC pipe minimum 50mm diameter (or as required) and above depending on No. of wires to be drawn, HMS grade (1 - 2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, inspection or non-inspection type Elbows, Tees, Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.	
	• Pipe type: **Rigid PVC conduits.**	
	• Thickness: 1.3mm to 2.0mm.	
	• Color: **white.**	
	• Size: **50 /70mm dia. / as required.**	
	• Smooth inner surface for easy wiring. • Flexibility for long radius bending. • Non Conductor of Electricity and prevent Electrical shocks. • High mechanical strength for buried and open application. • Non corrosive in nature and are immune to Chemical and Galvanic corrosion. • Do not support combustion and are self-extinguishing. • Light weight to handle, install and Transport.	

10 Earthing & Grounding System:

The contractor shall provide the complete bonding & earthling of the neutral point of power system & non-current carrying metal parts of all electrical equipment & apparatus.

Each & every piece of electrical equipment & apparatus shall be connected to the main earth bus by means of branch main connection of earth continuity conductors.

All electrical equipment, except those operating at extra low voltages shall be provided with an earth terminal.

EARTH PIT DETAILS:

Copper earth rod of 35/50 sq. mm x 1000 mm buried in specifically prepared earth pit of 1.2 meters below ground level with **20 kg charcoal & salt** with alternate layers of charcoal & salt with 2 number of **50 mm dia. C class GI pipe** with **funnel** with wire mesh for watering &**brick masonry block** cover, heavy duty **cast iron cover** complete as per IS : 3043.

Necessary connections shall be done using **copper wire of 25 sq. mm** copper wire as per instructions of inspector connected to nearest switch gears as directed & duly tested by earth tester.

Pipe electrode shall be of 1.5 M long 50 mm dia. class C GI pipe. The GI pipes shall be provided with holes at regular intervals as per IS : 3043.

Each array structure and all metal casings of the panel etc. shall be earthed properly. And connected to ground hole including pure copper rod 50 sq.mm and adding salts and carbon.

RESISTANCE TO EARTH

The resistance of earthing system shall not exceed 1.0 ohm.

MATERIALS:

Item	Quantity
Copper earth rod of 35/50 sq. mm	1 meter
Charcoal & salt	20Kg
Copper wire of 25 sq. mm	As per system requirement.
C class GI pipe50 mm dia.	2 × 1.5 meter
Funnel	1
Cast Iron cover	1
Brick Masonry Block	Suitable for earth pit

Item	Quantity
Copper earth rod of 35/50 sq. mm	1 meter
Charcoal & salt	20Kg
Copper wire of 25 sq. mm	As per system requirement.
C class GI pipe50 mm dia.	2 × 1.5 meter
Funnel	1
Cast Iron cover	1
Brick Masonry Block	Suitable for earth pit

After Sale Service & Warranty		
1	The PV modules will be warranted for a minimum period of 25 years from the date of supply. **(Output wattage should not be less than 90% at the end of 10 years and 80% at the end of 25 years).**	
2	The mechanical structures, electrical components including inverter and overall workmanship of the Solar System must be warranted for a minimum of **2 years.** Except the **batteries** should be warranted for **1 years.**	
3	**System Performance Should be Warranted for 1 Year with 80% Performance Ratio.**	
4	The contractor shall make arrangement to maintain a sufficient stock of essential **spares and consumable spare parts** to ensure proper maintenance of the system promptly. (Necessary maintenance spares for **five years** trouble free operation shall also be supplied with the system)	

Annex 3-B

1.8Kw Solar PV System Design (The Bidder must be Specify the below Categories)		
1	Single Solar PV Panel Output Power (W):	
2	Qty. of Solar PV Panels:	
3	Arrangement of Solar Panels:	
4	Total of Solar PV Capacity(W):	
5	Invert Operation Capacity (W):	
6	Inverter Battery Voltage System(Vdc):	
7	Mppt Voltage Range (Vdc) and Current (A):	
8	Max Solar Power Input (W):	
9	Single Battery Capacity(AH):	
10	Single Battery Voltage(V):	
11	Qty. of Batteries:	
12	Arrangement of Batteries:	
13	Total Storage Capacity(WH):	
14	Electrical & Wiring & Engineering Drawing and Details:	

Annex 4-A

No.	Technical Specification	Offered Technical Specifications (Must be filled by Bidder) *Please Specify Technical Specifications in details below*
1	**Photovoltaic modules:**	
	• Solar Panel Wattage at STC: Shall be ≥ **250Wp** (Bigger watt size Solar PV module will be **preferred (recommend 300Wp**).	
	• Type of PV Module: Higher cell efficiency **Poly Crystalline.**	
	• Module efficiency: **≥16%.**	
	• Max Power Voltage of each panel: **≥32Vdc.**	
	• Max. Power Current (A): **≥ 8 Amp.**	
	• No of cells in each panel: **60/72 per panel.**	
	• Total No of panels: **to be determined by the bidder based on the capacity of the system.**	
	• Total Wattage of solar PV Array: **1,800 Watt p.**	
	• Preferred Arrangement of solar panels: **3 or4 Series, ≥3 parallel of series.**	
	• Module frame: **Aluminum anodized** or **corrosion resistant material**. The anodizing Thickness shall be **15 micron or better.**	
	• Standards: Conform to **IEC 61215, IEC 61730** and **CE**. or equivalent. • PV modules to be used in a highly corrosive atmosphere (Coastal area etc.) must qualify salt mist corrosion testing **IEC 61701/ IS 61701.**	
	• Tolerance of maximum power rating: **±5%.**	
	• High transmittance glass: **minimum thickness of 3/4.0 mm.**	
	• System voltage: **≥1000Vdc.**	

	Junction box: **IP65** with sufficient at least **3/4 bypass diodes.** Highly heat-resistant bypass diode.	
	• Warranty : **Nominal power output 90% for 10 years, 80% for 25years.**	
	• Connection: **Weather proof DC rated MC4** connector. Easier and secure, not allowing for any loose connections.	
	• Lead cable coming out as a part of the module: **≥ 4mm², length 900 /1000mm& weather proofed.**	
	• Temperature coefficient: **Less than -0.42%/°C.**	
	• Thermal coefficient of voltage: **Less than-0.3/ C⁰.**	
	• With Normal operating temperature coefficient (NOTC): **45 ±2°C.**	
	• Operational Temperature: **-40 ~ +85°C**	
	- Resistant of **water, abrasion, hail impact, humidity**& other environment factor for the worst situation at site and **water drainage** structure. Suitable encapsulation and sealing arrangements to protect the silicon cells from the harsh environment.	
2	**Mounting structure For PV Panels** The PV modules shall be mounted on fixed metallic structures having adequate strength and appropriate design, which can withstand the load of the modules and high wind velocities. The support structure shall be hot dip galvanized steel or aluminum.	
	• Angle of orientation: When installation Panel tilt angle **South – South West** orientation with a fixed tilt **angle 15 - 30 degrees.**	
	• Structural material: **hot dip galvanized steel** or **aluminum** alloy.	
	• Hot dip galvanized: **≥ 80 micron galvanization thickness**	
	• Minimum **clearance** of the structure from the roof level should be **300 to 500 mm.**	
	• Wind velocity withstanding capacity: **150 km / hour.**	
	• Engineering Drawing:	

	• Bolts, nuts, fasteners, panel mounting clamps: **Stainless steel** • Mounting arrangement for elevated structures: The elevated structure has to be Securely anchored to the supporting surface. Concrete foundations of appropriate weight and depth for elevated structures mounted directly on the ground; Bolted with anchor bolts of appropriate strength for elevated structures mounted. • 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. • 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 Inspector.	
3	**DC Junction boxes / PV Combiner boxes** These combiner boxes are equipped with **touch DC fuse-holders, DC fuses, reverse protection diodes, lightning induced DC surge arresters** and **load disconnect switches.** Combiner boxes are installed near their PV arrays (that is, in the weather), and require appropriate outdoor ratings. Installations are expected to last at least the lifetime warranty of PV modules (about 25 years), so installing durable, long-lived equipment that will stand up to the environment in which it is placed is critical. Combiner boxes should be Corrosion resistance, Durable, Rust proof, Abrasion resistant, durability, reliability, lockable door, Longer service life, Sun shields (Available for top, sides, and door).	
	• **6 String** Solar Power Combiner. **6-String PV Enclosure.**	
	• Each String Continuous Duty Rated at **up to 500Vdc.**	

	• High-Voltage Protection: Each String with **high-voltage fuses, over-voltage & over-current protection.**	
	• Anti-backflow **diodes & anti-reverse protection.**	
	• **Circuit breaker output control: ≥60 Amp Circuit Breakers**	
	• Protection **class IP65** for **outdoor** with **waterproof, dustproof, rustproof, salt fog proof.**	
	• Includes Output cable Glands &**Safety Labels.**	
	• Includes **SPD Lightning/Surge** Protection Module (**500V**). **Lightning arrester** for both poles	
	• Max Input/ Output Voltage Rating: up to 500 **Vdc.**	
	• Operational Environment Temperature: **-30 C° ~ +60C°.**	
	• Cooling Method: **Natural Cooling.**	
	• Dimension: **as required.**	
	• Double Flanged Door Opening, Rain Drip Lip, Back Panel and Mounting Tab ...etc.	
4	**ON/OFF GRID Hybrid Solar Inverter**	
	• Type: **ON/Off Grid hybrid Solar Inverter single Phase with isolated transformer or transformerless High frequency.**	
	• **Built-in MPPT solar controller.**	
	• Rated Continuous Output power: **4000 Watt.**	
	• Power factor: **>0.8 lag. &**THD: **<3%.**	
	• Output Wave Form: **Pure Sine wave.**	
	• Inverter Efficiency: **>85%.**	
	• Output Voltage: (230VAc **±5%**) .	
	• Output Frequency: **50Hz±3.**	
	• Battery System Voltage: **48volte.**	

Annex 4-B

1.8Kw Solar PV System Design (The Bidder must be Specify the below Categories)		
1	Single Solar PV Panel Output Power (W):	
2	Qty. of Solar PV Panels:	
3	Arrangement of Solar Panels:	
4	Total of Solar PV Capacity(W):	
5	Invert Operation Capacity (W):	
6	Inverter Battery Voltage System(Vdc):	
7	Mppt Voltage Range (Vdc) and Current (A):	
8	Max Solar Power Input (W):	
9	Single Battery Capacity(AH):	
10	Single Battery Voltage(V):	
11	Qty. of Batteries:	
12	Arrangement of Batteries:	
13	Total Storage Capacity(WH):	
14	Electrical & Wiring & Engineering Drawing and Details:	

Annex 5-A

No.	Technical Specification	Offered Technical Specifications (Must be filled by Bidder) *Please Specify Technical Specifications in details below*
1	**Photovoltaic modules:**	
	• Solar Panel Wattage at STC: Shall be ≥ **250Wp** (Bigger watt size Solar PV module will be **preferred (recommend 300Wp)**.	
	• Type of PV Module: Higher cell efficiency **Poly Crystalline.**	
	• Module efficiency: **≥16%.**	
	• Max Power Voltage of each panel: **≥32Vdc.**	
	• Max. Power Current (A): **≥ 8 Amp.**	
	• No of cells in each panel: **60/72 per panel.**	
	• Total No of panels: **to be determined by the bidder based on the capacity of the system.**	
	• Total Wattage of solar PV Array: **2,700 Watt p.**	
	• Preferred Arrangement of solar panels: **3 or4 Series, ≥3 parallel of series.**	
	• Module frame: **Aluminum anodized** or **corrosion resistant material**. The anodizing Thickness shall be **15 micron or better.**	
	• Standards: Conform to **IEC 61215, IEC 61730** and **CE**. or equivalent. • PV modules to be used in a highly corrosive atmosphere (Coastal area etc.) must qualify salt mist corrosion testing **IEC 61701/ IS 61701.**	
	• Tolerance of maximum power rating: **±5%.**	
	• High transmittance glass: **minimum thickness of 3/4.0 mm.**	
	• System voltage: **≥1000Vdc.**	
	Junction box: **IP65** with sufficient at least **3/4 bypass diodes.** Highly heat-resistant bypass diode.	
	• Warranty : **Nominal power output 90% for 10 years, 80% for 25years.**	
	• Connection: **Weather proof DC rated MC4** connector. Easier and secure, not allowing for	

	any loose connections.	
	• Lead cable coming out as a part of the module: **≥ 4mm², length 900 /1000mm& weather proofed.**	
	• Temperature coefficient: **Less than -0.42%/°C.**	
	• Thermal coefficient of voltage: **Less than-0.3/ C⁰.**	
	• With Normal operating temperature coefficient (NOTC): **45 ±2°C.**	
	• Operational Temperature: **-40 ~ +85°C**	
	- Resistant of **water, abrasion, hail impact, humidity&** other environment factor for the worst situation at site and **water drainage** structure. Suitable encapsulation and sealing arrangements to protect the silicon cells from the harsh environment.	
2	**Mounting structure For PV Panels** The PV modules shall be mounted on fixed metallic structures having adequate strength and appropriate design, which can withstand the load of the modules and high wind velocities. The support structure shall be hot dip galvanized steel or aluminum.	
	• Angle of orientation: When installation Panel tilt angle **South – South West** orientation with a fixed tilt **angle 15 - 30 degrees.**	
	• Structural material: **hot dip galvanized steel** or **aluminum** alloy.	
	• Hot dip galvanized: **≥ 80 micron galvanization thickness**	
	• Minimum **clearance** of the structure from the roof level should be **300 to 500 mm.**	
	• Wind velocity withstanding capacity: **150 km / hour.**	
	• Engineering Drawing:	

	• Bolts, nuts, fasteners, panel mounting clamps: **Stainless steel** • Mounting arrangement for elevated structures: The elevated structure has to be Securely anchored to the supporting surface. Concrete foundations of appropriate weight and depth for elevated structures mounted directly on the ground; Bolted with anchor bolts of appropriate strength for elevated structures mounted. • 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. • 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 Inspector.	
3	**DC Junction boxes / PV Combiner boxes** These combiner boxes are equipped with **touch DC fuse-holders, DC fuses, reverse protection diodes, lightning induced DC surge arresters and load disconnect switches.** Combiner boxes are installed near their PV arrays (that is, in the weather), and require appropriate outdoor ratings. Installations are expected to last at least the lifetime warranty of PV modules (about 25 years), so installing durable, long-lived equipment that will stand up to the environment in which it is placed is critical. Combiner boxes should be Corrosion resistance, Durable, Rust proof, Abrasion resistant, durability, reliability, lockable door, Longer service life, Sun shields (Available for top, sides, and door).	
	• **6 String** Solar Power Combiner. **6-String PV Enclosure.**	
	• Each String Continuous Duty Rated up to **500Vdc.**	

	• High-Voltage Protection: Each String with **high-voltage fuses, over-voltage & over-current protection.**	
	• Anti-backflow **diodes & anti-reverse protection.**	
	• **Circuit breaker output control: ≥60 Amp Circuit Breakers**	
	• Protection **class IP65** for **outdoor** with **waterproof, dustproof, rustproof, salt fog proof.**	
	• Includes Output cable Glands &**Safety Labels.**	
	• Includes **SPD Lightning/Surge** Protection Module **(500V). Lightning arrester** for both poles.	
	• Max Input/ Output Voltage Rating: **up to 500Vdc.**	
	• Operational Environment Temperature: **-30 C° ~ +60C°.**	
	• Cooling Method: **Natural Cooling.**	
	• Dimension: **as required.**	
	• Double Flanged Door Opening, Rain Drip Lip, Back Panel and Mounting Tab ...etc.	
4	**ON/OFF GRID Hybrid Solar Inverter**	
	• Type: **ON/Off Grid hybrid Solar Inverter single Phase with isolated transformer or transformerless High frequency output.**	
	• **Built-in MPPT solar controller.**	
	• Solar Inverter modular design, with **parallel connection** to easy capacity expansion.	
	• Rated Continuous Output power: **4000 Watt.**	
	• Power factor: **> 1 lag. &**THD: **<3%.**	
	• Output Wave Form: **Pure Sine wave.**	
	• Inverter Efficiency: **>85%.**	
	• Output Voltage: (230VAc **±5%**) .	
	• Output Frequency: **50Hz±3.**	
	• Battery System Voltage: **48Vdc.**	

	• Solar Charge Controller Type: - **MPPT smart charging . MPPT. Boost and Float, Smart Charger multi stage (plus) Suitable for AGM, OPZV battery.**	
	• **Power factor : not less than 4 Kw with ≥ 1**	
	• Solar Charge Current: 80A or more • Programmable charging current	
	• AC Charge Current: 30A or more	
	• Max Open circuit Voltage (Vdc): 140-145 Vdc or higher	
	• Max solar PV panels array capacity (Wp): **Not less than 4,000W.**	
	• System Operating Modes/Priority: **Solar>Grid>Battery by default (Auto mode). Can be configured to set priority rates of charging from solar panel.**	
	• Ambient temperature considered : **-20°C to 50°C or better.**	
	• Relative Humidity: **>90% Non-Condensing.**	
	• Operation Temperature Range: **- 20C°≈ 50C°.**	
	• Protection of Enclosure (Body): Indoor with **IP20 or better.**	
	• Cooling: **Heat sinks, Fins (extended surfaces) and Fans with temperature sensors. Intelligent Variable Speed Fan Operation.**	
	• Programmable multiple operation mode: **OFF-Grid, ON-Grid with backup battery.**	
	• Hybrid Support main/generator input.	
	• Directly power from PV to loads.	
	• Intelligent battery management charge stage	
	• Surge : 2 time capacity rate	
	• Perfect Protection: DC & AC overload, Under-voltage, Short-Circuit, Overcharge, Over discharge, Over-temperature, etc.	
	• Display: LCD display + LED status indicator.	
	• Display content: PV status, battery capacity, AC input voltage, AC output voltage, Load, running status, etc.	

	The solar input capacity, output power capacity, batteries system voltage, interfacing, display, etc in the inverter The inverters must be Programmable parameters	
5	**Batteries Bank :**	
	- Normal allows range voltage of batteries bank (V): **48Vdc**	
	- Capacity of batteries bank (**AH**): **48v-150AH-c10**	
	- Number of batteries: **To be determined by the bidder based on system design requirement.**	
	Specifications for each battery: • Sealed construction.	
	• Battery voltage: **12v or 2v.**	
	• Maintenance- Free Operation (**VRLA**).	
	• Weight: heavier batteries. Heavy-Duty Grids, lead plates thick.	
	• Production Date: must be not more than 6 month manufacturing.	
	• Wide Operating Temperature Range: **(-20C^0 ≈ +60/55C^0)**.	
	• Suitable **Charging / Discharging Current rate** according to solar PV array & loads (Inverter capacity) /as system design.	
	• Low self-discharge: less than **5% per month.**	
	• **Battery type : AGM** Or **OPZV** batteries	
	• Production Date: must be not more than 6 month manufacturing.	
	• Cycle performance: **not less 1600 Cycle @ 50 % DOD.**	
	• Terminations: **Screw Type.**	
	• Applications: **solar system applications.**	
	• Normal Operation Temperature: not less than 25Co (recommend 35Co high Temperature battery).	
	• Standards: Conforms to **IEC 60896,** and all standards & certificates **&Success stories** (or previous projects where this product was used) which related.	

	• Service design life : **not less than 5 years.**	
	• Container & Cover: **Acid-resistant ABS resin.**	
6	**Battery Rack:** • Should be **closed type** cabinets to use for placing batteries and in an efficient manner. • Provide adequate ceiling clearance for ventilation and maintenance. • Should be **Convenient, Easy to clean, Durable, Rust proof, Abrasion resistant, durability, reliability, lockable door (Key lock), Longer service life, Sturdy and Rigid design, excellent in finishing and smooth edges.** Battery Rack should be **smooth finishing** standards and is available • in **suitable sizes** as per the system requirements (batteries). • Consist of shelves, **ventilation fans** available in **220V AC.** • Standard **ventilation holes** are punctured on all sides including floors of shelves. • The clearance of place **floor and ceiling** of first shelve should not be **less than 20 cm / as required.** • Stable base: The weight should be **distributed** on all loading substrates. .	
7	**AC Distribution Board (ACDB)** The inverter output will be connected to the existing AC Distribution Board (DB). The contractor will verify the compliance of the existing AC DB with EU standards and if needed adapt the ACDB for integration of the solar system. All switches and the circuit breakers, connectors should conform to **IEC 60947, part I, II and III.**	
	All **indoor** equipment will have protection of **IP52 or better.** All **outdoor** panels will have protection of **IP65** or better.	
	All the devices / equipment like change over, circuit breakers, etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under harsh environmental conditions. The AC Distribution board shall consist of the following items:	Item | Description | Quantity

Item	Description	Quantity
AC Circuit Breaker	- **MCB** type. - Voltage:**220 VAC.** - Rated frequency: **50 Hz** - Breaker capacity : 16A - Utilization Category: **B** - No. of Poles: **2poles.** - Quality: High quality international brand - Ambient Temperature: **50C°** .	**1**
Manual Change Over	- **MCB type.** - **Voltage: 220VAC.** - **Current: at least 60 Amp.** - No. of Poles: **2poles** - **Rated frequency: 50 Hz.** - **Quality: High quality international brand** - **Ambient Temperature: 50C°** -	**1**

The MCB shall be provided with a quick make- quick break type of switching mechanism which a definite speed of travel of moving contacts is ensured.
All internal wiring shall be carried out with PVC insulated, stranded copper conductor, single core, **6-10 sq. mm.** or larger stranded copper wires.
The enclosure shall be dust & vermin proof, Rust proof and Corrosion resistance with a degree of protection of **IP-52.**

AC Circuit Breaker		**1**
Manual Change Over	-	**1**

The AC Distribution board shall consist of the following items:

8	**Cables.**	
	Sections of cables between **array interconnections, array to combiner boxes, combiner boxes** to **inverter, inverter to batteries, batteries interconnections, inverter to ACDB,** etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum: o For DC cables, the maximum drop shall be limited to **3%;** o For AC cables, the maximum drop shall be limited to **2%.**	o

Cables of appropriate size to be used in the system shall have the following characteristics:

- **Shall meet IEC 60227/IS 694, IEC 60502/IS1554 standards.**
- **Temp. Range: –10°C to +80°C;**
- **Voltage rating 600/1000V;**
- **Excellent resistance to heat, cold, water, oil, abrasion, UV radiation;**
- **Flexible;**
- **All conductors shall be copper;**

The outside PV cables: Flexible copper cables, recommended: flexible tinned copper stranded as IEC 60228 , **insulated** with a **special grade PVC or XPLE compound formulated** for **outdoor** use **(UV, weather protection).**

Cable routing/ marking:

- All cable/wires are to be routed in pipes and suitably **tagged** and **marked** with proper manner so that the cable **easily identified.**

Life Time:

- The cable should be so selected that it should be compatible **up to the life of the solar PV panels**, i.e. 20 years.
- Calculations of the current rating of the cables should be according to **IEC 60287.**

Cables to comply with :

- **IEC 60228 Conductors of insulated cables;**
- **IEC 60502 Power cables with extruded insulation;**

Sizing and length of Cables:

1) Cables between array interconnections:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	single core/ Multi-core Colored	10 meters per System	6 sq. mm

Cables between array interconnections:

Description	Type	Length	Size

2) Array to combiner boxes:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	Multi-core Colored	10 meters Per String For each System	2×6 sq. mm

Array to combiner boxes:

Description	Type	Length	Size

3) Combiner boxes to inverter:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	Multi-core Colored	25 meters per System	4×16 sq. mm

Combiner boxes to inverter:

Description	Type	Length	Size

4) Inverter to batteries:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated. • Multi-stranded flexible copper. • Indoor. • Heat resist.	Single – core Black color	2 meters per System	35 sq. mm
	Single – core Red color	2 meters per System	

Inverter to batteries:

Description	Type	Length	Size

5) Batteries interconnections:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated. • Multi-stranded flexible copper. • Indoor. • Heat resist.	Single – core colored	1 meters per System	35 sq. mm

Batteries interconnections:

Description	Type	Length	Size

	6) Inverter to ACDB: Description: AC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof. Type: Multi-core Colored Length: 30 meters per System Size: 4×6 sq. mm	Inverter to ACDB: Description Type Length Size
9	**Wiring Pipes.** PVC pipe minimum 50mm diameter (or as required) and above depending on No. of wires to be drawn, HMS grade (1 - 2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, inspection or non-inspection type Elbows, Tees, Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring. • Pipe type: **Rigid PVC conduits.** • Thickness: 1.3mm to 2.0mm. • Color: **white.** • Size: **50 /70mm dia. / as required.** • Smooth inner surface for easy wiring. • Flexibility for long radius bending. • Non Conductor of Electricity and prevent Electrical shocks. • High mechanical strength for buried and open application. • Non corrosive in nature and are immune to Chemical and Galvanic corrosion. • Do not support combustion and are self-extinguishing. • Light weight to handle, install and Transport.	

10 Earthing & Grounding System:

The contractor shall provide the complete bonding & earthling of the neutral point of power system & non-current carrying metal parts of all electrical equipment & apparatus.

Each & every piece of electrical equipment & apparatus shall be connected to the main earth bus by means of branch main connection of earth continuity conductors.

All electrical equipment, except those operating at extra low voltages shall be provided with an earth terminal.

EARTH PIT DETAILS:

Copper earth rod of 35/50 sq. mm x 1000 mm buried in specifically prepared earth pit of 1.2 meters below ground level with **20 kg charcoal & salt** with alternate layers of charcoal & salt with 2 number of **50 mm dia. C class GI pipe** with **funnel** with wire mesh for watering &**brick masonry block** cover, heavy duty **cast iron cover** complete as per IS : 3043.

Necessary connections shall be done using **copper wire of 25 sq. mm** copper wire as per instructions of inspector connected to nearest switch gears as directed & duly tested by earth tester.

Pipe electrode shall be of 1.5 M long 50 mm dia. class C GI pipe. The GI pipes shall be provided with holes at regular intervals as per IS : 3043.

Each array structure and all metal casings of the panel etc. shall be earthed properly. And connected to ground hole including pure copper rod 50 sq.mm and adding salts and carbon.

RESISTANCE TO EARTH

The resistance of earthing system shall not exceed 1.0 ohm.

MATERIALS:

Item	Quantity
Copper earth rod of 35/50 sq. mm	1 meter
Charcoal & salt	20Kg
Copper wire of 25 sq. mm	As per system requirement.
C class GI pipe50 mm dia.	2 × 1.5 meter
Funnel	1
Cast Iron cover	1
Brick Masonry Block	Suitable for earth pit

Item	Quantity
Copper earth rod of 35/50 sq. mm	1 meter
Charcoal & salt	20Kg
Copper wire of 25 sq. mm	As per system requirement.
C class GI pipe50 mm dia.	2 × 1.5 meter
Funnel	1
Cast Iron cover	1
Brick Masonry Block	Suitable for earth pit

After Sale Service & Warranty		
1	The PV modules will be warranted for a minimum period of 25 years from the date of supply. **(Output wattage should not be less than 90% at the end of 10 years and 80% at the end of 25 years).**	The PV modules will be warranted for a minimum period of 25 years from the date of supply. **(Output wattage should not be less than 90% at the end of 10 years and 80% at the end of 25 years).**
2	The mechanical structures, electrical components including inverter and overall workmanship of the Solar System must be warranted for a minimum of **2 years.** Except the **batteries** should be warranted for **1 years.**	The mechanical structures, electrical components including inverter and overall workmanship of the Solar System must be warranted for a minimum of **2 years.** Except the **batteries** should be warranted for **1 years.**
3	**System Performance Should be Warranted for 1 Year with 80% Performance Ratio.**	**System Performance Should be Warranted for 1 Year with 80% Performance Ratio.**
4	The contractor shall make arrangement to maintain a sufficient stock of essential **spares and consumable spare parts** to ensure proper maintenance of the system promptly. (Necessary maintenance spares for **five years** trouble free operation shall also be supplied with the system)	The contractor shall make arrangement to maintain a sufficient stock of essential **spares and consumable spare parts** to ensure proper maintenance of the system promptly. (Necessary maintenance spares for **five years** trouble free operation shall also be supplied with the system)

Annex 5-B

2.7Kw Solar PV System Design (The Bidder must be Specify the below Categories)		
1	Single Solar PV Panel Output Power (W):	
2	Qty. of Solar PV Panels:	
3	Arrangement of Solar Panels:	
4	Total of Solar PV Capacity(W):	
5	Invert Operation Capacity (W):	
6	Inverter Battery Voltage System(Vdc):	
7	Mppt Voltage Range (Vdc) and Current (A):	
8	Max Solar Power Input (W):	
9	Single Battery Capacity(AH):	
10	Single Battery Voltage(V):	
11	Qty. of Batteries:	
12	Arrangement of Batteries:	
13	Total Storage Capacity(WH):	
14	Electrical & Wiring & Engineering Drawing and Details:	

Annex 6-A

No.	Technical Specification	Offered Technical Specifications (Must be filled by Bidder) *Please Specify Technical Specifications in details below*
1	**Photovoltaic modules:**	
	• Solar Panel Wattage at STC: Shall be ≥ **250Wp** (Bigger watt size Solar PV module will be **preferred (recommend 300Wp)**.	
	• Type of PV Module: Higher cell efficiency **Poly Crystalline.**	
	• Module efficiency: **≥16%.**	
	• Max Power Voltage of each panel: **≥32Vdc.**	
	• Max. Power Current (A): **≥ 8 Amp.**	
	• No of cells in each panel: **60/72 per panel.**	
	• Total No of panels: **to be determined by the bidder based on the capacity of the system.**	
	• Total Wattage of solar PV Array: **2,700 Watt p.**	
	• Preferred Arrangement of solar panels: **3 or4 Series, ≥3 parallel of series.**	
	• Module frame: **Aluminum anodized** or **corrosion resistant material**. The anodizing Thickness shall be **15 micron or better.**	
	• Standards: Conform to **IEC 61215, IEC 61730** and **CE**. or equivalent. • PV modules to be used in a highly corrosive atmosphere (Coastal area etc.) must qualify salt mist corrosion testing **IEC 61701/ IS 61701.**	
	• Tolerance of maximum power rating: **±5%.**	
	• High transmittance glass: **minimum thickness of 3/4.0 mm.**	
	• System voltage: **≥1000Vdc.**	

	Junction box: **IP65** with sufficient at least **3/4 bypass diodes**. Highly heat-resistant bypass diode.	
	• Warranty : **Nominal power output 90% for 10 years, 80% for 25years.**	
	• Connection: **Weather proof DC rated MC4** connector. Easier and secure, not allowing for any loose connections.	
	• Lead cable coming out as a part of the module: **≥ 4mm^2, length 900 /1000mm& weather proofed.**	
	• Temperature coefficient: **Less than -0.42%/°C.**	
	• Thermal coefficient of voltage: **Less than-0.3/ C^0.**	
	• With Normal operating temperature coefficient (NOTC): **45 ±2°C.**	
	• Operational Temperature: **-40 ~ +85°C**	
	- Resistant of **water, abrasion, hail impact, humidity**& other environment factor for the worst situation at site and **water drainage** structure. Suitable encapsulation and sealing arrangements to protect the silicon cells from the harsh environment.	
2	**Mounting structure For PV Panels** The PV modules shall be mounted on fixed metallic structures having adequate strength and appropriate design, which can withstand the load of the modules and high wind velocities. The support structure shall be hot dip galvanized steel or aluminum.	
	• Angle of orientation: When installation Panel tilt angle **South – South West** orientation with a fixed tilt **angle 15 - 30 degrees.**	
	• Structural material: **hot dip galvanized steel** or **aluminum** alloy.	
	• Hot dip galvanized: **≥ 80 micron galvanization thickness**	
	• Minimum **clearance** of the structure from the roof level should be **300 to 500 mm.**	
	• Wind velocity withstanding capacity: **150 km / hour.**	
	• Engineering Drawing:	

	• Bolts, nuts, fasteners, panel mounting clamps: **Stainless steel** • Mounting arrangement for elevated structures: The elevated structure has to be Securely anchored to the supporting surface. Concrete foundations of appropriate weight and depth for elevated structures mounted directly on the ground; Bolted with anchor bolts of appropriate strength for elevated structures mounted. • 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. • 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 Inspector.	
3	**DC Junction boxes / PV Combiner boxes** These combiner boxes are equipped with **touch DC fuse-holders, DC fuses, reverse protection diodes, lightning induced DC surge arresters** and **load disconnect switches.** Combiner boxes are installed near their PV arrays (that is, in the weather), and require appropriate outdoor ratings. Installations are expected to last at least the lifetime warranty of PV modules (about 25 years), so installing durable, long-lived equipment that will stand up to the environment in which it is placed is critical. Combiner boxes should be Corrosion resistance, Durable, Rust proof, Abrasion resistant, durability, reliability, lockable door, Longer service life, Sun shields (Available for top, sides, and door).	
	• **6 String** Solar Power Combiner. **6-String PV Enclosure.**	
	• Each String Continuous Duty Rated up to 500**Vdc.**	

	• High-Voltage Protection: Each String with **high-voltage fuses, over-voltage & over-current protection.**	
	• Anti-backflow **diodes** & **anti-reverse protection.**	
	• **Circuit breaker output control: ≥60 Amp Circuit Breakers**	
	• Protection **class IP65** for **outdoor** with **waterproof, dustproof, rustproof, salt fog proof.**	
	• Includes Output cable Glands &**Safety Labels.**	
	• Includes **SPD Lightning/Surge** Protection Module (**500V**). **Lightning arrester** for both poles.	
	• Max Input/ Output Voltage Rating: **up to 500Vdc.**	
	• Operational Environment Temperature: **-30 C° ~ +60C°.**	
	• Cooling Method: **Natural Cooling.**	
	• Dimension: **as required.**	
	• Double Flanged Door Opening, Rain Drip Lip, Back Panel and Mounting Tab ...etc.	
4	**ON/OFF GRID Hybrid Solar Inverter**	
	• Type: **ON/Off Grid hybrid Solar Inverter single Phase with isolated transformer or transformerless High frequency output.**	
	• **Built-in MPPT solar controller.**	
	• Solar Inverter modular design, with **parallel connection** to easy capacity expansion.	
	• Rated Continuous Output power: **4000 Watt.**	
	• Power factor: **> 1 lag.** &THD: **<3%.**	
	• Output Wave Form: **Pure Sine wave.**	
	• Inverter Efficiency: **>85%.**	
	• Output Voltage: (230VAc **±5%**) .	
	• Output Frequency: **50Hz±3.**	

	• Battery System Voltage: **48Vdc.**	
	• Solar Charge Controller Type: - **MPPT smart charging . MPPT. Boost and Float, Smart Charger multi stage (plus) Suitable for AGM, OPZV battery.**	
	• **Power factor : not less than 4 Kw with ≥ 1 power factor**	
	• Solar Charge Current: 80A or more • Programmable charging current	
	• AC Charge Current: 30A or more	
	• Max Open circuit Voltage (Vdc): 140-145 Vdc or higher • MPPT Efficiency : not less than 95%	
	• Max solar PV panels array capacity (Wp): **Not less than 4,000W.**	
	• System Operating Modes/Priority: **Solar>Grid>Battery by default (Auto mode). Can be configured to set priority rates of charging from solar panel.**	
	• Ambient temperature considered : **-20°C to 50°C or better.**	
	• Relative Humidity: **>90% Non-Condensing.**	
	• Operation Temperature Range: **- 20C°≈ 50C°.**	
	• Protection of Enclosure (Body): Indoor with **IP20 or better.**	
	• Cooling: **Heat sinks, Fins (extended surfaces) and Fans with temperature sensors. Intelligent Variable Speed Fan Operation.**	
	• Programmable multiple operation mode: **OFF-Grid, ON-Grid with backup battery.**	
	• Hybrid Support main/generator input.	
	• Directly power from PV to loads.	
	• Intelligent battery management charge stage	

	• Surge : 2 time capacity rate	
	• Perfect Protection: DC & AC overload, Under-voltage, Short-Circuit, Overcharge, Over discharge, Over-temperature, etc.	
	• Display: LCD display + LED status indicator.	
	• Display content: PV status, battery capacity, AC input voltage, AC output voltage, Load, running status, etc.	
	The solar input capacity, output power capacity, batteries system voltage, interfacing, display, etc in the inverter The inverters must be Programmable parameters	
5	**Batteries Bank :**	
	- Normal allows range voltage of batteries bank (V): **48Vdc**	
	- Capacity of batteries bank (AH): **48v-150AH-c10**	
	- Number of batteries: **To be determined by the bidder based on system design requirement.**	
	Specifications for each battery: • Sealed construction.	
	• Battery voltage: **12v or 2v.**	
	• Maintenance- Free Operation (**VRLA**).	
	• Weight: heavier batteries. Heavy-Duty Grids, lead plates thick.	
	• Production Date: must be not more than 6 month manufacturing.	
	• Wide Operating Temperature Range: **(-20C^0 ≈ +60/55C^0)**.	
	• Suitable **Charging / Discharging Current rate** according to solar PV array & loads (Inverter capacity) /as system design.	

	• Low self-discharge: less than **5% per month.**	
	• **Battery type : AGM** Or **OPZV** batteries	
	• Production Date: must be not more than 6 month manufacturing.	
	• Cycle performance: **not less 1600 Cycle @ 50 % DOD.**	
	• Terminations: **Screw Type.**	
	• Applications: **solar system applications.**	
	• Normal Operation Temperature: not less than 25Co (recommend 35Co high Temperature battery).	
	• Standards: Conforms to **IEC 60896,** and all standards & certificates &**Success stories** (or previous projects where this product was used) which related.	
	• Service design life : **not less than 5 years.**	
	• Container & Cover: **Acid-resistant ABS resin.**	
6	**Battery Rack:** • Should be **closed type** cabinets to use for placing batteries and in an efficient manner. • Provide adequate ceiling clearance for ventilation and maintenance. • Should be **Convenient, Easy to clean, Durable, Rust proof, Abrasion resistant, durability, reliability, lockable door (Key lock), Longer service life, Sturdy and Rigid design, excellent in finishing and smooth edges.** Battery Rack should be **smooth finishing** standards and is available	

	• in **suitable sizes** as per the system requirements (batteries). • Consist of shelves, **ventilation fans** available in **220V AC.** • Standard **ventilation holes** are punctured on all sides including floors of shelves. • The clearance of place **floor and ceiling** of first shelve should not be **less than 20 cm / as required.** • Stable base: The weight should be **distributed** on all loading substrates. .	
7	**AC Distribution Board (ACDB)** The inverter output will be connected to the existing AC Distribution Board (DB). The contractor will verify the compliance of the existing AC DB with EU standards and if needed adapt the ACDB for integration of the solar system. All switches and the circuit breakers, connectors should conform to **IEC 60947, part I, II and III.**	
	All **indoor** equipment will have protection of **IP52 or better.** All **outdoor** panels will have protection of **IP65** or better.	

All the devices / equipment like change over, circuit breakers, etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under harsh environmental conditions.

The AC Distribution board shall consist of the following items:

Item	Description	Quantity
AC Circuit Breaker	- **MCB** type. - Voltage:**220 VAC.** - Rated frequency: **50 Hz** - Breaker capacity : 16A - Utilization Category: **B** - No. of Poles: **2poles.** - Quality: High quality international brand - Ambient Temperature: **50C°** .	**1**
Manual Change Over	- **MCB type.** - **Voltage: 220VAC.** - **Current: at least 60 Amp.** - No. of Poles: **2poles** - **Rated frequency: 50 Hz.** - **Quality: High quality international brand** - **Ambient Temperature: 50C°** -	**1**

The MCB shall be provided with a quick make- quick break type of switching mechanism which a definite speed of travel of moving contacts is ensured.

All internal wiring shall be carried out with PVC insulated, stranded copper conductor, single core, **6-10 sq. mm.** or larger stranded copper wires.

The enclosure shall be dust & vermin proof, Rust proof and Corrosion resistance with a degree of protection of **IP-52**.

The AC Distribution board shall consist of the following items:

Item	Description	Quantity
AC Circuit Breaker		**1**
Manual Change Over	-	**1**

8	**Cables.**	

	Sections of cables between **array interconnections, array to combiner boxes, combiner boxes to inverter, inverter to batteries, batteries interconnections, inverter to ACDB**, etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum: o For DC cables, the maximum drop shall be limited to **3%**; o For AC cables, the maximum drop shall be limited to **2%.**	o
	Cables of appropriate size to be used in the system shall have the following characteristics: ➢ **Shall meet IEC 60227/IS 694, IEC 60502/IS1554 standards.** ➢ **Temp. Range: –10°C to +80°C;** ➢ **Voltage rating 600/1000V;** ➢ **Excellent resistance to heat, cold, water, oil, abrasion, UV radiation;** ➢ **Flexible;** ➢ **All conductors shall be copper;**	
	The outside PV cables : Flexible copper cables, recommended: flexible tinned copper stranded as IEC 60228 , **insulated** with a **special grade PVC or XPLE compound formulated** for **outdoor** use **(UV, weather protection).**	
	Cable routing/ marking: •All cable/wires are to be routed in pipes and suitably **tagged** and **marked** with proper manner so that the cable **easily identified.**	
	Life Time: •The cable should be so selected that it should be compatible **up to the life of the solar PV panels**, i.e. 20 years. •Calculations of the current rating of the cables should be according to **IEC 60287.** Cables to comply with : •**IEC 60228 Conductors of insulated cables;** •**IEC 60502 Power cables with extruded insulation;**	

Sizing and length of Cables:

1) Cables between array interconnections:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	single core/ Multi-core Colored	10 meters per System	6 sq. mm

Cables between array interconnections:

Description	Type	Length	Size

2) Array to combiner boxes:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	Multi-core Colored	10 meters Per String For each System	2×6 sq. mm

Array to combiner boxes:

Description	Type	Length	Size

3) Combiner boxes to inverter:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	Multi-core Colored	25 meters per System	4×16 sq. mm

Combiner boxes to inverter:

Description	Type	Length	Size

4) Inverter to batteries:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated. • Multi-stranded flexible copper. • Indoor. • Heat resist.	Single –core Black color	2 meters per System	35 sq. mm
	Single –core Red color	2 meters per System	

Inverter to batteries:

Description	Type	Length	Size

5) Batteries interconnections:

Description	Type	Length	Size
DC cabling; • PVC. • Insulated. • Multi-stranded flexible copper. • Indoor. • Heat resist.	Single –core colored	1 meters per System	35 sq. mm

Batteries interconnections:

Description	Type	Length	Size

6) Inverter to ACDB:

Description	Type	Length	Size
AC cabling; • PVC. • Insulated and sheathed. • UV-stabilized. • Multi-stranded flexible copper. • Outdoor. • Weather proof.	Multi-core Colored	30 meters per System	4×6 sq. mm

Inverter to ACDB:

Description	Type	Length	Size

9	**Wiring Pipes.**

	PVC pipe minimum 50mm diameter (or as required) and above depending on No. of wires to be drawn, HMS grade (1 - 2mm thick), accessories for PVC pipes of the same make that of pipe; such as Spacers & Saddles, Couplers, Bends, inspection or non-inspection type Elbows, Tees, Junction boxes of required ways and resin / adhesive to make all joints rigid. Black pipe shall not be used for surface type wiring.	
	• Pipe type: **Rigid PVC conduits.**	
	• Thickness: 1.3mm to 2.0mm.	
	• Color: **white.**	
	• Size: **50 /70mm dia. / as required.**	
	• Smooth inner surface for easy wiring. • Flexibility for long radius bending. • Non Conductor of Electricity and prevent Electrical shocks. • High mechanical strength for buried and open application. • Non corrosive in nature and are immune to Chemical and Galvanic corrosion. • Do not support combustion and are self- extinguishing. • Light weight to handle, install and Transport.	
10	**Earthing & Grounding System:** The contractor shall provide the complete bonding & earthling of the neutral point of power system & non-current carrying metal parts of all electrical equipment & apparatus. Each & every piece of electrical equipment & apparatus shall be connected to the main earth bus by means of branch main connection of earth continuity conductors. All electrical equipment, except those operating at extra low voltages shall be provided with an earth terminal. EARTH PIT DETAILS: **Copper earth rod of 35/50 sq. mm x 1000 mm** buried in specifically prepared earth pit of 1.2 meters below ground level with **20 kg charcoal & salt** with alternate layers of charcoal & salt with 2 number of **50 mm**	

	dia. C class GI pipe with **funnel** with wire mesh for watering &**brick masonry block** cover, heavy duty **cast iron cover** complete as per IS : 3043. Necessary connections shall be done using **copper wire of 25 sq. mm** copper wire as per instructions of inspector connected to nearest switch gears as directed & duly tested by earth tester. Pipe electrode shall be of 1.5 M long 50 mm dia. class C GI pipe. The GI pipes shall be provided with holes at regular intervals as per IS : 3043. Each array structure and all metal casings of the panel etc. shall be earthed properly. And connected to ground hole including pure copper rod 50 sq.mm and adding salts and carbon. RESISTANCE TO EARTH The resistance of earthing system shall not exceed 1.0 ohm. MATERIALS:	

Item	Quantity
Copper earth rod of 35/50 sq. mm	1 meter
Charcoal & salt	20Kg
Copper wire of 25 sq. mm	As per system requirement.
C class GI pipe50 mm dia.	2 × 1.5 meter
Funnel	1
Cast Iron cover	1
Brick Masonry Block	Suitable for earth pit

Item	Quantity
Copper earth rod of 35/50 sq. mm	1 meter
Charcoal & salt	20Kg
Copper wire of 25 sq. mm	As per system requirement.
C class GI pipe50 mm dia.	2 × 1.5 meter
Funnel	1
Cast Iron cover	1
Brick Masonry Block	Suitable for earth pit

After Sale Service & Warranty		
1	The PV modules will be warranted for a minimum period of 25 years from the date of supply. **(Output wattage should not be less than 90% at the end of 10 years and 80% at the end of 25 years).**	The PV modules will be warranted for a minimum period of 25 years from the date of supply. **(Output wattage should not be less than 90% at the end of 10 years and 80% at the end of 25 years).**
2	The mechanical structures, electrical components including inverter and overall workmanship of the Solar System must be warranted for a minimum of **2 years.** Except the **batteries** should be warranted for **1 years.**	The mechanical structures, electrical components including inverter and overall workmanship of the Solar System must be warranted for a minimum of **2 years.** Except the **batteries** should be warranted for **1 years.**

3	**System Performance Should be Warranted for 1 Year with 80% Performance Ratio.**	**System Performance Should be Warranted for 1 Year with 80% Performance Ratio.**
4	The contractor shall make arrangement to maintain a sufficient stock of essential **spares and consumable spare parts** to ensure proper maintenance of the system promptly. (Necessary maintenance spares for **five years** trouble free operation shall also be supplied with the system)	The contractor shall make arrangement to maintain a sufficient stock of essential **spares and consumable spare parts** to ensure proper maintenance of the system promptly. (Necessary maintenance spares for **five years** trouble free operation shall also be supplied with the system)

Annex 6-B

2.7Kw Solar PV System Design (The Bidder must be Specify the below Categories)		
1	Single Solar PV Panel Output Power (W):	
2	Qty. of Solar PV Panels:	
3	Arrangement of Solar Panels:	
4	Total of Solar PV Capacity(W):	
5	Invert Operation Capacity (W):	
6	Inverter Battery Voltage System(Vdc):	
7	Mppt Voltage Range (Vdc) and Current (A):	
8	Max Solar Power Input (W):	
9	Single Battery Capacity(AH):	
10	Single Battery Voltage(V):	
11	Qty. of Batteries:	
12	Arrangement of Batteries:	
13	Total Storage Capacity(WH):	
14	Electrical & Wiring & Engineering Drawing and Details:	

Annex 7

Detail Specifications for Ceiling Fan

No.	Technical Specification	Offered Technical Specifications (Must be filled by Bidder) *Please Specify Technical Specifications in details below*
1	**Energy Efficient Ceiling Fan.**	
	Low Energy 40-50% less electricity power than a standard ceiling fan. The enhanced remote control & wall mounted controller system offers at least 4 speeds. Fan should be easily lowered or raised for simplified installation or maintenance. Fan blades should be lightweight and corrosion resistant. Powerful blade airfoil should provide greater airflow at lower power. Fewer blades and lower solidity ratio and long using time. Ceiling fan blades Should be a minimum of 220cm and a maximum of 260cm above the floor to be safe and effective. Designed to be safely shut-off switch.	
	• Voltage: **220 VAC, ±15%, 50 Hz ±2%.**	
	• Power: **Less than 70W; on High Speed.**	
	• Max. Speed: **At least 300 RPM**	
	• Wall Mounted Controller: **Standard with at least 4 speeds.**	
	• Sweep: **At least 1200 mm.**	
	• No. of Fan Blades: **3 or 4 blades.**	

	• Estimated Fan System Weight: **Less than 4.5/5Kg.** • Airflow: **At least 240 CMM.** • Sound Level: **Low noise.** • Operating Temperature: **Min. - 10.5C⁰ to Max. + 50C⁰.** • Speed Control: **At least 4 speeds can be adjusted.** • Materials: **Corrosion Resistant.** • Down rod length: **Standard.** • Warranty: **2 Years.** All materials of winding wire used in winding fan, shaft, bearing top, bottom bearing, blades, rod bottom and fan cover must be of high quality, resistant to environmental conditions in accordance with international standards.	
2	**LED Bulbs.** • Lamp Shape: **Bulb.** • Cap Types & Bases: Bayonet Bulbs - **B22d-BC/ E27 Light Bulb.** • Color temperatures (CCT): At least **6500K (White LED).** • Lamp Luminous Flux: **At least 1500 lm.** • Input Voltage (V): **AC220-240V.** • Lamp Power (W): **10 – 16 W.** • Lamp Luminous Efficiency (lm/w): **At least 90.** • Operation Temperature (C⁰): **-20 to 50** • Certification: All related certificates shall be provided as **CE, RoHS, , , etc.** • Working Lifetime (Hour): At least **10Kh.** • Warranty: **1 Years.** The bulbs should be provided with all accessories needed for installation and operation.	

Annex 8

Detail Specifications for Ceiling Fan

No.	Technical Specification	Offered Technical Specifications (Must be filled by Bidder) *Please Specify Technical Specifications in details below*
1	**Energy Efficient Ceiling Fan.**	
	Low Energy 40-50% less electricity power than a standard ceiling fan. The enhanced remote control & wall mounted controller system offers at least 4 speeds. Fan should be easily lowered or raised for simplified installation or maintenance. Fan blades should be lightweight and corrosion resistant. Powerful blade airfoil should provide greater airflow at lower power. Fewer blades and lower solidity ratio and long using time. Ceiling fan blades Should be a minimum of 220cm and a maximum of 260cm above the floor to be safe and effective. Designed to be safely shut-off switch.	
	• Voltage: **220 VAC, ±15%, 50 Hz ±2%.**	
	• Power: **Less than 70W; on High Speed.**	
	• Max. Speed: **At least 300 RPM**	
	• Wall Mounted Controller: **Standard with at least 4 speeds.**	
	• Sweep: **At least 1200 mm.**	

	• No. of Fan Blades: **3 or 4 blades.** • Estimated Fan System Weight: **Less than 4.5/5Kg.** • Airflow: At least **240 CMM.** • Sound Level: **Low noise.** • Operating Temperature: **Min. - 10.5C^0 to Max. + 50C^0.** • Speed Control: **At least 4 speeds can be adjusted.** • Materials: **Corrosion Resistant.** • Down rod length: **Standard.** • Warranty: **2 Years.** All materials of winding wire used in winding fan, shaft, bearing top, bottom bearing, blades, rod bottom and fan cover must be of high quality, resistant to environmental conditions in accordance with international standards.	
2	**LED Bulbs.** • Lamp Shape: **Bulb.** • Cap Types & Bases: Bayonet Bulbs - **B22d-BC/ E27 Light Bulb.** • Color temperatures (CCT): At least **6500K (White LED).** • Lamp Luminous Flux: **At least 1500 lm.** • Input Voltage (V): **AC220-240V.** • Lamp Power (W): **10 – 16 W.** • Lamp Luminous Efficiency (lm/w): **At least 90.** • Operation Temperature (C^0): **-20 to 50** • Certification: All related certificates shall be provided as **CE, RoHS, , , etc.** • Working Lifetime (Hour): At least **10Kh.** • Warranty: **1 Years.** The bulbs should be provided with all accessories needed for installation and operation.	

Annex 9

Detail Specifications for Solar Street Lighting System

No.	Technical Specifications	**Offered** Technical Specifications (Must be filled by Bidder) *Please Specify Technical Specifications in details below*
1	**WHITE-LED (W-LED) BASED SOLAR STREET LIGHTING SYSTEM** **Solar Street Light:** The luminaries is based on White Light Emitting Diode (W-LED), a solid state device which emits light when electric current passes through it. The luminaries is mounted on the pole at a suitable angle to maximize illumination on the ground. Electricity generated by the PV module charges the battery during the day time which powers the luminaries from dusk to dawn. The system lights at dusk and switches off at dawn automatically.	
	- Solar street light **30** watt to **40** watt **W-LED** light with combatable **solar panel, battery, controller** and **photocell**.	
	- The rated energy generated by Solar panel (For **7** hour sunny day) must be more than of the total consumption energy for **12** hour running time of LED light.	
	- The rated energy generated by Solar panel (For **7** hour sunny day) must be more than of the total storage capacity (Battery).	

	- **Auto** & **manual** running controlled.	
	- Long lifetime of LED.	
	- Running time at least **12** hour.	
	- Heavy body (**outdoor** type and **anti-corrosive**).	
	- Supply with all **wiring** and **accessories**.	
	- Provide with all **standards** & **certificates** which related.	
	- Beam Angle: **120⁰ to 160⁰**.	
	Suitable Box: - Suitable Box for System Should be **anti-corrosive, anti-theft** and **photocell.**	
	- Suitable **mounting structure** for Box and LED light.	
	- **Outdoor** type: (The lamps should be housed in an assembly suitable for outdoor use).	
	- Light Source: White Light Emitting Diode (W-LED).	
	- Light Output: Minimum 15 Lux when measured at the periphery of 4 meter diameter from a height of 4 meter. The illumination should be uniform without dark bands or abrupt variations, and soothing to the eye. Higher light output will be preferred.	
	- Mounting of light: Minimum 4 meter pole mounted.	
	- PV Module: At least of **100 Wp** under STC. **Or suitable capacity to operate unit 12h in night.**	
	- Battery: Lead acid **GEL / AGM (VRLA) Or lithium ion battery. The battery should be at least** 12V- 40 AH @ C/10. Or **suitable capacity to operate unit 12h in night.**	
	- The color temperature of white LED used in the system should be in the range of **5500°K–6500°K**.	
	- The total efficiency should be at least **85%**.	
	- Adequate protection should be provided against battery **reverse polarity**.	
	- The pole should be made of **Galvanized Iron (GI) pipe**.	

	- The height of the pole should be **4 meter** above the **ground level**, after grouting and final installation.	
	- The pole should have the provision to hold the luminaries.	
	- The lamp housing should be **water proof** and should be **anti-corrosion**.	
	- A **vented, acid proof** and **corrosion resistant metallic box** with a **locking arrangement for outdoor** use should be provided for housing the battery.	
	- The street lighting system (including the battery) will be **warranted** for a period of **2 years** from the date of supply and installation.	
	- Operating Temperature: **Min. - 10.5C^0 to Max. + 50/60C^0.**	
	- Materials: **Corrosion Resistant.**	