Technical Specifications

1. Solar Photovoltaic (PV) Array

- The PV module must be of crystalline type;
- The peak power of individual module must be at least 250Wp at Standard Test Conditions;
- The module efficiency for PV module must be at least 15% and the fill factor must be at least 70%;
- The module must have minimum 60 cells;
- The junction box must have at least IP65 protection according to IEC 60529;
- The operating temperature must be in the range of -20^{o}C to +50^{o}C;
- The warranty must be as follows.

  Product Warranty: ≥ 5 years
  Performance (Power Output) Warranty:
  10 years: ≥ 90% of STC Power
  25 years: ≥ 80% of STC Power
- The RETS Certificate (PIT Certificate and RST Certificate) must be provided;
- All PV modules offered for the project must be of same type, same model, same power rating and from the same manufacturer;
- The technical datasheet of PV Module must be provided;
- The following documents must be provided.
  - **RETS (PIT and RST) Certificates**

2. Pump Controller

- The pump controller must be of Maximum Power Point Tracker (MPPT) type;
- The efficiency of MPPT must be at least 95%;
- The pump controller must have at least IP65 protection according to IEC 60529;
- The pump controller must include the protection against dry run, PV reverse polarity, PV short circuit, temperature, lightning;
- The operating temperature must be in the range of -20^{o}C to +50^{o}C;
- The warranty must be of minimum 2 years;
- The technical datasheet of Pump Controller must be provided.

3. Solar Pump

- The Solar Pump must be Submersible or Surface and of DC type;
- The motor used shall be brushless DC motor (BLDC);
- The pump set (pump motor) efficiency must be at least 50% at rated head and discharge. The pump performance curve (flow vs. power at rated head) must be provided.
- The pump set must have at least IP68 protection for Submersible Pump and at least IP65 for Surface Pump according to IEC 60529;
- The pump set must include the protection against reverse polarity, short circuit, temperature, lightning;
- The pump must be manufactured with non-corrosive materials. Ceramic or equivalent non corrodible materials must be used for bearings. Rotors and impellers must be made of stainless steel with a minimum grade of AISI 304 or higher;
- The oil must not be used for lubrication;
- The operating temperature must be in the range of -20^{o}C to +50^{o}C;
- The manufacturing warranty must be of minimum 2 years;
- The solar pump Test Report from IEC accredited laboratory must be provided according to:

  IEC 62253:2011 - Photovoltaic pumping systems - Design qualification and performance measurements

  The Solar Pump must be certified by Certification Body Testing Laboratory (CBTL) or Renewable Energy Testing Laboratory (RETL) or National Certification Body (NCB) or Renewable Energy Certification Body (RECB) enlisted in the IECEE website or IECRE website.

- The technical datasheet of Solar Pump must be provided;
- The following documents must be provided.
  - **Pump performance curve**
  - **IEC Test Report**

Note: For the pump capacity equal to or greater than 7.5hp, AC pump can also be eligible and IEC requirement is also not mandatory.

4. DC Combiner Box

- The DC combiner box shall be rated for exterior installation suitable for the Site Conditions, shall be UV and weather resistant and must be rated minimum for IP65 according to IEC 60529;
- The DC combiner box shall have DC breaker and must comply with IEC 60947-2;

- The DC combiner box must have appropriately sized surge protection device conforming to IEC 61643-31:2018 or EN 50539-11:2013 and grounded adequately;
- The DC combiner box installation shall be protected from direct rain, sun and dust;
- All cables must be connected properly and cable entering/outings into/from the box must be sealed properly (use of cable glands, cables shoes, copper tube, thimble, cable ties) so that dust and insects, mice cannot enter the box.

5. Support Structure for PV Modules

- The support structure must be tilted at given latitude/longitude of the site and oriented towards south;
- The mounting structure should withstand wind speed up to 170 km/hr;
- The solar PV module structure must be made of MS galvanized suitable sections of rectangular tubes/angles/channels. There must be minimum of 25mm uniform spacing between the modules;
- The mounting structure shall be installed in such a way that PV array shading is minimized as much as possible considering site condition;
- The minimum clearance between ground level and bottom edge of the PV modules/arrays must be at least 80cm for ground based;
- Stainless Steel (SS 304) nuts & bolts should be used for fixing modules with the structure. Stainless Steel (SS 304) or Galvanized bolts, nuts, fasteners, washers, mounting clamps should be used for fixing structure and compatible with materials which it is being fixed. In case of welding structure, the galvanization should be done after the fabrication work.

6. Cables and Accessories

- All cables must be of copper and DC type;
- Cables shall be selected with an insulation voltage level applicable to the system voltage for which they are used and ampacities suitable for the load being serve;
- Cables shall be multi-strand, PVC insulated cables and UV resistant, suitable for outdoor installations;
- The allowable voltage drop from PV module or PV array to pump controller to pump must be less than 3%;
- The outdoor cables from PV array to pump should be fitted with adequate size of HDPE or GI pipe;
- All external wiring, cabling, insulation material and junction boxes must be UV-resistant and terminals protected against dust and moisture.

7. Lightning Protection System

a. Air Termination System

- The lightning air termination system must have following specifications.
    - The air terminal rod must be at a minimum height of 1 meter above the highest point of the PV array to be protected;
    - The minimum thickness of the 1-meter top part must be of 8-10 mm diameter;
    - The air terminal rods must be made of stainless steel, aluminum or copper or copper bonded. If copper bonded is used then it must be of minimum 150 microns;
    - The air termination system shall have as few joints in it as possible. The joints may be clamped, screwed, bolted, crimped, riveted or exothermic welded and must be electrically connected;
    - The air terminal rod must be rated to withstand a discharge current capacity of 200kA;
    - The air terminal rod must comply with IEC 62305.
- The technical datasheet of Air Termination System must be provided.

b. Down Conductor

- The down conductor must have following specifications.
    - The minimum size of the down conductor system must be of 50mm^2 cable
    - The down conductor must be electrically connected to air termination system by clamping, screwing, bolting, crimping, riveting or welding;
    - The down conductor must be made of GI or aluminum, copper or copper bonded. If copper bonded is used then it must be of minimum 150 microns;
    - The down conductor must comply with IEC 62305.
- The technical datasheet of Down Conductor must be provided.

c. Earth Electrode

- The earth termination system must have following specifications.
    - The earth termination system shall consist of earthing rod(s);
    - The length of the earthing electrodes must be minimum 1.5 meters length and the diameter of rod must be minimum 20 mm;
    - The earthing electrodes must be made of copper or copper bonded. If copper bonded is used then it must be of minimum 250 microns;
    - The earth electrode must be electrically connected with down conductor by clamping, screwing, bolting, crimping, riveting or welding;
    - The maximum allowable earth resistance is 10 Ohms;
    - The earth termination system must comply with IEC 62305.
- The technical datasheet of Earthing System must be provided.

d. Surge Protection Device (SPD)

- The SPD must be DC type;
- The SPD must have following specifications;
  - Type of SPD: Type 2
  - Maximum Continuous Operating Voltage: (670) VDC
  - Voltage Protection Level at In: 2.8kV
  - Nominal Discharge Current In (8/20): 20kA
  - Maximum Discharge Current In (8/20): 40kA
- The SPD must comply with IEC 61643-31:2018.
- The technical datasheet of SPD must be provided.