

## **100 kW Solar PV Experimental set up**

### **1 Solar Photovoltaic Module for a total capacity of 100 kW Setup with suitable panel structure**

- Comprising of solar crystalline modules of minimum 200 Wp and above wattage

### **2. ARRAY JUNCTION BOX, MAIN JUNCTION BOXES :**

- The junction boxes are to be provided in the PV yard for termination of connecting cables. The J. Boxes shall be made of FRP/Powder Coated Aluminium with full dust, water & vermin proof arrangement. All wires/cables must be terminated through cable lugs. The J.Bs shall be such that input & output termination can be made through suitable cable glands.
- Made of FRP or cast aluminium/ copper
- Copper bus bars/terminal blocks housed in the junction box with suitable termination threads
- Conforming to IP65 standards and IEC 62208 Hinged door with EPDM rubber gasket to prevent water entry. Single compression cable glands. Provision of earthing. it should be placed at 5 feet height or above for ease of accessibility.
- Each Junction Box shall have High quality Suitable capacity Metal Oxide Varistors(MOVs) / surge arrestors, suitable Reverse Blocking Diodes. The Junction Boxes shall have suitable arrangement monitoring and disconnection for each of the groups.
- Array tilt angle to the horizontal, with permitted tolerance;
- Interconnection details inside the junction/terminal boxes;
- Structure installation details and drawings;
- Electrical grounding (earthing);
- Inter-panel/Inter-row distances with allowed tolerances

## 2. Power Conditioning Unit

- Control Type: : Voltage source , microprocessor assisted , output regulation
- Output voltage : 3 phase, 415 V ac (+5 %)
- Frequency : 50 Hz (  $\pm$  0.5%) variation
- Continuous rating : 100 KVA Hybrid inverter (Grid tied and off Grid)
- DC link voltage range : 0 to 600 V
- Nominal Power : 100 kVA
- Standard conformation : IEC 61683
- Total Harmonic Distortion : less than 3%
- Operating temperature Range : -25 to 60 deg C
- Housing cabinet : PCU to be housed in suitable switch cabinet, Within IP 20 degree of ingress protection
- PCU efficiency : 94 % and above at full load,
- Power Control : MPPT
- DISCONNECTION AND ISLANDING (GRID TIED MODE)
  - Disconnection of the PV generator in the event of loss of the main grid supply while on Grid Tied Mode
- DISCONNECTION (OFF GRID TIED MODE)
- any over lover load detected at PCU, should intelligently actuate changeover switch at any one place aforementioned above to bring the connected load within the available capacity of SPV generation within 5 seconds to ensure continued utilization of generated energy.

## 3. Power Electronic Conversion:

Necessary DC-DC Boost Converters for raising generated PV voltage

Inverters for interfacing to grid

## 4. Sensors and Data Logging system

- PV array energy production: Digital Meters to log the actual value of AC/DC Voltage, Current & Energy generated by the PV system shall have to be provided. Two way LT 415V energy meter (Import - Export metering) shall be incorporated in the system on the main LT AC Grid supply.

- Solar Irradiance an integrating pyranometer should be provided with the sensor mounted in the plane of the array. Readout should be integrated with data logging system .
- Wind Speed: An integrated wind speed measurement unit is provided.
- Temperature Sensor: Integrated temp, sensors for measuring the module surface temp., inverter inside enclosure temp, and ambient temp to be provided complete with readouts integrated with the data logging system.
- A data logging system (Hardware and software) for plant control and monitoring shall be provided with the following features:
  - Two no's suitable Computers : 2.7 GHz Pentium with 500GB HDD, 2GB RAM, 2 Serial Port, Wi-Fi Lan Card, DVD RW Drive , 20" LCD, USB Scroll Mouse, along with 1 KVA ups .
  - GSM Modem / Wi Fi modem in case GSM connectivity is used or Wireless Router + modem in case Ethernet connection is being used for remote access must be provided.
  - Remote Supervisory Control and data acquisition through LABVIEW software at the purchasers location with latest software/hardware configuration and service connectivity for online / real time data monitoring/control complete to be supplied and operation and maintenance/control to be ensured by the supplier.
  - Interface of all the sensors to the computing system(PC, dSPACE-1103)
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## **5. DC Distribution units**

DC Distribution panel to receive the DC output from the array field with analog measurement meter for voltage, current and power from different MJBs so as to check any failure in the array field.

DC DPBs shall have sheet from enclosure of dust & vermin proof. The bus bars are to made of copper of desired size. Suitable capacity MCBs be provided for controlling the DC power output to the PCU along with necessary surge arrestors.

## **6. AC Distribution units**

AC Distribution Panel Board (DPB) shall control the AC power from PCU, and should have necessary surge arrestors. Interconnection from ACDB to mains at LT Bus bar while in grid tied mode and to distribution panel of aforementioned five places when operating in off grid mode, be carried out and complete equipment, sensors along with metering to be installed in the ACDB and switch room at each locations where power is required to be fed. Requirement/specifications of DCDB and ACDB may be changed as per site conditions. An ACDB to be provided at the cable terminating point emanating from 100KVA PCU for interconnection control of dedicated electrical loads.

7. Fire extinguisher in accordance to the set-up BIS codes for electrical short circuit fires along with sand buckets

8. Lightning arrester complete set

9. Earthing complete set

10. Fuses, Transfer switches, Printed Circuit boards required for power

11. Active Power Filter Setup using CRIO Based FPGA System

**Out of the 100 KW PV System, 90 KW will feed the local load and the rest 10KW (5KW × 2) will be used for experimentation on grid integration issues and verification newly developed control algorithms on**

**a) Maximum Power Point Algorithms**

**b) DC Link Voltage control**

**c) Effects on modulation techniques on the inverter control are to be provided.**

**The 10 KW PV system is to be equipped with an AC Programmable power source to act as a grid.**

**12. Proteus and PV system software**