



Phone :+91-512 -2597102(O)  
 +91-512-2597832(Lab)  
 +91-512-2598772 (R)  
 Fax: +91-512-2590063  
 e-mail: [rsanand@iitk.ac.in](mailto:rsanand@iitk.ac.in)  
 Home page: [home.iitk.ac.in/~rsanand](http://home.iitk.ac.in/~rsanand)

No.IITK/EE/RSA/2011/27  
 Department of Electrical Engineering  
 INDIAN INSTITUTE OF TECHNOLOGY  
 KANPUR 208016 INDIA

05 Jan 2012.

Dr. RAGHUBIR SINGH ANAND  
 Principal Research Engineer

### TENDER NOTICE

**Subject: Automated Monitoring System for 5x10 KW PV Power Plant**

We are setting up 5 x 10KW = 50 KW Photovoltaic (PV) power plant to study the performance of different PV technologies. We like to setup an automated monitoring system to evaluate the performance of each technology in terms of voltage, current, energy, power output along with solar radiation, temperature, moisture, wind and rain measurements.

Quotations are invited to supply the following components and to develop online data acquisition and monitoring system taking into account the following parameters.

1. Voltage, current, power, energy and temperature to be monitored at string levels
  - a. Details of strings voltage and current etc. are given in Annexure 'A' and sketch of the proposed system is given in Annexure 'B'
  - b. Compatible voltage and current transducers compatible with controller and input modules are to be provided.
  - c. **Suitable controller, chasis, input modules as given below will be provided (Being procured separately).**

Monitoring Station for	Voltages of Strings	Current of Strings	Temperature of Strings	No. of cRIO Controller and Chasis	No. 9205 16 Channel Analog Input modules	9213 16 Channel Thermocouple Input modules	9871 4 Channel RS 485 modules
5x2KW crystalline Silicon	6	6	8	9075 – 4 slots	1	1	1
5x2KW Multi-crystalline Silicon	4	4	6	9075 – 4 slots	1	1	
10KW thin film Silicon	36	36	38	9074 – 8 slots	4	2	1
10KW thin film CIGS	22	22	24	9074 – 8 slots	4	2	
High Efficiency Concentrated PV System	1	1	4	9075 – 4 slots	1	1	1

2. Monitoring of Voltage, Current, power, energy data on DC and AC Side of Inverter (Networked through RS485 or Ethernet).
3. Solar Radiation Measurement using Pyranometer- 3 Nos (Horizontal, in-plane & on Tracker at Normal Incidence)
4. Pyroheliometer for Normal Incidence 1 No. (**Will be provided**)
5. Temperature Sensor - 80 Nos.
6. Humidity Sensor 1 Nos.
7. Rain Gauge/Tipping bucket 1 No.
8. Anemometer (Velocity and direction) 1 No.

Other Requirements:

- (a) All data to be collected, monitored in real time through WiFi or Ethernet to a server for display. **(Server PC will be provided by the IITK).**
- (b) To be stored in tabular form and be displayed graphic mode with respect to suitable time/day/month/year format.
- (c) The software integration should provide the capability to acquires, analyzes, and presents the results of the I-V characterization of strings on a central computer.
- (d) Software capabilities should include efficiency, fill factor, maximum power, open circuit and short circuit voltages and current respectively.
- (e) All connectors, switches, wires should conform to the ISI or international standards.
- (f) All sensors of make RM Young or equivalent with calibration certificate from IMD or other internationally recognised laboratories.
- (g) The PV systems and monitoring room will be within an area 25x40 meter square (See Annexure 'B'). Suitable wired (e.g. RS 485) /wireless protocol for data transmission to be provided.
- (e) At least 3 years warranty of hardware and monitoring system.

**Last date & time for receiving the Quotation is 22 Jan 2012, 5pm.**

(RS ANAND)

**Details of the Photovoltaic Systems**

1. Mono-crystalline 2 x 5KW

Number of strings for 5 KW Fixed Angle PV system -3 Nos.  
String Voltage ( $V_{OC}$ ) for 2 strings - 365.92V for each string  
String Voltage ( $V_{OC}$ ) for 1 string - 411.66 V for each string  
String Current ( $I_{SC}$ ) - 6A of each string  
Number of strings for 5 KW 2D Tracking PV system -3 Nos.  
String Voltage ( $V_{OC}$ ) for 2 strings - 365.92V for each string  
String Voltage ( $V_{OC}$ ) for 1 string - 411.66 V for each string  
String Current ( $I_{SC}$ ) - 6A of each string

2. Multi-crystalline 2 x 5KW

Number of strings for 5 KW Fixed Angle PV system -2 Nos.  
String Voltage ( $V_{OC}$ ) for 2 strings - 403.7V for each string  
String Current ( $I_{SC}$ ) - 8.4A of each string  
Number of strings for 5 KW 2D Tracking PV system -2 Nos.  
String Voltage ( $V_{OC}$ ) for 2 strings - 403.7V for each string  
String Current ( $I_{SC}$ ) - 8.4A

3. Thin Film Amorphous Silicon 2 x 5KW

Number of strings for 5 KW Fixed Angle PV system -18 Nos.  
String Voltage ( $V_{OC}$ ) for 18 strings - 411.0V for each string  
String Current ( $I_{SC}$ ) - 1.15A of each string  
Number of strings for 5 KW Tracking PV system -18 Nos.  
String Voltage ( $V_{OC}$ ) for 18 strings - 411.0V for each string  
String Current ( $I_{SC}$ ) - 1.15A of each string

4. Thin Film CIGS 2 x 5KW

Number of strings for 5 KW Fixed Angle PV system -11 Nos.  
String Voltage ( $V_{OC}$ ) for 11 strings - 445.0V for each string  
String Current ( $I_{SC}$ ) - 1.68A of each string  
Number of strings for 5 KW Tracking PV system -11 Nos.  
String Voltage ( $V_{OC}$ ) for 11 strings - 445.0V for each string  
String Current ( $I_{SC}$ ) - 1.68A of each string

5. High Efficiency Concentrated PV System 1.8 KW

Number of strings for 1.8 KW Tracking PV system -1 Nos.  
String Voltage ( $V_{OC}$ ) for 1 string - 204.0V  
String Current ( $I_{SC}$ ) - 8.8A

6. Pyranometer for Solar Radiation (visible range) measurement ( $\Rightarrow 1000 \text{ W/m}^2$ ) - 3 Nos.  
Make RM Young or equivalent with calibration certificate from IMD.

7. Anemometer(Ultrasonic) for Speed and Direction - 1 No.  
Make RM Young or equivalent with calibration certificate from IMD.

8. Hygrometer with Multi-Plate shield for humidity measurement - 1 No.  
Make RM Young or equivalent with calibration certificate from IMD.

9. Rain Gauge Measurement - 1 No.

10. Development of software for collection and display of data in graphical form using Ethernet.

# Annexure 'B'

