Supporting Structural Reforms in the Indian Power Sector



Specifications for Remote Monitoring System- PM KUSUM Component A, C

Supporting Structural Reforms in the Indian Power Sector

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Contents

Disclaimer2
Specifications for Remote Monitoring System – Grid Connected Solar Pumps4
Specifications for Remote Monitoring System – Decentralised Gird Connected Solar Plants.7
System Components and Architecture: PM KUSUM Component C: Option 1 (Net Metering) 9
System Components and Architecture: PM KUSUM Component C: Option 2 (Pump to run on solar power only)
System Components and Architecture: PM KUSUM Component C or A: Option 3 (Solarisation of agricultural feeder at sub-station level)

Specifications for Remote Monitoring System – Grid Connected Solar Pumps

- 1. State Implementing Agency (SIA) will have a common SWPS (Solar Water Pumping System) Management platform for monitoring of operation and performance of SWPS installed under PM KUSUM Scheme.
- 2. Remote Monitoring System (RMS) of SWPS should have following minimum features or modules
 - a. Solar System Performance: DC Voltage, DC current, AC output Current, Power, Energy, Inverter Status, Drive Frequency etc.
 - b. Pump Performance and Protections: Parameters such as Running Hours, Water Discharge (Output), Voltage, Current, Power, Energy of pump as well as protections required for "On Grid Systems" such as Over Voltage, Under Voltage, Voltage Un Balance, Overload, Short Circuit, Earth Leakage protection etc.
 - c. Net Metering:
 - i. As per CEA guidelines, on grid solar plant will require minimum Two energy meters mainly:
 - Bi-Directional Grid Interface Meter
 - Solar Generation Audit Meter.
 - ii. Remote Monitoring System should have provision to integrate both energy meters on DLMS communication protocol on RS232 ports
 - iii. Important electrical parameters of Bi-Directional Grid Interface Meter such as Imported Energy, Exported Energy, Net Energy, Solar Generation Energy, Voltage, Power (Import or Export)
 - iv. Important electrical parameters of Solar Generation such as Voltage, Current, PF, Power, Energy etc.
 - d. Billing Data Management: Remote Monitoring System should provide Billing parameters from Bi-Directional Grid Interface meter required by DISCOMS
 - e. RMS Performance: %Device Connectivity, %Data Availability etc.
 - f. Events and Notifications: Faults related to Pump Operation, Solar generation, inverter fault, Controller/Drive faults like overload, dry run, short circuit etc.
 - g. Consumer Management: Name, Agriculture details, Service No, Contact Details etc.
 - h. Asset Management: Ratings, Serial Number, Make, Model Number of Pump, Panel and Controller, IMEI number (of communication module) and ICCID (of SIM) etc.
 - i. Complaint and Ticket Management
 - j. Consumer Mobile Application: Generation, Running Hours, Water Discharge, Complaint logging, etc.
- 3. Remote Monitoring System (RMS) provided by all bidders should connect to State Level Solar Energy Data Management platform, which will have interface with National level Solar Energy Data Management platform.
- 4. Communication Architecture between SWPS and RMS should be as per following:
 - a. Communication Connectivity:
 - i. **Field Device Connectivity:** Communication between RMS and Pump Controller / Inverter should be on RS485 MODBUS RTU protocol to ensure interoperability irrespective of make and manufacturer
 - ii. **Remote Connectivity:** RMS of SWPS should be using GSM/GPRS/2G/3G/4G cellular connectivity

- iii. Local Connectivity: Ethernet/Bluetooth/Wi-Fi connectivity to configure parameters, notifications, communication interval, set points etc. or to retrieve locally stored data
- iv. Sensor Connectivity: RMS should have provision for at least four Analog inputs with 0.1% accuracy to address the requirement of local sensors connectivity if required by SIA/Consumer for applications such as irradiation, flow meter for water discharge, moisture sensor for micro irrigation etc. and four digital inputs.
- RMS should have provision of relay or contactors of suitable ratings for remote pump operations with multiple modes such as farmer mobile app based operations / configurable schedule based operations / sensor based operations

b. Communication Modes:

- i. Push Data on Event/Notification: such as pump on, pump off, protection operated etc.
- ii. Push Data Periodically: important parameters of solar pump (as mentioned in tender) should be pushed to central server on configurable interval. Interval should be configurable in multiple of 1 minute.
- iii. Command On Demand: It should be possible to send commands via GSM or GPRS to RMS either to control pump operations or to update configuration

c. Communication Protocol:

i. RMS should provide data on MQTT Protocol to establish communication with thousands of systems.

d. Security:

- i. Communication between RMS and Server should be secured and encrypted using TLS/SSL/X.509 certificate etc.
- ii. As a part of IoT protocol, Authentication and Authorization should be implemented using token/password mechanism

e. Message Format:

i. RMS should provide data in a JSON message format as required by respective SNA

f. Data Storage:

- i. In case of unavailability of cellular network, RMS should store data locally and on availability of network it should push data to central server. Local data storage should be possible for at least one year in case of unavailability of cellular network.
- g. **Configuration Update Over-The-Air:** Configuration update over the air of multiple parameters such as IP, APN, Data Logging Interval, Set Points etc. is essential.

5. EMI/EMC Certifications:

1	Surge Immunity Test (IEC 61000-4-5)	A
2	Electrical Fast Transient (IEC 61000-4-4)	А
3	Electrostatic Discharge (IEC 61000-4-2)	A
4	Radiated Electromagnetic Field Test (IEC 61000-4-3)	А

5	Power Frequency Magnetic Field (IEC 61000-4-8)	A
6	Conducted Disturbances induced by radio frequency (IEC 61000-4-6)	A
7	Voltage Dips, short interruptions (IEC 61000-4-11)	A
8	Dry Heat test (IEC 60068-2-2), continuous operations @ 55 deg. C	0
9	Damped Heat Test (IEC 60068-2-78), @ 95% RH and 40 deg. C	0

Note: Passing Criteria

- A: Temporary degradation or loss of function or performance which is self-recoverable
- O: Normal performance within the specified limits

Specifications for Remote Monitoring System – Decentralised Gird Connected Solar Plants

- 1. State Implementing Agency (SIA) will have a common SWPS (Solar Water Pumping System) Management platform for monitoring of operation and performance of SWPS and decentralised solar plants installed under PM KUSUM Scheme.
- 2. Remote Monitoring System (RMS) of SWPS should have following minimum features or modules
 - a. Solar System Performance: DC Voltage, DC current, AC output Current, Power, Energy, Status of Inverter & String Combiner Box etc.
 - b. Net Metering:
 - i. As per CEA guidelines, grid connected solar plant will require minimum Two energy meters mainly:
 - Bi-Directional Grid Interface Meter
 - Solar Generation Audit Meter.
 - ii. Remote Monitoring System should have provision to integrate both energy meters on DLMS communication protocol on RS232 ports
 - iii. Important electrical parameters of Bi-Directional Grid Interface Meter such as Imported Energy, Exported Energy, Net Energy, Solar Generation Energy, Voltage, Power (Import or Export)
 - iv. Important electrical parameters of Solar Generation such as Voltage, Current, PF, Power, Energy etc.
 - c. Billing Data Management: Remote Monitoring System should provide Billing parameters from Bi-Directional Grid Interface meter required by DISCOMS
 - d. RMS Performance: %Device Connectivity, %Data Availability etc.
 - e. Events and Notifications: Faults related to solar generation, inverter fault/alarms, Breaker status change such as on/off/trip etc.
 - f. Asset Management: Ratings, Serial Number, Make, Model Number of Inverter, String combiner Box, IMEI number (of communication module) and ICCID (of SIM) etc.
 - g. Complaint and Ticket Management
- 3. Remote Monitoring System (RMS) provided by all bidders should connect to State Level Solar Energy Data Management platform, which will have interface with National level Solar Energy Data Management platform.
- 4. Communication Architecture between SWPS and RMS should be as per following:
 - a. Communication Connectivity:
 - i. **Field Device Connectivity:** Communication between RMS and Inverter / String Combiner Box should be on RS485 MODBUS RTU protocol to ensure interoperability irrespective of make and manufacturer
 - ii. **Remote Connectivity:** RMS of SWPS should be using GSM/GPRS/2G/3G/4G cellular connectivity
 - iii. Local Connectivity: Ethernet/Bluetooth/Wi-Fi connectivity to configure parameters, notifications, communication interval, set points etc. or to retrieve locally stored data
 - iv. **Sensor Connectivity:** RMS should have provision for at least four Analog inputs with 0.1% accuracy for applications such as breaker & transformer health etc. and four digital inputs for breaker status
 - b. Communication Modes:
 - i. Push Data on Event/Notification: Faults related to solar generation, inverter fault/alarms, Breaker status change

- ii. Push Data Periodically: important parameters of inverter, string combiner box and energy meter should be pushed to central server on configurable interval. Interval should be configurable in multiple of 1 minute.
- iii. Command On Demand: It should be possible to send commands via GSM or GPRS to RMS either to update configuration

c. Communication Protocol:

i. RMS should provide data on MQTT Protocol to establish communication with thousands of systems.

d. Security:

- i. Communication between RMS and Server should be secured and encrypted using TLS/SSL/X.509 certificate etc.
- ii. As a part of IoT protocol, Authentication and Authorization should be implemented using token/password mechanism

e. Message Format:

i. RMS should provide data in a JSON message format as required by respective SNA

f. Data Storage:

- i. In case of unavailability of cellular network, RMS should store data locally and on availability of network it should push data to central server. Local data storage should be possible for at least one year in case of unavailability of cellular network.
- g. **Configuration Update Over-The-Air:** Configuration update over the air of multiple parameters such as IP, APN, Data Logging Interval, Set Points etc. is essential.

5. EMI/EMC Certifications:

1	Surge Immunity Test (IEC 61000-4-5)	A
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4	Radiated Electromagnetic Field Test (IEC 61000-4-3)	А
5	Power Frequency Magnetic Field (IEC 61000-4-8)	А
6	Conducted Disturbances induced by radio frequency (IEC 61000-4-6)	A
7	Voltage Dips, short interruptions (IEC 61000-4-11)	A
8	Dry Heat test (IEC 60068-2-2), continuous operations @ 55 deg. C	0
9	Damped Heat Test (IEC 60068-2-78), @ 95% RH and 40 deg. C	0

Note: Passing Criteria

A: Temporary degradation or loss of function or performance which is self-recoverable

O: Normal performance within the specified limits

System Components and Architecture: PM KUSUM Component C: Option 1 (Net Metering)



System Components and Architecture: PM KUSUM Component C: Option 2 (Pump to run on solar power only)



System Components and Architecture: PM KUSUM Component C or A: Option 3 (Solarisation of agricultural feeder at sub-station level)

