

Annexure – I

Minigrid Power Conversion & Control System

End Use:-

To integrate different Power Sources like Solar Photovoltaic (PV), Battery Bank, Diesel Generator & Utility Grid as well as Three Phase Loads and also to control the Power Flow Intelligently in a Minigrid, as defined in the detailed specifications.

Detailed Specification:-

Minigrid Level:-

- 1) Solar PV integration capacity of at least 50kWp
- 2) Nominal voltage of battery bank = 48VDC
- 3) Battery bank integration capacity (at C10 charging rate) of at least 5000Ah
- 4) Compatible with battery bank made from Solar Tubular Flooded Lead Acid batteries
- 5) Three Phase load of rated capacity of at least 40kW
- 6) Permissible unbalanced phase to phase loading must be 100%
- 7) Diesel generator integration capacity of at least 50kW
- 8) The system offered must consist of at least two Independent Three Phase Standalone units, and each of the units must be capable to perform all the functionalities (mentioned in point no. 11) at its rated power level. Also combined parallel operation of all the units must perform all the functionalities at the full power rating (mentioned above) of minigrid.
- 9) Remote monitoring capability of system parameters must be provided. The remote monitoring unit must satisfy at least the following requirements.
 - a) LAN/WiFi/GSM SIM card based data transfer to server.
 - b) Web portal based data access by user.
 - c) Data to be recorded at sampling period of 15 minutes or less.
 - d) At least last 30 days of data must be accessible and downloadable (in CSV format) from web portal.
 - e) Parameters to be recorded: - Voltage, Current and Power of Solar PV, Battery Bank, Diesel Generator (all three phases), Utility Grid (all three phases), Load (all three phases). The parameters which are specific to each of Independent Three Phase Standalone units and common parameters for the complete system must be recorded.
 - f) Power and energy trends must be available and downloadable (in CSV format) from web portal.
 - g) Alarm and event log with time stamps must be saved for at least last 50 alarms and events.
- 10) The system offered must be modular, scalable and capable of supporting increase of loads in future. The system must allow addition of more number of Independent Three Phase

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Standalone units to the already existing units. The system should be scalable to increase the power capacities (in future) of different components as following :

- a) Solar PV integration capacity of at least up to 100kWp
 - b) Battery bank integration capacity (at C10 charging rate) of at least up to 15000Ah
 - c) Three phase load of rated capacity of at least up to 80kW
 - d) Diesel generator integration capacity of at least up to 80kW
- 11) The system offered must be capable to perform following functionalities.
- a) Operational capability for On and Off grid conditions.
 - b) Seamless transition of power from one source to another.
 - c) Configurable control functions to set the usage priority of different sources. Default setting must give highest priority to Solar PV for supplying load power and battery bank is to be charged with excess solar power.
 - d) Remote start/stop of diesel generator (with Automatic Mains Failure control panel) based on the battery bank charge levels.
 - e) Option to enable/disable charging of battery bank from diesel generator and utility grid (only one of either diesel generator or utility grid will be used at a time).
 - f) Provision of export of excess solar power to grid must also be provided.

Each of the Independent Three Phase Standalone Unit must satisfy the technical requirements mentioned below.

Solar PV:-

- 1) Maximum allowable PV input DC voltage $\geq 900\text{VDC}$
- 2) MPPT voltage range = Minimum value $\leq 420\text{V}$ & Maximum Value $\geq 700\text{V}$
- 3) Start-up voltage $\leq 330\text{V}$
- 4) Initial feed-in voltage $\leq 360\text{V}$
- 5) Number of independent MPPT channels $\geq 2\text{Nos.}$
- 6) Number of PV input pair per MPPT channel $\geq 2\text{Nos.}$
- 7) Maximum allowed input current per MPPT channel $\geq 18\text{A}$
- 8) Maximum PV input power $\geq 18\text{kW}$

Battery Bank:-

- 1) Nominal voltage = 48VDC
- 2) Battery type = Solar Tubular Flooded Lead Acid Battery
- 3) Maximum charging power $\geq 12\text{kW}$
- 4) Maximum battery charging current, Bulk and Float voltage values must be user settable.

Diesel Generator And Utility Grid:-

- 1) Three phase four wire connection
- 2) Nominal AC input voltage = 230V/phase
- 3) Acceptable AC input voltage range for proper operation = Minimum value $\leq 190\text{V/phase}$ & Maximum Value $\geq 260\text{V/phase}$

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- 4) Nominal input frequency = 50Hz
- 5) Input frequency tolerance for proper operation $\geq \pm 4\%$

Output Load:-

- 1) Rated load power $\geq 14\text{kW}$
- 2) Three phase four wire connection
- 3) Nominal AC output voltage per phase = 230V
- 4) Nominal output frequency = 50Hz
- 5) Permissible unbalanced phase to phase load = 100%

Protection:-

- 1) Overvoltage and Overcurrent protection at both AC & DC input and output sides.
- 2) Surge Protection Device (SPD) on each of MPPT channel input, utility grid and output load.
- 3) On-load disconnection with current protection on battery input via a Switch Fuse Unit (SFU).

Environmental & General Requirements:-

- 1) Operating ambient temperature range = Minimum value $\leq -3^{\circ}\text{C}$ & Maximum Value $\geq 50^{\circ}\text{C}$
- 2) No derating of output power is allowed below 45°C and above that at a maximum rate of 1% per degree
- 3) Ingress Protection $\geq \text{IP21}$
- 4) Warranty ≥ 2 years
- 5) Wall mountable

User Interface & Remote Monitoring:-

- 1) Graphical display for control & monitoring
- 2) Remote monitoring capability as mentioned above
- 3) Communication provision for parallel operation with other similar units

Scope of Supply & Incidental Services:-

1. Supplier must supply the complete system fulfilling all the technical requirements at the site i.e. CSIR-CMERI-CoEFM, Ludhiana, Punjab.
2. Supplier must also provide support for successful installation & commissioning of the system by means of deputing trained engineers at the site location.
3. Supplier must inform in advance, the requirements at site from client's side to ensure timely and successful installation & commissioning of system.

Inspection and Tests Required:-

On request factory inspection and testing for full load and functionalities must be offered by supplier.

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Acceptance Test:-

After delivery of the necessary components of the system, supplier must also provide support for successful installation & commissioning of the system by means of deputing trained engineers at the site location. Following acceptance tests will be carried out on the installed system:

1. Each of the independent three phase units will be tested individually for their functionalities, by providing power inputs from solar PV panels and battery bank.
2. Functionalities of the total system through parallel operation of independent three phase units will also be tested, by providing power inputs from solar PV panels and battery bank.
3. Functionality for remote start/stop of diesel generator (with Automatic Mains Failure control panel) will be checked.

Qualification Criteria:-

1. Supplier must submit technical literature along with datasheets, explaining in detail how the required functionalities and specifications will be fulfilled by the proposed system.
2. Bid documents which merely provide compliance statements mentioning that all the required specifications and functionalities are fulfilled, without attaching proper supporting technical literature, will not be accepted.
3. Supplier must have supplied at least one system with similar functionalities at a power rating of 15kW or above to any of Government/Private Sector organizations, during last three years. Relevant purchase order copies from end users are to be attached with the technical bid as documentary evidence.

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