RFP. No.: PAKIS/RFP/23/023

Specifications for Electrical Equipment

This annexure presents the minimum requirement required to be met by the VENDOR, for the equipment to be procured under this RFP. VENDOR shall provide all relevant technical documents/ datasheets of the proposed equipment, ensuring that the technical specifications and characteristics are clearly specified in the documents and are compliant with specifications provided in this document. Product brochures, catalogues, manuals, and verifiable relevant certificates must be attached with the technical proposal. Within the scope of this RFP, VENDOR must ensure to propose compatible products i.e., electrical characteristics of solar panels, inverters and battery banks must be compatible with each other.

Solar Panel

Parameter	Specification
Operational Temperature Range	-20°C ~ +80°C
Type	Tier-1 (A-Grade) Monocrystalline (Half Cut Cell Mono-PERC)
Maximum Power	≥ 540 W at STC[1]
Power Output Tolerance	Positive
Module Efficiency	≥ 20%
Open Circuit Voltage	Vendor to specify
Short Circuit Current	Vendor to specify
Junction Box	Weatherproof terminal junction box having at least IP67 protection with provision of opening for replacement of DC cables, blocking diodes and easy debugging, if necessary
Protection	Class II as per IEC 61730-1
Fire Rating	Minimum Class C as per IEC 61730-2
Frame	Anodized aluminum alloy frame with anti-reflective, hydrophobic, low-iron tempered cover glass
Mandatory Certification	• IEC 61215 • IEC 61730
Desirable Certification	• UL 1703 • IEC 60364-4-41 or equivalent • IEC 62804-1 or equivalent • IEC 60068-2-68 or equivalent
Material Warranty	Minimum 10 years for manufacturing defects
Performance Warranty	≥ 80% of Maximum Power after 25 years
Weight	Vendor to specify
Dimensions	Vendor to specify

General Requirements

- N-Type Mono PV Cell Modules are desirable
- The PV module should be compatible with the proposed inverter.

[1] STC (Standard Test Conditions): Irradiance of 1000 W/m2 (1 kW/m^2) with the panel and cells at ambient temperature of 25°C with a sea level air mass (AM) of 1.5.

- Unique Serial number, Name / Logo of manufacturer and date of manufacturing (DD/MM/YYYY) should be laminated inside the module so as to be clearly visible from the front side.
- A properly laminated sticker containing the following details should be available at the back side of the module:
    - Name of the manufacturer / distinctive logo
    - Model Name and Type of Cell Technology
    - Peak Watt Ratting (W_p) and Power Tolerance Range
    - Voltage (V_{mp}) and Current (Imp) at STC
    - Open Circuit Voltage (V_{oc}) and Short Circuit Current (I_{sc})
    - Maximum System Voltage (V_{dc})
    - Dimensions of PV Module
    - Test Standard(s) to which the module has been tested and certified
    - Verification barcode
- The PV modules offered should not be more than 12 months old from the date of issue of payment order.
- PV Module should have a Snow Load bearing of 5400 Pa and Wind Load Bearing of at least 2400 Pa

Hybrid Inverter

Parameter	Specification
Ambient Temperature Range	-20°C ~ +50°C
Type	Hybrid
DC Input Rated Voltage	Vendor to specify
DC Input Rated Current	Vendor to specify
AC Rated Output Power	Vendor to specify
AC Rated Output Voltage	230 ± 5% or 240 ± 5% V Single phase Hybrid Inverter
AC Rated Output Voltage	400 ± 5% or 415 ± 5% V Three phase Hybrid Inverter
AC Output Waveform	Pure sinusoidal (<3% harmonic distortion)
AC Output Frequency	50±0.05 Hz
AC Output Rated Current	Vendor to specify
Power Factor Range	0.8 leading to 0.8 lagging
Efficiency	≥95%
MPPT	Multi-string/multi-MPPT inverter
Degree of Protection	Minimum IP 42 (outdoor installation under shade)
Protection	Input reverse polarity, under/over voltage, over current, short circuit, overheating, lightning induced transient
Battery Type	Lithium $LiFePO_4$
Battery Voltage Range	To be matched with proposed battery
Display	LED indicators for normal operation and faults; display for the following minimum input/ output electrical parameters: • DC Input Voltage • DC Input current • AC Output Voltage • AC Output Current • AC output Power (kW) • Current time and date • Energy Generated (kWh)

Parameter	Specification
	• Energy Exported to the Grid (kWh)
Mandatory Certification	• IEC 62109-1, IEC 62109-2 • IEEE 1547 or UL 1741
Desirable Certification	• IEC 62477-1 or equivalent • IEC 61000-6-1 & IEC 61000-6-3 or equivalent • Applicable tests of IEC 60068-2 or equivalent
Warranty	Minimum 5 years for manufacturing defects
Weight	Vendor to specify
Dimensions	Vendor to specify

General Requirements

- Inverter shall have separate connections for back-up loads (to be supplied through batteries when required) and normal loads (to be disconnected from the battery in case of no PV power).
- Priority of the inverter should be end-user configurable so that solar PV, battery and grid can be prioritized based on site conditions.
- Inverter must be capable of communication with the BMS of Lithium Batteries
- Inverter shall have wide input voltage range capability. (i.e.: Voltage Range can be adjustable /selectable)
- Inverter shall have natural convection cooling for maximum reliability
- The output of the inverter must synchronize its AC output automatically to the exact AC voltage and frequency of the grid.
- Inverter should have the capability of parallel operation

Battery

Parameter	Specification
Ambient Temperature Range	-10°C ~ +50°C
Type	Lithium Iron Phosphate ($LiFePO_4$)
Rated Capacity Per Bank	10 kWh (48V 200 Ah or equivalent)
Rated Voltage	To be matched with proposed inverter
Charge Voltage	To be matched with proposed inverter
Max. Charging Current	To be matched with proposed inverter
Max. Discharge Current	To be matched with proposed inverter
Internal Resistance	Vendor to specify
Container Material	Vendor to specify
Guaranteed Lifetime	≥4500 cycles @ 80% depth of discharge
Mandatory Certification	• IEC 62619 or equivalent
Desirable Certification	• UL 1973 or equivalent
Warranty	Minimum 5 years for manufacturing defects
Weight	Vendor to specify
Dimensions	Vendor to specify

General Requirements

- Lab test reports for battery cycle life shall be provided.

- Battery bank shall be compatible with the proposed inverter.
- Battery must support parallel connection to increase capacity in case of future expansion.
- Each Battery should have following minimum information printed on it:
    - Model Number, Serial Number and Type of battery
    - Rated Voltage and Capacity (Ah or Wh)
    - Nominal Discharge Rate
    - Country of Origin
    - Manufacturer Name with distinct logo
- The battery must have Integrated Battery Management System (BMS) to ensure battery safety and reliability.
- The BMS of the battery must have the following specifications:
    - Temperature protection
    - Over charge protection
    - Low voltage disconnect
    - High voltage disconnect
    - Short circuit alarm function
    - Self-balancing function
- Battery shall have LED status and alarm indication.