

SCHEDULE OF WORK

Name of Work: SITC of 40 kWp On- Grid roof top Solar Photovoltaic (SPV) Power Generation System at Directorate of Arecanut and Spices Development (DASD), Kozhikode.

Sl No	Description	Quantity	Unit	Rate (DSR rate with CI)	Amount
1	Solar Photovoltaic Power Plant				
1.1	Supply, Installation, Testing and Commissioning of on-grid Solar Photovoltaic Power Plant conforming to various applicable standards BIS, IEC, MNRE guidelines, the Central Electricity Authority Regulations and CPWD Specifications as amended up to date, consisting of Mono/Poly Crystalline silicon solar cells module, net metering facility, necessary control, protections, earthing, cabling, mounting structure, junction boxes, power conditioning units, Real time online web interfaced Data Monitoring System, Distribution panels, grid connecting arrangement, conduits, pipes, cable trays and other accessories etc. as required.				
	a) High Energy Efficiency Solar Photovoltaic Module of capacity 330 Wp or above, manufactured in India, conforming to IS 14286/IEC 61215, IS/IEC 61730-Part-1, IS/IEC 61730-Part-2. Solar Photovoltaic Module conversion efficiency shall not be less than 23% at STC with temperature coefficient of Pmax better than -0.30% per degree Celsius. PV modules used in solar power plants/ systems must be warranted for their output peak watt capacity, which should not be less than 90% at the end of 10 years and 80% at the end of 25 years. Solar Modules shall be designed to operate in relative humidity upto 100% with temperature between -10 Deg C and +85 Deg C. Further, each PV module used in any solar power project must have Radio frequency identification tag with information such as name of manufacturer, month and year of manufacturing, country of origin (separately for Solar cell and module), I-V curve, Unique Serial No and Model No of the module, Wattage, Im, Vm and FF, name of test lab issuing IEC certificate.				
	b) Power Conditioning Unit (PCU) of 350-800 V DC Input voltage range and 415 V AC, three phase, 4 wire, 50Hz +/- 2.5 Hz, output voltage suitable to generate AC with a variation of 10% at nominal voltage. Power with efficiency not less than 97%, total harmonic distortion less than 3% and suitable for ambient temperature from 0 to 50 degree C , Minimum IP-65 for outdoor and Minimum IP 21 for indoor, Built-in meter and data logger, MPPT, switching devices IGBT/MOSFETs and controller Microprocessor /DSP . PCU/inverter shall be capable of complete automatic operation including wake-up, synchronization & shutdown.				

	The PCU shall be able to withstand unbalanced load conforming to IEC standard with shutdown/standby mode. It must be provided with grid islanding along with manual disconnect pole isolation switch besides automatic disconnection. Minimum protections: Mains Under/ Over Voltage, Over current, Over/Under grid frequency, Over temperature, Surge voltage induced at output due to external source, Short circuit, Lightening, Anti Islanding (for grid synch. Mode) and other protections as per applicable standards. LCD/LED display of minimum parameters: DC input voltage, DC current, AC Voltage and current (all 3 phases, in case of 3 phase), Instantaneous & cumulative AC output power, Daily DC energy produced and other parameters applicable standard. Communication interface RS 485/ RS 232.				
	c) Module mounting structure: The roof top solar plant generation units shall be installed above the existing tin/roofing sheet by using suitable supporting Aluminium/Galvanized MS structure (mass of zinc coating shall be as per IS 4759). The mounting structure shall be suitably designed and erected with a minimum clear vertical clearance of more than 100 mm between the top surface of the existing tin/roofing sheet and the lowest point of the solar PV mounting structure, ensuring that the structure does not come into contact with the roofing sheet and allowing adequate space for ventilation, drainage and maintenance. The mounting structure shall be designed to sustain the wind load and seismic parameters of the site of installation. All structural members shall be designed as per applicable BIS codes and the material shall also conform to the applicable BIS codes. Structural material shall be corrosion resistant and electrolytically compatible with the materials used in the module frame, fasteners, nuts and bolts.				
	Considering that the highest point of existing tin/roofing sheet is located at approximately 5.75 metre above the terrace level, the mounting structure shall be suitably designed to accommodate the existing roof profile and safely support the solar PV system. The load of the solar PV system and associated structures shall be safely transferred to the supporting structural members without imposing undue load on the existing roofing sheet.				

	A suitable access ladder with handrails shall be provided from the terrace level up to the top level of the existing roofing sheet for safe access to the roofing sheet and the solar PV maintenance area. The ladder shall be suitably designed, fixed and supported to ensure adequate strength, rigidity and safe access. The ladder shall be of corrosion-resistant material such as hot-dip galvanized MS or suitable Aluminium for portions exposed to weather. A suitable access door/hatch, either sliding type or hinged type as suitable for the site conditions, shall be provided at the roofing-sheet level at the ladder location to facilitate safe access and passage of personnel from the ladder to the roofing sheet/FRP walkway. The access door/hatch shall be of adequate size and strength and shall be provided with a suitable frame, secure locking arrangement, weather-resistant sealing and proper drainage arrangement to prevent accidental opening and water ingress when closed. The type and method of operation of the access door/hatch shall be selected considering the available space, ladder arrangement and safe movement of personnel, and shall not obstruct the ladder or FRP walkway when opened.				
	A FRP walkway of minimum 500 mm clear width shall be provided continuously throughout the entire length of the solar PV installation for safe movement, inspection, maintenance and cleaning of the solar PV modules. The FRP walkway shall be suitably supported by a corrosion-resistant structural framework, such as hot-dip galvanized MS, provided below the walkway and adequately connected to the main structural support system. The walkway supporting framework shall be designed to safely withstand the dead load, imposed load and applicable environmental loads.				
	The FRP walkway supporting framework shall be adequately supported from the terrace level through suitably designed structural supports/columns, with suitable connections to the main mounting structure wherever required, to ensure adequate strength, rigidity and stability. The supporting structure shall be properly anchored to the terrace/structural members and shall not rely solely on the existing tin/roofing sheet for structural support. The structural support system shall be designed such that the load of the walkway and personnel is safely transferred to the terrace/structural members.				

	The FRP walkway shall be provided with suitable side projections/guard rails and handrails on both sides throughout its entire length to prevent accidental slipping or falling from the elevated structure. Suitable full-body fall-arrest safety harnesses made of high-strength industrial polyester webbing, complete with suitable lifeline/anchorage arrangements, shall be provided for personnel engaged in cleaning, inspection and maintenance of the solar PV modules. The lifeline/anchorage system shall be securely fixed to the structural framework and suitably designed to provide effective fall protection during maintenance and cleaning activities.				
	All ladders, access doors/hatches, FRP walkways, supporting frameworks, columns, guard rails, handrails, safety harness/fall-arrest arrangements, connections and anchoring arrangements shall be suitably designed, fabricated and installed to ensure safe access, movement, inspection, maintenance and cleaning of the solar PV plant. The complete mounting structure and associated access and safety arrangements shall be designed to withstand the applicable wind load, seismic parameters, dead load, imposed load and other structural and environmental loads of the site. The entire work shall include all necessary structural members, brackets, clamps, fasteners, anchors, supports, connections and accessories required for a complete, safe and functional installation.				
	d) Real time online web interfaced Data Monitoring System complete with accessories for various parameters such as Solar Irradiance, temperature, AC Output Voltage and current, Output Power, Power factor, DC Input Voltage and Current, Time Active, Time disabled, Time Idle, Power produced and other parameters as per standard practices. e) Array junction box & Main junction box with IP 65 protection and termination arrangement for incoming and outgoing cable along with glands, lugs and other accessories etc. as required. Each junction box shall be made of GRP/FRP/Powder Coated Aluminium /cast aluminium alloy with full dust, water & vermin proof arrangement with High quality Suitable capacity Metal Oxide Varistors(MOVs) (semiconductor diode with resistant applied voltage)/ surge arrestors and suitable Reverse Blocking Diodes, isolation switches isolate the DC input to Inverter, copper bus bar etc.				

	f) Lightning ,surge voltage protection, earthing protection and grid islanding. g) Cables: Connections & Interconnections: By required size IR/UV protected XLPE insulated copper conductor, 1.1 kV grade, armoured power and control cables (ISI Marked), along with supplying and fixing of necessary channels/conduits, GI cable trays, supports, lugs, thimbles and other accessories etc. as required. The cabling from the solar PV generation system shall be extended up to the solar generation meter location, which shall be located near the existing KSEB net meter, or at any other suitable location as directed/insisted upon by KSEB. The complete cabling, including all necessary supports, protection, routing and accessories, shall be provided as required for safe and proper interconnection of the solar PV system with the electrical installation/grid. h) DC Distribution Board And AC Distribution Panel Board: IP65, free standing, metal cladded, having copper bus bar, having required protection and control gears, connection interconnection, etc. as required.	40	kWp	71650.00	2866000.00
2	Providing and fixing following rating and breaking capacity and pole MCCB with thermomagnetic release and terminal spreaders in existing cubicle panel board including drilling holes in cubicle panel, making connections, Ics=100% Icu and Operational Voltage 690V etc. as required.				
2.1	125 Amp, 36KA, FPMCCB	1	Each	11410.00	11410.00
	Total				2877410.00

Assistant Engineer (E)(P)
CLTED,CPWD, Calicut

Executive Engineer (E)
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