Creating Infrastructure

A PPP INITIATIVE OF GOVERNMENT OF KERALA

Notice for Inviting Quotations

Ref No: IL/RED/NIQ/2025-26/DHA-BOS/007

INKEL Limited,
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Kakkanad, Cochin Kerala - 682030
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1. ABSTRACT

Title	**Notice Inviting Quotation for Supply of BOS including MMS, Installation, Testing and Commissioning of 180 kWp Grid Connected SPV Power Plant at District Hospital Aluva, Ernakulam.**
Reference No:	**IL/RED/NIQ/2025-26/DHA-BOS/007**
Mode of Application	**Online via email to tenders.re@inkel.in**
Date of release of NIQ	**23-07-2025**
Last date & Time of submission of NIQ	**28-07-2025 @ 12:00 PM**
Contact Details for clarification	**Asst. Manager (RE) - 0484-2978101 (Extn 503)** **Manager (RE) - 0484-2978101(Extn 509)** **Email: tenders.re@inkel.in**
Date and Time of opening of NIQ	**28-07-2025**

Interested contractors shall download the NIQ documents from INKEL website (www.inkel.in) and submit the Quotation online on or before the deadline mentioned above.

Kakkanad
23-07-2025

S/d
Head-Renewable Energy

2. PREAMBLE

2.1. INKEL LIMITED (INKEL) is a public-private partnership (PPP) company promoted by Government of Kerala. INKEL is an innovative PPP initiative which brings together Government Agencies, prominent global investors, NRI Industrialists and businessmen. It is engaged in setting up sustainable infrastructure models to address all the infrastructure requirements of industrialists and entrepreneurs in the state of Kerala.

2.2. INKEL is on track to emerge as a one stop destination for meeting the requirements of implementing large scale infrastructural projects that will be self-sustaining and an instrument for fast-track development of the State's economy.

2.3. INKEL Ltd offers services ranging from Project Concept development to the Completion and Handing over stage covering Sectors like Construction, Road & Bridges, Development of Industrial/Business Park, Engineering Design and Consultancy, PMC, Advisory & Management Consultancy, Education and Skill development, Health & Hospitality, Power, Facilities Management, Hi-Tech Agro and Renewable Energy.

2.4. Renewable Energy is one of the core departments of INKEL Limited and is involved in the implementation of solar PV projects throughout Kerala.

3. ELIGIBILITY CRITERIA

The bidder must fulfil the following eligibility criteria;

3.1. The bidder must be registered under GST.

3.2. The bidder must have experience in the supply, installation, testing, and commissioning of a cumulative capacity of 250 kWp for Grid-Connected Solar Power Plants, with at least one project of 100 kWp capacity completed in the past 3 years. The bidder is required to submit work orders and completion report as evidence along with the bid.

3.3. The bidder must have an annual turnover of at least 50 Lakhs in any of the last 3 Years. The bidder should submit the audit reports & ITR of last 3 years along with the bid.

3.4. INKEL has the right to accept or reject any or all the applications without assigning any reason there of and their decision will consider as final.

The **bidder shall submit the bid as E-mail to tenders.re@inkel.in** The bid shall be **submitted in PDF formats consisting of technical bid and financial bid and only the financial bid shall be password protected**.

The last date for receipt of applications is **28-07-2025 @ 12:00 PM.**

4. SCOPE OF WORKS & TECHNICAL SPECIFICATIONS:

4.1. Brief Description of the project

INKEL Limited has taken up the design (as per site conditions), Design, Supply, Installation and Commissioning of 180 kWp Grid Connected SPV Power Plant at District Hospital Aluva, Ernakulam. The details of the site are as below;

Sl No	Name of Organization	Capacity (kW)	District	Net metering
01	District Hospital Aluva, Ernakulam	180	Ernakulam	HT
	Total	**180**		

INKEL intends to appoint a contractor for Supply of BOS items including Module Mounting Structures (MMS), Installation, Testing and Commissioning of Grid-Connected Solar Power Plants at District Hospital Aluva, Ernakulam. The bidder is advised to visit the project site and assess the site conditions, accessibility, and other relevant factors before submitting their bids. Completion of Work shall be 45 days from date of site handing over. No claims related to lack of knowledge or site conditions shall be entertained at a later stage.

4.2. Scope of the Work

4.2.1. Vendor's scope includes Supply of BOS items including Module Mounting Structures (MMS), Installation, Testing and Commissioning of Grid-Connected Solar Power Plants at District Hospital Aluva, Ernakulam. Claims for price variation post quote submission shall not be accepted.

4.2.2. INKEL shall supply the Solar PV Modules and Inverters at the site mentioned in clause no 4.1. The supply of all other materials required for successful commissioning of the solar power plant shall be the in the scope of the bidder. The contractor shall be solely responsible for arranging the unloading, loading, transportation and safe handling of all the materials (INKEL supply of materials & Bidder supply of materials) at the site. It shall also be the contractor's responsibility to ensure the security, protection, and proper upkeep of the materials delivered to site by INKEL and the bidder also responsible for the materials supplied by the bidder during transit and also responsible for all the

materials at site until the handing over of the site to INKEL after commissioning.

4.2.3. The additional costs if any for site specific cabling works, earthing, mounting structure modifications etc are under the scope of the bidder.

4.2.4. The scope of Single phase to 3Phase conversion, enhancing the load, modification of Panel boards etc. wherever necessary is under the scope of the bidder. The rates for the same are to be considered in the bid. Statutory fees (Feasibility, Registration, Load Enhancement etc..) paying is the scope of the contactor and shall be released on submission of payment receipts.

4.2.5. Scheme approval, rectification of defects as per Electrical Inspectorate (EI) requirements, coordination for inspections, obtaining Energisation sanction, and execution of all other related electrical works shall be under the scope of the bidder. The contractor shall bear and pay all statutory fees associated with these activities; such payments shall be reimbursed upon submission of valid payment receipts. All aforementioned electrical works must be carried out through a licensed Class-A Electrical Contractor.

4.2.6. All the necessary approvals from KSEBL, Electrical Inspectorate & ANERT, feasibility, necessary civil work, Mounting of Module Structures, PV Module Installation, Inverter Installation, DC/AC Cabling and interconnections, Installation of Lightning Arresters and Earthing System, HT Net-Meter Installation as per the standards. Arranging all the necessary inspections from KSEBL, Electrical Inspectorate, ANERT as part of Pre-Commissioning, commissioning if any are also in the scope of bidder. The scope of bidder shall include the rectification of Defects by inspection authorities/INKEL.

4.2.7. The bidder shall provide permanent arrangement for module washing in the SPV Plant. Water lines may be drawn to feed water from the available resources. Contractor has to provide additional facility including pipeline, motor for pumping to the additional overhead tank, if required.

4.2.8. The bidder shall provide FRP Walkways and access ladders for cleaning and replacement of solar PV modules and proper canopy to be provided for the safety

of Solar Inverters as per the direction of the Engineer-in-charge of INKEL Ltd.

4.2.9. Ferrules or cable tags shall be provided for labelling the AC, DC Cables, Distribution Boards and Equipment's as per approved scheme and cable schedule.

4.2.10. The scope includes all activities for successful commissioning of the solar power plant but not limited to obtaining approval from INKEL for the datasheets/drawings/MQP,Manufacture/testing/inspection at manufacturer's works, packing, supply, transportation, insurance, delivery to site, unloading, storage, installation and commissioning of the power plant identified under this specification.

4.2.11. The rate quoted should be all inclusive including delivery of materials at the site, and the cost of materials and labour for the civil works if required.

4.2.12. The price quotes should be inclusive of initial cost of supply of BOS including MMS, installation, testing and commissioning of solar power plants support during the warranty period of 2-years from the date of commissioning & The scope of enhancing load, modification of Panel boards etc. wherever necessary.

4.2.13. The Contractor shall provide at his own expense all tools, plant and equipment required for the execution and completion of work in all respects as per the contract. The Contractors are advised to take necessary insurance coverage for the tools, plant and equipment used for the project and the workers who engaged in the project. The Contractor shall furnish as desired by the Engineer-in-Charge all details of tools, plant and equipment mobilized to the site with date of mobilization.

4.2.14. The Contractor shall secure and maintain throughout the duration of this Contract, insurance of such types and in such amounts as may be necessary to protect himself, INKEL and the owner of the premises in which the solar power plant is installed against all usual hazards or risk of loss. The form and limits of such insurance and the company together with the underwriting

thereof in each case, such as will be acceptable to the INKEL but, regardless of such acceptance, it shall be the responsibility of the Contractor to maintain adequate insurance coverage at all times. Failure of the Contractor to maintain adequate coverage shall not relieve him of any contractual responsibility.

4.2.15. The contractor has to provide a display board of size at the project site of size minimum 60 cm x 30 cm including the following details. Plant Name, Capacity, Location, Type of Renewable Energy plant (solar), Date of commissioning etc. The logo of ANERT and details of the scheme as specified in the work order. The design shall be as per approval from INKEL.

4.3. Module Mounting Structure

4.3.1. Photovoltaic arrays must be mounted on a stable, durable structure that can support the array and withstand wind, rain, and other adverse conditions. The modules will be fixed on structures with fixed arrangement.

4.3.2. The Module Mounting Structure (MMS) for a solar power plant be provided considering highly corrosive coastal environment, high wind loads, and challenging soil conditions. The MMS should be made of corrosion-resistant materials such as Hot-Dip Galvanized (HDG) steel with a minimum zinc coating thickness of 80–120 microns (as per IS 4759 or ASTM A123), aluminum alloys (e.g., 6063-T6), or stainless steel (SS304/316) for critical components. Fasteners and bolts shall be SS304 to avoid galvanic corrosion.

4.3.3. Additional protective coatings like epoxy or polyurethane may be applied in high-exposure areas. In terms of foundations, suitable options such as pile, screw, or precast concrete bases must be chosen based on a detailed geotechnical investigation, ensuring anti-corrosion treatments for embedded parts.

4.3.4. The structure should comply with relevant IS and IEC standards for steel quality, wind load, and structural safety. Design should facilitate proper drainage and avoid water pooling, especially in areas with frequent salt mist and humidity.

4.3.5. The module mounting structures shall have adequate strength and appropriate design suitable to the locations, which can withstand the load and high wind velocities. Stationary structures shall support PV modules at a given orientation, absorb and transfer the mechanical loads to the surface properly.

4.3.6. Wherever required, suitable number of PV panel structures shall be provided. Structures shall be of flat-plate design using minimum size of C (75 x 40 x 5mm) or L (55 x 55 x 5mm) or I (60x 40x 4mm) sections or higher dimensions for respective sections.

4.3.7. Each structure with fixed tilt should have a tilt angle as per the site conditions to take maximum insolation which will be approximately equal to the latitude of the location facing true South with a North - South orientation. The tilt angle can vary from 9 degree to 12 degree based on the location's latitude in Kerala.

4.3.8. The PV module mounting structure shall have a capacity to withstand a wind velocity of 150 km/hr. unless specified for dedicated requirements.

4.3.9. Suitable fastening arrangement such as grouting and calming should be provided to secure the installation against the specific wind speed. The PV array structure design shall be appropriate with a factor of safety of min 1.5.

4.3.10. The upper edge of the module must be covered with wind shield so as to avoid build air ingress below the module. Slight clearance must be provided on both edges (upper & lower) to allow air for cooling.

4.3.11. The materials used for structures shall be Hot dip Galvanized Mild Steel conformed to IS 2062:1992 or aluminum of suitable grade minimum alloy 6063 or better.

4.3.12. The minimum thickness of galvanization for hot dip Galvanized Mild Steel should be at least 80 microns as per IS 4759. The galvanization thickness will be checked during inspection and the vendor is to arrange the equipment needed for the same at the site.

4.3.13. The Bolts, Nuts, fasteners, and clamps used for panel mounting shall be of Stainless-Steel SS 304. Structures shall be supplied complete with all members to be compatible for allowing easy installation at the site. Additional Structures/Frames for required for the installation of modules if any need to be provided by the bidder.

4.3.14. The structures shall be designed to allow easy replacement of any module, repairing and cleaning of any module. No Welding is allowed on the mounting structure. Adequate spacing shall be provided between two panel frames and rows of panels to facilitate personnel protection, ease of installation, replacement, cleaning of panels and electrical maintenance.

4.3.15. Aluminum structures used shall be protected against rusting either by coating or anodization. Aluminum frames should be avoided for installations in coastal areas.

4.3.16. The structure shall be designed to withstand operating environmental conditions for a period of minimum 25 years. And shall be free from corrosion while installation.

4.3.17. Screw fasteners shall use existing mounting holes provided by module manufacturer. No additional holes shall be drilled on module frames.

4.3.18. The total load of the structure (when installed with PV modules) on the roof should be less than 60 kg/m2.

4.3.19. The Rooftop Structures maybe classified in three broad categories as follows.

I. <u>Ballast structure</u>

- The mounting structure must be Non-invasive ballast type and any sort of penetration of roof to be avoided.
- The minimum clearance of the structure from the roof level should be in between 70-150 mm to allow ventilation for cooling, also ease of cleaning

and maintenance of panels as well as cleaning of terrace.

- The structures should be suitably loaded with reinforced concrete blocks of appropriate weight made out of M25 concrete mixture.

II. Tin shed

- The structure design should be as per the slope of the tin shed.
- The inclination angle of structure can be done in two ways.
- Parallel to the tin shed (flat keeping zero-degree tiling angle), if the slope of shed in Proper south direction.
- With same tilt angle based on the slope of tin shed to get the maximum output.
- The minimum clearance of the lowest point from the tin shade should be more then 100mm.
- The base of structure should be connected on the Purlin of tin shed with the proper riveting
- All structure member should be of minimum 2 mm thickness.

III. RCC Elevated structure: It can be divided into further three categories:

A. Minimum Ground clearance (300MM – 1000 MM)

a. The structure shall be designed to allow easy replacement of any module and shall be in line with site requirement. The gap between modules should be minimum 30MM.

b. Base Plate – Base plate thickness of the Structure should be 5MM for this segment.

c. Column – Structure Column should be minimum 2MM in Lip section / 3MM in C- Channel section. The minimum section should be 70MM in Web side and 40MM in flange side in Lip section.

d. Rafter - Structure rafter should be minimum 2MM in Lip section / 3MM in C-Channel section. The minimum section should be 70MM in Web site (y-axis) and 40MM in flange side (x-axis).

e. Purlin - Structure purlin should be minimum 2MM in Lip section. The minimum section should be 60MM in Web side and 40MM in flange side in Lip section.

f. Front/back bracing – The section for bracing part should be minimum 2MM thickness.

g. Connection – The structure connection should be bolted completely. Leg to rafter should be connected with minimum 12 diameter bolt. Rafter and purlin should be connected with minimum 10 diameter bolt. Module mounting fasteners should be SS-304 only and remaining fasteners either SS-304 or HDG 8.8 Grade.

h. For single portrait structure the minimum ground clearance should be 500MM.

B. Medium Ground clearance (1000MM – 2000 MM)

a. Base Plate – Base plate thickness of the Structure should be Minimum 6MM for this segment.

b. Column – Structure Column should be minimum 2MM in Lip section / 3MM in C- Channel section. The minimum section should be 80MM in Web side and 50MM in flange side in Lip section.

c. Rafter - Structure rafter should be minimum 2MM in Lip section / 3MM in C-Channel section. The minimum section should be 70MM in Web side and 40MM in flange side in Lip section.

d. Purlin - Structure purlin should be minimum 2MM in Lip section. The minimum section should be 70MM in Web side and 40MM in flange side in

Lip section.

e. Front/back bracing – The section for bracing part should be minimum 2MM thickness.

f. Connection – The structure connection should be bolted completely. Leg to rafter should be connected with minimum 12 diameter bolt. Rafter and purlin should be connected with minimum 10 diameter bolt. Module mounting fasteners should be SS-304 only and remaining fasteners either SS-304 or HDG 8.8 Grade.

C. Maximum Ground clearance (2000MM – 3000 MM)

a. Base Plate – Base plate thickness of the Structure should be minimum 8 MM for this segment.

b. Column – Structure Column thickness should be minimum 2.6MM in square hollow section (minimum 50x50) or rectangular hollow section (minimum 60x40) or 3MM in C-Channel section.

c. Rafter - Structure rafter should be minimum 2MM in Lip section / 3MM in Channel section. The minimum section should be 80MM in Web side and 50MM in flange side in Lip section.

d. Purlin - Structure purlin should be minimum 2MM in Lip section. The minimum section should be 80MM in Web side and 50MM in flange side in Lip section.

e. Front/back bracing – The section for bracing part should be minimum 3MM thickness.

f. Connection – The structure connection should be bolted completely. Leg to rafter should be connected with minimum 12 diameter bolt. Rafter and purlin should be connected with minimum 10 diameter bolt. Module mounting fasteners should be SS-304 only and remaining fasteners either SS-304 or

HDG 8.8 Grade.

D. ***Super elevated structure*** (More than 3000 MM)

I. Base structure

- Base Plate – Base plate thickness of the Structure should be 10MM for this segment.
- Column – Structure Column minimum thickness should be minimum 2.9MM in square hollow section (minimum 60x60) or rectangular hollow section (minimum 80x40).
- Rafter - Structure Rafter minimum thickness should be minimum 2.9MM in square hollow section (minimum 60x60) or rectangular hollow section (minimum 80x40)
- Cross bracing – Bracing for the connection of rafter and column should be of minimum thickness of 4mm L-angle with the help of minimum bolt diameter of 10mm.

II. Upper structure of super elevated structure

- Base Plate – Base plate thickness of the Structure should be minimum 5MM for this segment.
- Column – Structure Column should be minimum 2MM in Lip section/ 3MM in Channel section. The minimum section should be 70MM in Web side and 40MM in flange side in Lip section.
- Rafter - Structure rafter should be minimum 2MM in Lip section / 3MM in Channel section. The minimum section should be 70MM in Web side and 40MM in flange side in Lip section.
- Purlin - Structure purlin should be minimum 2MM in Lip section. The minimum section should be 60MM in Web side and 40MM in flange side in

Lip section.

- Front/back bracing – The section for bracing part should be minimum 2MM thickness.

- Connection – The structure connection should be bolted completely. Leg to rafter should be connected with minimum 12 diameter bolt. Rafter and purlin should be connected with minimum 10 diameter bolt. Module mounting fasteners should be SS-304 only and remaining fasteners either SS-304 or HDG 8.8 Grade.

iii. If distance between two legs in X-Direction is more than 3M than sag angle/Bar should be provide for purlin to avoid deflection failure. The sag angle should be minimum 2MM thick, and bar should be minimum 12Dia.

iv. Degree - The Module alignment and tilt angle shell be calculated to provide the maximum annual energy output. This shall be decided on the location of array installation.

v. Foundation – Foundation should be as per the roof condition; two types of the foundation can be done- either penetrating the roof or without penetrating the roof.

a) If penetration on the roof is allowed (based on the client requirement) then minimum 12MM diameter anchor fasteners with minimum length 100MM can be used with proper chipping. The minimum RCC size should be 400x400x300 cubic mm. Material grade of foundation should be minimum M20.

b) If penetration on roof is not allowed, then foundation can be done with the help of 'J Bolt' (refer IS 5624 for foundation hardware). Proper Neto bond solution should be used to adhere the Foundation block with the RCC roof. Foundation J - bolt length should be minimum 12MM diameter and length should be minimum 300MM.

4.4. Cabling Practice

4.4.1. Cable Cabling is required for wiring from AC output of inverter/PCU to the Grid Interconnection point. It includes the DC cabling from Solar Array to AJB and from AJB to inverter input.

4.4.2. All cables of appropriate size to be used in the system shall have the following characteristic:

- Shall conform to IEC 60227 / IS 694 & IEC 60502 / IS 1554 standards.
- Temperature Range: -10 degree Celsius to +80 degree Celsius
- Voltage rating: 660/1000V
- Excellent resistance to heat, cold, water, oil, abrasion, UV radiation
- Flexible

4.4.3. Sizes of cables between any array interconnections, array to junction boxes, junction boxes to inverter etc. shall be so selected to keep the voltage drop (power loss) of the entire solar system to the minimum (2%).

4.4.4. For the DC cabling, XLPE or XLPO insulated and sheathed, UV stabilized single core flexible copper cables shall be used; Multicore cables shall not be used.

4.4.5. Wherever the cables pass through water, the marine grade cables shall be used;

- All LT XLPE cables shall conform to IS: 7098 part I&II.
- The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0%.
- The total voltage drop on the cable segments from the solar grid inverter to the building distribution board shall not exceed 2.0%.
- Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers.
- The minimum DC cables size shall be 4.0mm2 copper; the minimum AC cable size shall be 4.0mm2 copper/6.0mm2 aluminum. In three phase systems, the size of the neutral wire size shall be equal to the size of the phase wires.

4.4.6. Cable Marking: All cable/wires are to be marked in proper manner by good quality ferule or by other means so that the cable can be easily identified. The following colour code shall be used for cable wires.

- DC positive: red (the outer PVC sheath can be black with a red line marking.
- DC negative: black
- AC single phase: Phase: red; Neutral: black
- AC three phase: phases: red, yellow, blue; neutral: black
- Earth wires: green

4.4.7. Cable conductors shall be terminated with tinned copper end ferrules to prevent fraying and breaking of individual wire strands. The termination of the DC and AC cables at the Solar Grid Inverter shall be done as per instructions of the manufacturer, which in most cases will include the use of special connectors.

4.4.8. All cables and connectors used for installation of solar field must be of solar grade which can withstand harsh environment conditions including high temperatures, UV radiation, rain, humidity, dirt, salt, burial and attack by moss and microbes for 25 years and voltages as per latest IEC standards. DC cables used from solar modules to array junction box shall solar grade copper (Cu) with XLPO insulation and rated for 1.5 kV as per relevant standards only.

4.4.9. Bending radii for cables and laying of cables shall be as per manufactures recommendations and IS: 1255.

4.4.10. For laying/termination of cables latest BIS/IEC Codes/ standards shall be followed.

4.5. Surge Protection

The system should have installed with Surge Protection Device (SPD) for higher

withstand of the continuous PV-DC voltage during earth fault condition. SPD shall have safe disconnection and short circuit interruption arrangements through integrated DC in-built bypass fuse (parallel) which should get tripped driving failure mode of MOV, extinguishing DC arc safely in order to protect the installation against fire hazards. The SPD should be provided in the AC Distribution Box as well.

4.6. Earthing

4.6.1. The Solar PV Plant should have a dedicated earthing system. The Earthing for array and LT power shall be made as per the provisions of IS:3043-2018 "Code of practice for earthing (Second Revision)," that governs the earthing practices of a PV system and IS 732:2019 "Code of practice for electrical wiring installations (Fourth Revision).

4.6.2. Earthing System shall connect all non –current carrying metal receptacles, electrical boxes, appliance frames, chassis and PV module mounting structures in one long run. The earth strips should not be bolted. Earthing GI strips shall be interconnected by proper welding.

4.6.3. The earthing conductor should be rated for 1.56 times the maximum short circuit current of the PV array. The factor 1.56 considers 25 percent as a safety factor and 25 percent as albedo factor to protect from any unaccounted external reflection onto the PV modules increasing its current.

4.6.4. In any case, the cross-section area or the earthing conductor for PV equipment should not be less than 6 mm2 if copper, 10 mm2 if aluminum or 70 mm2 if hot-dipped galvanized iron. For the earthing of lightning arrestor, cross-section of the earthing conductor should not be less than 16 mm2 of copper or 70 mm2 if hot-dipped galvanized iron. The complete Earthing system shall be mechanically & electrically connected to provide independent return to earth.

4.6.5. Masonry enclosure with the earth pit of size not less than 400mm X 400 mm(depth) complete with cemented brick work (1:6) of minimum 150mm

width duly plastered with cement mortar (inside) shall be provided. Hinged inspection covers of size not less than 300mm X 300mm with locking arrangement shall be provided. Suitable handle shall be provided on the cover by means of welding a rod on top of the cover for future maintenance.

4.6.6. Interconnected earth pit needs to be provided in each location. Minimum required gap shall be provided in between earth pits as per relevant standard. Body earthing shall be provided in inverter, each panel frame, module mounting structure, kiosk and in any other item as required.

4.6.7. Earth pit shall be constructed as per IS: 3043-2018. Electrodes shall be embedded below permanent moisture level. Earth pits shall be treated with salt and charcoal if average resistance of soil is more than 20-ohm meter.

4.6.8. Earth resistance shall not be more than 5 ohms.

4.6.9. In compliance to Rule 11& 61 Of Indian Electricity Rules,1956 (as amended up to date), all non-current carrying metal parts shall be Earthing with two separate and distinct earth continuity conductors to an efficient earth electrode.

4.6.10. The equipment grounding wire shall be connected to earth strip by proper fixing arrangement.

4.6.11. Necessary provisions shall be made for bolted isolating joints of each earthing pit for periodic checking of earth resistance.

4.6.12. For each earth pit, a necessary test point shall be provided.

4.6.13. Total no of Earth pits required for solar plants shall be as per the Electrical Inspectorate norms.

4.6.14. Minimum 4 Nos. of earth pits must be incorporated with each solar power plant.

4.7. Lightning Protection for PV Array

4.7.1. The SPV power plant should be provided with lightning and over voltage protection. The source of over voltage can be lightning or other atmospheric disturbance. The lightning conductors shall be made as per applicable Indian Standards in order to protect the entire array yard from lightning stroke.

4.7.2. The design and specification shall conform to IS/IEC 62305, "Protection against lightning" govern all lightning protection-related practices of a PV system.

4.7.3. The entire space occupying SPV array shall be suitably protected against lightning by deploying required number of lightning arresters. Lightning protection should be provided as per IS/ IEC 62305.

4.7.4. Lightning system shall comprise of air terminations, down conductors, test links, earth electrode etc. as per approved drawings.

4.7.5. Conventional Lightning Arresters shall be used to protect entire solar module area.

4.7.6. The protection against induced high voltages shall be provided by the use of surge protection devices (SPDs) and the earthing terminal of the SPD shall be connected to the earth through the earthing system.

4.7.7. The EPC Contractor/Company shall submit the drawings and detailed specifications of the PV array lightning protection equipment to Employer for approval before installation of system.

4.8. AC Distribution Panel Board

4.8.1. AC Distribution Board (ACDB) shall control the AC power from inverter and should have necessary surge arrestors.

4.8.2. An ACDB panel shall be provided in between PCU and Utility grid. It shall have MCB/MCCB/ACB or circuit breaker of suitable rating for connection and disconnection of PCU from grid.

4.8.3. The connection between ACDB and Utility grid shall be of standard cable/ Conductor with suitable termination. It shall have provision to measure grid voltage, current and power.

4.8.4. The incomer shall be selected at required rating. The ACDB enclosure shall be of good protection and suitable for mounting on the trenches / on wall.

4.8.5. The panels shall be designed for minimum expected ambient temperature of 45 degree Celsius, 80 percent humidity and dusty weather.

4.8.6. The incomer shall be selected at required rating. The ACDB enclosure shall be of good protection and suitable for mounting on the trenches / on wall.

4.8.7. All the 415 V AC or 230 V AC devices/equipment like bus support insulators, circuit breakers, SFU isolators (if applicable), SPD, etc. mounted inside the switch gear shall be suitable for continuous operation.

4.8.8. Switches/ circuit breakers/ connectors meeting general requirements and safety measurements as per IS 60947 Part I, II, III and IEC 60947 part I, II and III.

4.8.9. Junction boxes, enclosures, panels for inverters/ Controllers shall meet IP 65 (for indoor) as per IEC 529. The use of PVC enclosures is not permitted.

4.8.10. All combiner boxes shall be provided with suitable surge protective device with arc extinguishing capability as per the relevant standards to avoid any risk of fire.

4.8.11. The inverter output shall have the necessary rated AC surge arrestors, if required and MCB/ MCCB. RCCB shall be used for successful operation of the PV system, if inverter does not have required earth fault/residual current protection.

4.8.12. Disconnection switches or circuit breakers provided in combiner boxes to disconnect the photovoltaic system from all other conductors of the system

shall be located at a readily accessible location.

4.9. DC Distribution Board

4.9.1. DC bus/ cable which can handle the current and the voltage of inverter output safely with necessary surge arrester as per the relevant IS standards.

4.9.2. DC panel should be equipped with an adequate capacity indoor DC circuit breaker along with control circuit, protection relays, fuses, annunciations and remote operating and controlling facility from the main control facility.

4.9.3. DCDB shall have sheet from enclosure of water, dust and vermin proof, the busbar/ cables are to be made of copper of desired size. DCDB shall be fabricated to comply with IP 67 protection.

4.10. Cables, Switches and General Requirements

4.10.1. PVC insulated copper cables with current rating suitable for AC and DC as per the National Electric Code, and meeting:

4.10.2. General Test and Measuring Method as per IEC 60189/ IS 694 PVC insulated cables for working voltages up to 1100 V and UV resistant for outdoor installation as per IEC 60502/ IS 1554 (Pt. I & II)

4.10.3. Cable Marking: All cable/wires are to be marked in proper manner by good quality ferule or by other means so that the cable can be easily identified.

4.10.4. Switches/ circuit breakers/ connectors meeting general requirements and safety measurements as per IS 60947 Part I, II, III and EN 50521 for AC/DC. Junction boxes, enclosures for inverters/ charge controllers shall meet IP 54 (for outdoor)/ IP 21 (for indoor) as per IEC 529.

4.10.5. All the civil construction works shall comply the relevant IS Codes/Standards. Contractor shall do solar modules cleaning arrangements by deploying sufficient water lines from available source. Ladder for accessing solar module area as required shall be done by the contractor.

4.11. AC/DC Wiring

4.11.1. Before submitting the tender, actual measurement of cables required for wiring from AC output of inverter/PCU to load point should be calculated and this work is also included in the tender. The actual cable required from module to DC distribution board and DC distribution board to inverter input should be calculated and this work should be done as a part of Solar Power Plant installation.

4.12. CIVIL WORKS

4.12.1. While installing solar power pants on rooftops, the physical condition of the rooftop, chances of shading, chances water level rise in the rooftop during raining due improper drainage in the roof-top should be taken in to consideration.

a. PV array shall be installed in the terrace space free from any obstruction and/or shadow and to minimize effects of shadows due to adjacent PV panel rows.

b. PV array shall be oriented in the south direction in order to maximize annual energy yield of the plant.

c. The solar PV array must be installed on the rooftop in such a way that there is sufficient space on the rooftop for maintenance etc.

d. There should not be any damage what so ever to the rooftop due to setting up of the solar power plant so that on a later day there is leakage of rainwater, etc. from the rooftop.

e. Some civil works are inevitable for erecting the footings for the module mounting structure as discussed in Module Mounting Structure section. The roof top may be given a suitable grading plaster with suitable leak proof compound so as to render the roof entirely leak proof.

f. Ample clearance shall be provided in the layout of the inverter and DC/AC distribution boxes for adequate cooling and ease of maintenance.

g. While cabling the array, care must be taken such that no loose cables lie on the rooftops.

h. The roof top should look clean and tidy after installation of the array.

i. tidiness and aesthetics must be observed while installing the systems.

j. RCC Works - All RCC works shall be as per IS 456 and the materials used viz. Cement reinforcement, steel etc. shall be as per relevant IS standards. Reinforcement shall be high strength TMT Fe 415 or Fe 500 conforming to IS: 1786-1985.

k. Brick Works (If any) - All brick works shall be using 1st class bricks of approved quality as per IS 3102.

l. Plastering - Plastering in cement mortar 1:5, 1:6 and 1:3 shall be applied to all.

m. Display of mandatory items- Single Line Diagram and layout diagram of modules and interconnection at installation site shall be provided near the inverter.

n. For painting on concrete, masonry and plastered surface IS: 2395 shall be followed. For distempering IS 427 shall be followed referred. For synthetic enamel painting IS 428 shall be followed. For cement painting IS 5410 shall be followed.

o. All Civil works required for the installation of the PV Plant and other civil and electrical work in evacuation infrastructure, wherever necessary, shall be within the scope of the bidder.

p. The layout of Inverter accommodation shall be designed to enable adequate heat dissipation and availability. Mount within the existing infrastructure available in consultation with the Site in charge. String Inverters may be installed with Canopy type structure over it to protect it from frequent monsoon and weather changes.

4.13. NET METERING AND UTILITY INTERCONNECTION

a) Net metering equipment (an Import-Export Energy Meter) approved and tested by the electrical utility based on the accuracy class required for the proposed capacity of the system must be provided with the necessary data cables if required.

b) Supply of Bi directional meter, solar meter, Current transformers and the Potential transformers shall be scope of the bidder. The accuracy class shall as per KSERC, CEA regulation and KSEBL approved specifications. The meters, CT and PTs shall have valid calibration certificates issued by NABL accredited lab approved by KSEBL. Net Metering and Utility Interconnection should be accomplished according the Kerala State Electricity Regulatory Commission (Renewable Energy & Net Metering) Regulations, 2020 and amendments thereto.

c) As the Consumer is 11KV HT, Testing and Installation of HT Bi-directional meter and the replacement of CTs (Class 0.2s), PT (Class 0.2) of rating.

d) Reverse power relay shall be provided to avoid back feeding to diesel generator.

e) If required, the successful bidder shall replace the existing CTs, PT, RPRs and other electrical works required for the successful commissioning of the power plant.

4.14. INTER CONNECTION OF INVERTER OUTPUT WITH UTILITY GRID

a) The interconnection of load with inverter output should be done after

obtaining permission from Electrical Inspectorate and Electrical Utility.

b) The plan scheme and drawing related to interconnection details should be submitted to Electrical Inspectorate through a licensed Electrical contractor with the guidance appropriate Engineering Authority.

c) Licensed contractor has to be engaged for preparation of plan scheme to be submitted to the Kerala State Electricity Licensing Board and necessary fee should be remitted for energization of Solar Power Plant.

d) The panel board and distribution board required for AC interconnection should be done as per specification/ instruction given appropriate Engineering Authority.

e) All the electrical works required for the interconnection of load with inverter output should be done by the successful bidder as a part of the Solar Power Plant installation.

f) Bidder should visit the actual site and ensure the exact place for providing Solar Modules and Inverter etc. in presence of technical representative from the ANERT.

g) Net Metering Equipment shall be installed and maintained in accordance with the provisions of The Central Electricity Authority (Installation and Operation of Meters) Regulations, 2006 as amended from time to time. The Contractor shall maintain the Metering System as per metering code and CEA guidelines. The defective meter shall be immediately tested and calibrated.

h) The accuracy class of the Net Metering Equipment will be selected so that all levels of energy produced or taken by the Solar Power Plant will be measured accurately, and this equipment has applicable accuracy class.

i) Net Metering Equipment shall be microprocessor-based conforming to the relevant IEC standards with Advanced Metering Infrastructure (AMI) with RS232 cable facility.

j) Net Metering Equipment shall measure active energy (both import and export) and reactive energy (import) by 3 ph, 4 wire principle suitable for balanced / un-balanced 3 phase load (With KVAr, KWh, KVA measuring registers). Tri-vector based energy meter shall have an accuracy class of energy measurement of at according to IEC 60687.

k) Display parameters: LCD test, KWH import, KWH export, MD in KW export, MD in KW import, Date & Time, AC current and voltages and power factor (Cumulative KWH will be indicated continuously by default)

4.15. REMOTE MONITORING SYSTEM

A dedicated Remote Monitoring System (Hardware and software) with required connection for monitoring the plant shall be provided. The following parameters shall be accessible through the Data Logging Facility.

a) AC Voltage
b) AC Output current
c) Output Power
d) Energy in kWh
e) DC Input Voltage
f) DC Input Current
g) Temperatures (C)
h) Inverter Status
i) Any other parameter required by the DISCOM

Provision for Internet monitoring and download of historical data shall be incorporated. GSM based connectivity is to be ensured at all sites and only M2M sim cards to be used to ensure data security. This data is to be transmitted to ANERT server and the successful bidder must undertake all the works required for such deployment including software and arrange for APIs etc. The cost for data connectivity for the period of warranty must be borne by the bidder and shall be included in the bid.

4.16. Technical Standards should be as follows

The connectivity should be as per;

- Technical Standards for connectivity of the Distributed generation resources, Regulation, 2013.
- KSERC (Renewable Energy and Net Metering) Regulations, 2020 and amendments thereto
- KSERC (Grid interactive Distributed Solar Energy Systems) Regulations, 2014.
- Central Electricity Authority (Measures relating to Safety and Electric Supply)
- Regulations, 2023 has to be followed safety and Electricity supply.
- Metering should be as per CEA regulation 2006.
- Any amendments thereof will also be applicable.

5. WARRANTY

1. The warranty of the materials supplied by the bidder shall be of for Five years.
2. 2 years' warranty should be provided by the supplier for the BOS items and components, or part of the system has to be provided as per the special conditions of the contract.
3. The Warranty Card to be supplied with the system must contain the details of the all the components supplied including serial numbers accompanied with the OEM warranty card.

6. OTHER TERMS AND CONDITIONS:

1. The quoted price shall be inclusive of loading, unloading of materials, all

statutory fee, GST, all taxes and duties.

2. Warranty - 2 years for Solar Power Plants from the date of commissioning.
3. All the works shall be completed within 30 Days from the date of site handing over.

7. TECHNICAL SPECIFICATION

Sl. No.	Item Description	Specification	Applicable Standards	Remarks
1	Module Mounting Structure	As per the required capacity	IS 2062 – Hot Rolled Medium and High Tensile structural Steel. IS 4759 – Hot-dip Zinc Coatings on structural steel and other products.	
2	Cables	As required	IEC 60227 / IS 694 IEC 60502 / IS 1554 (Pt. I & II)	
3	Switches/ Circuit Breakers	As required	EN 50521	
4	Connectors	As required	IEC 60947 part I, II, III /IS 60947 Part I, II, III	
5	Surge Protection Device	As required	IEC 60364-5-53/ IS 15086-5	DC SPD-CITEL/MERSON; AC SPD-280V, CITEL Type-II
6	Junction Boxes/Enclosures for Inverters/ Charge Controllers	As required	IP 54 (for outdoor) or IP 65 /IP 21(for indoor) as per IEC 529	
7	Energy Meter for Recording Solar Electricity Generated & Two-way meter for Distribution Licensee grid connection with CTs & PTs of accuracy class as mentioned in CEA regulation		As per CEA Regulations; IEC 60687/ IEC 62052-11 / IEC62053- 22 / IS 14697	
8	Lightning Protection	As required	As per IEC 62305/ IEC 62561	
9	Electrical Grounding (Earthing)	As required	As per IS 3043	
10	Installation, Testing, Commissioning & Connectivity	Complying with Electrical Inspectorate & KSEB standards		

8. PRICE BID FORMAT (BOQ)

Sl.No.	Item	Qty	Unit	Rate per Unit (Rs.)	Amount Exclusive of GST (Rs.)
1	Supply of BOS including MMS for 180 kWp Grid Connected SPV Power Plant at District Hospital Aluva, Ernakulam.	180	kWp		
2	Installation, Testing and Commissioning of 180 kWp Grid Connected SPV Power Plant at District Hospital Aluva, Ernakulam.	180	kWp		
Total in Words:					

Date: **Name of Contractor**

Place: **Sign & Seal of the Contractor**

Note: Price shall be for carrying out the entire works as per the Scope of Work and Technical Specifications and all related works for executing everything necessary to complete the project satisfactorily in all respects as detailed in the Tender document.

9. MILESTONE PAYMENT TERMS:

Payment shall be released in stages as follows:

1. **50% of the Contract Value** (excluding GST) upon delivery of MMS at a site, subject to submission of delivery documentation and invoice verified by INKEL.
2. **30% of the Contract Value** (excluding GST) following completion of BOS materials supply and full power plant installation, certified by the INKEL.
3. **20% of the Contract Value** (excluding GST) after successful commissioning of the grid-connected system and submission of the Connectivity Report.
4. **5% Performance Security** will be cumulatively withheld from all payments. This retention shall be released 30 days after the 24-months Defects Liability Period, minus costs for rectifying defects or valid Liquidated Damages or against the submission of Bank Guarantee for an equivalent amount.
5. **The GST portion** of any payment will be released only upon submission of the original tax invoice and confirmation of its reflection in the Client's GSTR-2B.