Notice Inviting Limited Quotations (Re-Tender)

Ref No. NIQ-11MW-BOS-CHEPLRY Date: 12.09.2023

INKEL Ltd. Invites competitive quotes from financially sound reputed Contractor for Supply of BOS, Installation, Testing and Commissioning of 450 kWp Grid Connected Ground Mount Solar Power Plants at 110kV Substation Cherpulassery for KSEBL as per given standards and specifications.

Name of Work	Supply of BOS items, Installation, Testing and Commissioning of 450 kWp Grid Connected Ground Mount Solar Power Plants at 110kV Substation Cherpulassery for KSEBL as per given standards and specifications.
Date of publishing bid documents	12.09.2023
Last Date & Time of Submission of Quotation document	22-09-2023, 03:00 PM
Opening of Quotation Cover	22-09-2023, 04:00 PM
Nature of Contract	Supply of BOS Items, Installation, Testing and Commissioning
Time of Completion of Project	120 Days

Eligibility Criteria

The bidder must meet the following minimum eligibility criteria.

a) The bidder must be a firm registered under GST.
b) The firm must have executed solar power plant installation and commissioning related/similar works for an aggregate capacity of at least 300 kWp or more during the last 3 years.

The Technical specifications and scope of work to be executed in site is scheduled in Appendix - 1

All the Quotation documents are to be submitted by Password Protected PDF via email -: tenders.re@inkel.in **or Speed post or courier in the designated covers on the below address by mentioning name of work. Price bid should be password protected PDF, We will ask the password at the time of opening of price bid. Don't send the password along with the email.**

The Managing Director,
INKEL Limited, Door No. 14/812 & 813,
1st Floor, Ajiyal Complex,Kakkanad, Cochin,
Ernakulam, Kerala - 682030

The quotation shall be valid for 30 days reckoned from the date of opening of quotation. No correspondence would be made with the bidders once the quotation is

submitted. The Bidder shall visit the site before submitting the quotation and later queries will not allowed. The decision taken in the INKEL will be final.

INKEL Ltd reserves the right to modify/cancel any or all quotations without assigning any reasons thereof.

Further details can be had from the office of the General Manager - RE , INKEL Limited, Door No. 14/812 & 813, 1st Floor, Ajiyal Complex, Kakkanad, Cochin, Ernakulam, Kerala - 682030. Any clarification/ queries shall be sent to tenders.re@inkel.in. Bidders who wish to visit the site shall sent a request to tenders.re@inkel.in.

Bid Submission Checklist

The bidder shall submit the following:

1. The entire NIQ signed and sealed as a token of acceptance of terms and conditions.
2. Contact Form Duly filled and signed Appendix 2
3. Price Bid as per Appendix 3 in separate sealed cover.
4. Copy of GST registration certificate.
5. Document to prove eligibility criteria as per Sl. No. b.

NLQ Annexures:

1. Scope of Work and Technical Specifications
2. Format for Price Bid
3. Tentative PV Layout and SLD of the Site
4. Module Mounting Structure GA drawing

APPENDIX - 1

SCOPE OF WORK AND TECHNICAL SPECIFICATIONS

1. OVERVIEW OF THE SCOPE OF WORK

INKEL SCOPE	CONTRACTOR SCOPE
1. Supply of SPV Modules. 2. Supply of Solar Inverters. 3. Supply of Module Mounting Structures with Fasteners. 4. Supply of Transformer. 5. Payment of Statutory Fees (Scrutiny and Inspection) to Electrical Inspectorate.	1. Supply of Balance of System inclusive of all other items which are not supplied by INKEL as per site conditions and technical specifications. 2. Unloading of SPV Modules, Solar Inverters, MMS and all other materials supplied by the contractor safe storage during execution. 3. Installation Testing and Commissioning of the solar power plant. 4. Obtaining Statutory Approvals including drawing submission. 5. All other works which are not specified as INKEL scope are deemed to be in the scope of the contractor.

2. NATURE OF WORK

2.1. This project encompasses supply of BOS items, installation, testing and commissioning of grid connected ground mounted solar PV power projects at listed locations.

2.2. Solar PV power plant can be constructed in the shade free South facing ideal location. All civil constructions including cable lying up to the point of connection to the KSEBL grid including transformer erection inside the allotted land etc. will be the scope of the Contractor.

3. CONTRACT PERIOD

The work shall be completed in all respects within 120 days from the date of handing over of the site.

4. PERFORMANCE RATIO

The Performance ratio shall be minimum 75%.

5. ELECTRICAL INSPECTORATE APPROVAL

5.1. Vendor shall be responsible for obtaining sanction from Electrical Inspectorate sanction and shall prepare all the drawings to be submitted to electrical inspectorate.

5.2. The contractor shall be responsible for AC side earthing design for which Soil resistivity measurement is to be carried out at site. INKEL will extend its support to the contractor/consultant in obtaining signatures of client on hardcopy of documents whenever required.

5.3. All statutory Fee to be paid to inspectorate will be paid by INKEL.

6. SUBMISSION OF DRAWINGS AND TECHNICAL DOCUMENTS

6.1. INKEL will provide the following drawings to the contractor:

6.1.1. Overall Plant Layout
6.1.2. Plant SLD
6.1.3. PV Array Layout
6.1.4. Stringing Layout
6.1.5. GA and Assembly drawings of MMS
6.1.6. Datasheets and installation manuals of PV Modules, Inverters and Transformers.

6.2. The design documents to be submitted by the contractor will include:

6.2.1. Earthing Layout of the Plant.
6.2.2. Earthing design calculations
6.2.3. Lightning protection design and layout
6.2.4. All technical specifications/GA drawings/Schematics of equipment/components supplied by the contractor.
6.2.5. Cable schedules
6.2.6. Civil drawings of LT/HT Panel and inverter mounting arrangement along with Canopy.
6.2.7. The drawings along with detailed structure design and material selected and their standards shall be submitted to INKEL for approval before starting the execution work. The work will be carried out as per the approved design.

7. QUALITY ASSURANCE:

7.1. The successful bidder shall establish a Quality Assurance system for the work and shall be subject to the approval of INKEL or authorized personnel designated.

7.2. Strict compliance with the approved, proven & established quality assurance systems and procedures during the different stages of the plant starting from sizing, selection of make, storage (at site), during erection, testing and commissioning have to be ensured by the contractor.

7.3. The material to be supplied for the project should be tested as per the technical specification of this NLQ. The successful bidder in the presence of INKEL or authorized personnel designated shall carry out all factory acceptance tests of equipment as per the specification and relevant standards.

7.4. All works shall be undertaken with the highest levels of quality and workmanship. Work shall be carried out in conformity with quality and safety norms.

7.5. Any materials or work found to be defective or which does not meet the requirements of the specification will be rejected and shall be replaced at successful bidder's cost.

7.6. The successful bidder shall furnish a detailed quality assurance plan (QAP) for the plant. The test and Inspection shall be done in accordance with the relevant standards and the Manufacturer's standard before the delivery to site as well as after the erection and commission at site.

7.7. The successful bidder shall give the list of tests they will carry out at site to show the performance of plant.

8. GENERAL QUALITY REQUIREMENTS OF SOLAR PV PLANT

The equipment and materials for each location wise Grid Interactive Solar PV Power Plant with associated system (Typical) shall include but not be limited to the Supply, Erection, and Testing & Commissioning of the following:

8.1. Solar PV modules in array (to obtain the capacity specified in each of the Locations) including mounting frames, structures, array foundation and module inter connection. PV Modules and Mounting structures will be supplied by INKEL.

8.2. Array Junction boxes/SMU, distribution boxes and Fuse boxes, MCB's, Surge Arrestors, etc.

8.3. Inverters, common AC power evacuation panel with bus bars and circuit breakers LT Power Interfacing Panel, DC Distribution board. Inverters will be supplied by INKEL.

8.4. Metering and protection along with associated battery system.

8.5. LT Power and Control Cables including end terminations and other required accessories for both AC & DC power.

8.6. Suitable and Standard Isolation.

8.7. Suitable Panels and enclosures as per standards and weather proof enclosures as applicable in outdoor installations.

8.8. Metering facilities.

8.9. Lightning arrestors.

8.10. PVC pipes and accessories/trenches.

8.11. Tool kit and Earthing kit.

8.12. Any other equipment/material required to achieve the generation of total of the designated kWp at STC from Solar Power Plants at each site.

8.13. Receipt, unloading, storage, erection, testing and commissioning of all supplied material including materials supplied by INKEL.

8.14. Suitable termination and Isolation from Grid for Safety of Maintenance with Lock and Key as applicable.

8.15. Power evacuation from the SPV plants shall be made available at the feasible interconnection point of the KSEBL Grid and is under Bidder's scope of work. The power generated from each of the location can be evacuated to the nearest LT/HT grid at various locations. Necessary solar meters shall be installed for monitoring the generated electricity from each plant. Net meters of the required specification shall be provided at the interconnection point at which, output from the inverter is fed to the grid of KSEBL.

8.16. Contractor shall be responsible for obtaining all statutory clearances including sanction from Electrical Inspectorate regarding operation of the Plant. KSEBL shall facilitate to ensure that the same is obtained successfully.

8.17. HT evacuation shall be done from Grid connected ground mounted SPV to the interconnection point of KSEBL Grid (which will be in the plant premises) is under bidder's scope of work.

8.18. The contractor shall provide necessary drawings and documents required by statutory authorities and obtain the approval before taking up erection.

8.19. Any modification in the equipment or installation that may be demanded by the inspecting authorities shall be carried out by the contractor at no additional cost to the INKEL

8.20. In accordance with the specific installation instruction as per the manufacturers drawings or as directed by INKEL, the successful Bidder shall unload, assemble, erect, install test, commission and hand over all electrical equipment included in this contract.

8.21. Erection materials including all consumables, tools, testing instruments or any other equipment required for successful commissioning shall be arranged by the successful Bidder in a timely manner.

8.22. All equipment and instruments, indoor and outdoor, shall be marked with No. and provided with danger boards before commissioning.

8.23. All Power equipment's shall be handled and erected as per the relevant codes of practice and manufacturer's drawings and instruction manuals

8.24. The Contractor shall obtain the temporary Electrical connection for construction purposes and the same has to be dismantled off the premises after completion of erection of plant.

9. TECHNICAL SPECIFICATIONS OF THE PLANT

9.1. String combiner box or array junction boxes

9.1.1. The string combiner box/ junction box shall be dust, vermin, and waterproof and made of FRP/ABS Plastic. The terminal will be connected to copper bus-bar arrangement of proper size to be provided. The junction boxes shall have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables. Suitable markings shall be provided on the bus-bars for easy identification and cable ferrules will be fitted at the cable termination points for identification.

9.1.2. The string combiner box/ junction box shall be with protection class IP 65 for mounting outside in Open weather condition.

9.1.3. Each string combiner box/ junction box will have suitable Reverse Blocking Diodes of maximum DC blocking voltage 1000V/1500V with suitable arrangement for its connecting.

9.1.4. The string combiner box/ Array junction Box will also have suitable surge protection device. The Surge Protective Device shall be of Type 2 as per IEC 60364-5-53.

9.1.5. Provision shall be provided for Fire protection. The details/drawings for fire protection system shall be got approved by the agreement authority before starting the work.

9.1.6. The junction Boxes shall have suitable arrangement for the followings (typical) :-

a) Combine groups of modules into independent charging sub-arrays that will be wired into the controller.
b) Provide arrangement for disconnection for each of the groups.
c) Provide a test point for each sub-group for quick fault location.

9.1.7. The current carrying ratings of the string combiner box/ junction box shall be suitable with adequate safety factor, to inter connect the Solar PV array.

9.1.8. The Junction boxes / string combiner boxes shall conform to IEC 60529 (Degrees of Protection provided by Enclosures (IP Code).

9.2. DC DISTRIBUTION BOARD

9.2.1. DC generated by the solar modules is transmitted through the appropriate cables from Array Yard to Control facility. DC bus & panel should be provided for the incoming DC supply from array yard. The panel should consist of adequate size.

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

9.2.3. 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.

9.2.4. DC DB shall have sheet from enclosure of dust and vermin proof, the bus bar/cables are to be made of copper of desired size. DC DB shall be fabricated to comply with IP 65 protection.

9.2.5. DC distribution boxes shall be provided at appropriate locations.

9.3. REMOTE MONITORING SYSTEM

9.3.1. Remote monitoring shall be provided in all other locations to monitor the applicable site wise parameters.

9.3.2. Power generation and performance of the solar power plant to be monitored through online system to capture electrical parameters from multiple devices such as meters, Inverters, String Combiner boxes to capture parameters such as AC/DC voltage, power, energy as well as monitoring of Breaker, Performance Ratio (PR) of the plant, daily, monthly, yearly generation summary etc. The software should support secure MQTT protocol to transmit the data to the PMKUSUM portal and KSEBL data canter.

9.4. TECHNICAL SPECIFICATION OF ELECTRICAL EQUIPMENT & WORK

9.4.1. The power evacuation system shall comprise of necessary and statutory protection and Isolation as per standards.

9.4.2. The electrical works shall be carried out as per applicable standards. The contractor shall obtain concurrence of INKEL on the following before commencing the work:

9.4.2.1. Module Mounting layout.
9.4.2.2. SCB cabling Layout
9.4.2.3. Earthing layout
9.4.2.4. Power Evacuation System
9.4.2.5. Layout of Complete plan
9.4.2.6. Single Line Diagram.

9.4.3. **Approvals and Safety**: Labelled with CE mark and complies with applicable European Directives: EMC Directive: EN50081-2 (replaced by EN61000-6-4); EN50082-2(replaced by EN61000-6-2), Low Voltage Directive: EN50178; complies with the requirements of VDEW and IEC

standards for Safety of power converters for use in photovoltaic power systems.

9.5. PROTECTIVE RELAYS

9.5.1. The Solar PV system and associated power evacuation system shall be protected as per relevant Indian Standards. Over current relays, reverse power relays and earth fault relays have to be essentially provided wherever required.

9.5.2. Numerical type Over current relays and earth fault relays have to be essentially provided at the locations where the power is evacuated in HT level.

9.5.3. Operational Requirements for Numerical Relays and Auxiliary Relays:

9.5.3.1. All protection relays to be supplied shall be Numerical type. The communication protocol for major Transformer protections such as multi-functional O/C & E/F relays shall be IEC 61850.

9.5.3.2. All numerical relays, auxiliary relays and devices shall be of latest version, reputed make and types proven for the application, satisfying requirement covered elsewhere. Relays and timers shall have appropriate setting ranges, accuracy, resetting ratio, transient overreach and other characteristics to provide required sensitivity to the satisfaction of the owner.

9.5.3.3. Numerical relays shall be suitable for efficient and reliable operation of the protection scheme. Necessary auxiliary relays, timers, trip relays, etc. required for complete scheme, interlocking, alarm, logging, etc. shall be provided. No control relay, which shall trip the circuit breaker when relay is de-energized, shall be employed in the circuits.

9.6. AC DISTRIBUTION BOARD (ACDB)

9.6.1. The ACDB shall be mounted close to the solar grid inverter and have a suitable circuit breaker of suitable rating for connection and disconnection of Inverter from grid.

9.6.2. Output from the inverter shall be fed to the ACDB through 4 pole MCCB of suitable current rating and multifunction export solar meter.

9.6.3. The ACDB shall be connected to KSEBL grid with standard cable/ Conductor with suitable termination.

9.6.4. It shall have provision to measure grid voltage, current and power.

9.6.5. ACDB shall control the AC power from inverters and should have necessary surge arresters (Class I&II).

9.6.6. Unidirectional Energy Export Meter along with CT/PT shall be provided to monitor the solar PV generation.

9.6.7. The ACDB enclosure shall be IP 42 and suitable for mounting on the wall.

9.6.8. The ACDB incomer shall be four (4) pole MCCB with thermal over current and earth fault releases. The incomer shall be selected at required rating.

9.7. CABLES

9.7.1. Irrespective of utilization voltage and current rating all type of power cables shall be minimum of 1100 V grade PVC insulated conforming to **IEC 60227/IS 694 & IEC 60502/IS 1554 Voltage rating: 1100V AC, 1800V DC**. Control cable shall be of min. 500 V grade, the control and power cable have to be laid separately. All LT XLPE cables shall conform to IS: 7098 Part I & II.

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

9.7.3. For the AC cabling, PVC or XLPE insulated and PVC sheathed single or, multi-core flexible Aluminium cables shall be used, Outdoor AC cables shall have a UV -stabilized outer sheath.

9.7.4. All LT XLPE cables shall conform to IS: 7098 part I&II.

9.7.5. The total voltage drop on the cable segments from the solar PV modules to the solar grid inverter shall not exceed 2.0 %.

9.7.6. The total voltage drop on the cable segments from the solar grid inverter to the distribution board shall not exceed 2.0%.

9.7.7. The DC cables from the SPV module array shall run through a UV-stabilized PVC conduit pipe of adequate diameter with a minimum wall thickness of 1.5 mm.

9.7.8. Cables and wires used for the interconnection of solar PV modules shall be provided with solar PV connectors (MC4) and couplers.

9.7.9. The minimum DC cables size shall be 4.0mm^2 copper; The minimum AC cable size shall be 4.0mm^2 copper. In three phase systems, the size of the neutral wire shall be equal to the size of the phase wires.

9.7.10. The following color code shall be used for cable wires and shall confirm to IEC 69947

- 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

9.7.11. Cables and conduits that have to pass through walls or ceilings shall be taken through PVC pipe sleeve

9.7.12. 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.

9.7.13. Bending radii for cables shall be as per manufactures recommendations and IS: 1255. Cables shall also conform to IEC 60189 for test and measuring methods.

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

9.8. LIGHTNING PROTECTION

9.8.1. The SPV power plant should be provided with lightning and over voltage protection.

9.8.2. 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 IEC 62305 and applicable IS.

9.8.3. 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.

9.8.4. Surge protection shall be provided on the DC side and AC side of the solar system.

9.8.5. The DC surge protection device shall be installed in the DC distribution box adjacent to the solar grid inverter.

9.8.6. The AC surge protection devices shall be in the AC distribution box.

9.8.7. 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.

9.9. EARTHING SYSTEM

9.9.1. 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.

9.9.2. The complete earthing system shall be electrically connected to provide return to earth from all equipment independent of mechanical connection.

9.9.3. The equipment grounding wire shall be connected to earth strip by proper fixing arrangement. Each strip shall be continued upto at least 500mm from the equipment.

9.9.4. Earthing system design should be as per the standard practices and should conform to the 1987 edition of IS 3043.

9.9.5. Masonry enclosure with the earth pit of size not less than 400mm X 400mm (width) complete with cemented brick work (1:6) of minimum 500 mm depth 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.

9.9.6. Minimum four (04) numbers of interconnected earth pit need 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, module mounting structure, kiosk and in any other item as required.

9.9.7. Earthing system must be interconnected through GI strip to arrive equipotential bonding. The size of the GI earth strip must be minimum 25mmX 6mm.

9.9.8. All metal casing/shielding of the plant shall be thoroughly grounded in accordance with IE Rules. The earthing for array and LT power system shall be as required as per provisions of IS.

9.9.9. The complete earthing system shall be mechanically and electrically connected to provide independent return to earth. All three-phase equipment shall have two distinct earth connections. An earth bus shall be provided inside the control facility. For each earth pit, necessary test point shall have to be provided.

9.9.10. In compliance to Rule 33 and 61 of Indian Electricity Rules, 1956 (as amended up to date), all non-current carrying metal parts shall be earthed with two separate and distinct earth continuity conductors to an efficient earth electrode.

9.10. HT EQUIPMENT

9.10.1. The HT side equipment and parts shall be earthed as required under provisions of IS. RMU shall be provided as per the relevant Indian Standards and IE rules.

9.10.2. The system shall be designed with appropriate CTs & PTs to have all relevant protection. In addition, CTs and PTs shall also be provided for metering and protection purposes as elsewhere specified.

9.10.3. The HT side shall have the following protections provided:

- Over current & earth fault relay with under voltage & over voltage protection
- Reverse power, under and over frequency protection relay

9.10.4. The CTs and PTs provided shall be furnished for the approval and shall be provided as per the relevant Indian Standards

9.11. HT PANEL

9.11.1. The HV output from transformer shall be terminated at the existing 11 kV bus of the substation as per the schematic drawing. The following equipment/panels shall be provided:

9.11.1.1. 11kV LBS Panel

A Load Break Switch Panel shall be provided within 10m of the transformer installation to provide isolation to the HV side of the transformer. The 11KV, 630A, 25KA HT LBS shall be totally enclosed, should be fabricated out of 233 thick CRCA sheet steel, floor mounting, free standing, dust and vermin proof outdoor type (IP54) with 7 tank treatment, aluminium bus bar arrangement for outgoing complete confirming to IEC-60298 & IS3427. The LBS panel should have the following:

a. 11KV, 630A, 25KA Air insulated Load break switch outdoor with earth switch.

b. Space heater with ON/OFF switch with thermostat.
c. Incoming and outgoing cable box for bottom entry.
d. Civil foundation for mounting.

9.11.1.2. 11kV VCB Panel with Metering

9.11.1.2.1. The outgoing cable from the LBS panel shall be terminated to the 11kV bus of the substation by adding a new bay to the existing 11kV Panel.

9.11.1.2.2. The newly added bay shall be complete with VCB, relays, CTs-PTs for measurement and protection, voltmeter & ammeter, Multifunction meters and HT TOD metering compartment as per Inspectorate and KSEBL standards.

9.11.1.2.3. The circuit breaker along with CT, PT, Control & relay Panels shall be suitable for indoor installations with vacuum as interrupting media incorporating separate interrupters of 1250A rating for each phase mounted on single frame.

9.11.1.2.4. The newly added bay shall be compatible with the existing switchgear of the substation. Bidder is advised to visit the site and take necessary data to ensure compatibility.

9.11.1.2.5. The busbars shall have a continuous rated current of 630 A at 40 deg. C and a short time withstand current capacity of 25 kA for 3 secs. Bus bar support insulating material shall be SMC/DMC resin.

9.11.1.2.6. Any civil/electrical modification work as part of the bay addition shall be carried out as per applicable standards.

9.12. CLEANING

9.12.1. Water storage and necessary feed lines has to be provided by the contractor. Water lines may be drawn to feed water from the available resources. Contractor has to provide additional facility including pipeline and motor for pumping to the additional overhead tank if required for cleaning the SPV modules, depending on the site conditions.

9.12.2. Contractor shall provide permanent arrangement for module washing in the SPV Plant. The source of water for the proposed Solar PV plant would be the ground or surface water for which adequate number of ordinary open wells can be constructed at the site. If existing water sources are not available, wells to be provided depending upon the site. Adequate size network of CPVC pipe in each row of SPV panels shall also be provided for the supply of water for cleaning the solar PV modules on a periodic base. Opening from the CPVC pipe with manual isolating valves with nozzles should be provided at regular interval in each row of SPV panels. The pipe network also shall include appropriate arrangement for easy sprinkling of water on to the panels. Water optimization will be carried out during detailed engineering stage to meet the water consumption allocation for cleaning of the panels. Contractor shall provide the single line diagram of water washing arrangement along with location of pump to KSEB for approval. Contractor has to provide facility including

pipeline and motor for pumping to the overhead tank if required for cleaning the SPV modules, depending on the site conditions.

9.13. CIVIL WORKS

9.13.1. Land Development for site activities

9.13.1.1. The EPC contractor shall be responsible for detailed soil investigation and contour survey at required locations for the purposes of foundation design for the module structure as well as the Control room. He shall also make the site ready by clearing of bushes, felling of trees, leveling of ground (wherever required) etc. for commencing the project.

9.13.1.2. Engineer-in-Charge shall take necessary actions such as tree cutting sanction from social forestry department and land construction approval if required.

9.13.1.3. All Civil works required for the installation of a **Photo Voltaic plant shall be within the scope of the bidder.**

9.13.2. Fencing

If fencing is not there for the sites that are not situated in the substation compound, providing the same will be in the scope of the contractor.

9.14. INVERTER ACCOMMODATION

The layout of Inverter accommodation shall be designed so as to enable adequate heat dissipation and space availability within the existing infrastructure available in consultation with the Site in charge. The infrastructure shall be kept in adequate enclosure locked, to avoid public intrusion. One Key of the same shall be given for the custody of the site in charge. All access to the installed infrastructure shall be made in concurrence with the Engineer in charge binding safety.

9.15. ILLUMINATION SYSTEM

Supply and providing of suitable illumination system for inverter accommodation is in bidder's scope. The bidder shall opt for lighting fixtures and accessories based on energy saving concept technology such as LED.

9.16. DC BATTERY & CHARGER

Adequate capacity DC battery bank should be provided for emergency control supply of control /protection system & emergency lighting. An appropriate capacity battery charger with relevant IS / IEC standards & protection and automatic change over system should be provided to charge the battery bank along with relay circuit, fuses, annunciations and remote operating and controlling facility from Main Control Room. A DC power supply Distribution panel/ board should be supplied along with the charger as per relevant IS standards.

9.17. ENERGY METER

9.17.1. As per KSERC (Grid Interactive Distributed Solar Energy Systems) Regulation, 2014 and its amendment thereof, net metering system is to be provided to the solar consumer. Net metering means a system

consisting of a solar meter and net meter with their associated equipment. Solar meter means a unidirectional meter to be installed at the delivery point of the solar energy system to measure the solar electricity generated. Solar meter and an import export energy meter suitable for the installed solar plant shall be supplied and installed by the contractor after obtaining testing and sealing from respective TMR Divisions. Meters must be provided with the necessary data cables if required.

9.17.2. Energy meters 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.

9.17.3. The accuracy class of the energy meters and current and potential transformers will be selected and agreed upon by KSEBL so that all levels of energy produced or taken by the Solar Power Plant will be measured accurately. Based on the circular issued by KSEBL circular No. CE(REES)/AE8/Meter Allocation/2018-19/814(A) dated 08-08-2018), the specification of the meters is furnished below.

Sl. No	Type of Meter	Specification
1	Single Phase	ISI marked LT single phase, DLMS compatible with RS 232 communication port, Static bi-directional energy meter having LCD and TOD facility of rating 5-30A accuracy class 1.0.
2	Three Phase Whole current	DLMS compliant & AMR compatible, 3 phase,4 wire, bi-directional Static Tri-vector meter of accuracy class 1.0 with TODregister and having ISI marking.
3	Three Phase CT	DLMS compliant & AMR compatible with optical port and RS 232 port, 3 phase,4 wire, LT CT operated, bi-directional accuracy class 0.5S for kWh and class 1S for kVARh, -/5A, Static Tri-vector meter with TOD register and having ISI marking.

4	HT meter	DLMS compliant & AMR compatible with optical port and RS 232 port, 3 phase,4 wire, HT CT/PT operated, bi- directional accuracy class 0.2S for kWh and class 0.2S for kVARh, -/5A, Static Tri-vector meter with TOD register and having ISI marking.

Meters shall be microprocessor-based conforming to IEC 60687/IEC 62052-11/ IEC 62053-22/IS14697

Meters shall measure active energy (both import and export) and reactive energy (import) by3 ph, 4 wire principle suitable for balanced/unbalanced 3 phase loads.

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 & other parameters through push-button).

9.18. SAFETY REGULATIONS

Adequate firefighting equipment and extinguishing agents of sufficient capacity and quantity must always be available at site and kept ready for immediate use. The firefighting system for the proposed power plant for fire protection shall be consisting of: Portable fire extinguishers in the control room for fire caused by electrical short circuits and Sand buckets in the control room. The installation of Fire Extinguishers should confirm to TAC regulations and BIS standards. The fire extinguishers shall be provided in the control room housing PCUs as well as on the site where the PV arrays have been installed.

The fire extinguishers shall be suitable for fighting fire of oils, solvents, gasses, paints, varnishes, electrical wiring, live machinery fires and all flammable liquid & gas.

9.19. ERECTION, TESTING & COMMISSIONING

9.19.1. The contractor shall provide necessary drawings and documents required by statutory authorities and obtain the approval before taking up erection.

9.19.2. Any modification in the equipment or installation that may be demanded by the inspecting authorities shall be carried out by the contractor at no additional cost to the KSEBL

9.19.3. In accordance with the specific installation instruction as per the manufacturers drawings or as directed by the KSEBL, the successful Bidder shall unload, assemble, erect, install test, commission and hand over all electrical equipment included in this contract after O&M of 5 years.

9.19.4. Erection materials including all consumables, tools, testing instruments or any other equipment required for successful commissioning shall be arranged by the successful Bidder in a timely manner.

9.19.5. All equipment and instruments, indoor and outdoor, shall be marked with No. and provided with danger boards before commissioning.

9.19.6. All Power equipment shall be handled and erected as per the relevant codes of practice and manufacturer's drawings and instruction manuals.

9.19.7. The Contractor shall obtain the temporary Electrical connection for construction purposes and the same has to be dismantled off the premises after completion of erection of plant.

9.20. DATE OF COMMISSIONING

After the Inspection and approval of the Electrical Inspectorate, date of Energisation to the Grid will be considered as the official Date of Commissioning (CoD) of the project.

9.21. WARRANTY

The components supplied as well as the installation shall carry a warranty of 24 months from the date of commissioning.

X----------X----------X

Appendix - 2

CONTACT FORM

Name of the Firm	
Complete Office Address with Phone Number and E-mail ID	
Type of Ownership	
GST No.	
PAN	
Year of Establishment	
Electrical Contractor License Details	
Name of Contact Person with Designation	
Mobile Number & E-mail ID of the Contact Person	

Name of Authorized Signatory:

Signature .....

Official Seal

Date:

Appendix - 3

Price Quote:

Sl. No	Item Description	450kWp Grid Connected SPV System
1	Supply of BOS items for Grid Connected Ground Mount Solar Power Plant for KSEBL as per given standards as per **Appendix 1**	
2	Installation, Testing and Commissioning of Grid Connected Ground Mount Solar Power Plant for KSEBL as per given standards as per **Appendix 1**	
3	GST	
	Total	
Grand Total (in Figures)		
Grand Total (in Words)		

Payment Terms:

a. 25% against completion of installation of SPV Modules.
b. 40% against delivery of BOS Materials at site.
c. 25% on completion of Installation in all respects.
d. Balance 10% after Testing and Commissioning.
e. Release of GST portion with any payment will be subject to submission of original tax invoice and reflection of credit in the GST portal.

Contractor Name & Address:

Signature .....

Official Seal

Date:

450kWp GROUND MOUNTED SPV SYSTEM AT 110kV SUBSTATION, CHERPULASSERY.

PROJECT LOCATION

SYSTEM INFORMATION

PV MODULE MODEL	: 72 CELLS POLYCRYSTALLINE - 335Wp (KSEB APPROVED MAKE)
INVERTER	: [2] 250kW STRING INVERTER
SURFACE	: GROUND MOUNTED STRUCTURE
AZIMUTH	: 9°
TILT	: 10°

LOCATION CO-ORDINATES: 10°53'13.6'' N, 76°19'19.3'' E

KSEB SIGN & SEAL :

INKEL SIGN & SEAL :

Client:
Kerala State Electricity Board Limited
Vydyuthi Bhavanam, Pattom,
Thiruvananthapuram-695 004

Project By:
INKEL Limited
Door No.7/473 ZA-5&6, Ajiyal Complex, Post Office Road, Kakkanad, Cochin - 682030

Project Name: 450kWp SPV System at 110kV Substation,Cherpulassery

Notes:

Title: Title sheet (T1 of 2)

Issued For: Approval

Drawing No.	Scale	Date
IL-KSEB11MW-CHEPLRY-COM-001	NTS	04/08/2023

Design By	Checked By	Approved By
NJ	PR	NJ

Rev.	Description	Date
1.0	For Approval	04/08/2023

INDEX OF DRAWINGS

SHEET NO:	DESCRIPTION
T 1 of 2	TITLE SHEET
T 2 of 2	INDEX OF DRAWINGS
PV 1 of 4	SITE OVERVIEW
PV 2 of 4	PV LAYOUT
PV 3 of 4	STRINGING LAYOUT
PV 4 of 4	EQUIPMENT LAYOUT
E 1 of 2	DC SINGLE LINE DIAGRAM
E 2 of 2	AC SINGLE LINE DIAGRAM

SYSTEM INFORMATION

PV MODULE MODEL : 72 CELLS POLYCRYSTALLINE - 335Wp
(KSEB APPROVED MAKE)

INVERTER : [2] 250kW STRING INVERTER

SURFACE : GROUND MOUNTED STRUCTURE

AZIMUTH : 9°

TILT : 10°

LOCATION CO-ORDINATES: 10°53'13.6'' N, 76°19'19.3'' E

KSEB SIGN & SEAL :

INKEL SIGN & SEAL :

Client:
Kerala State Electricity Board Limited
Vydyuthi Bhavanam, Pattom,
Thiruvananthapuram-695 004

Project By:
INKEL Limited
Door No.7/473 ZA-5&6, Ajiyal Complex, Post Office Road, Kakkanad, Cochin - 682030

Project Name: 450kWp SPV System at 110kV Substation,Cherpulassery

Notes:

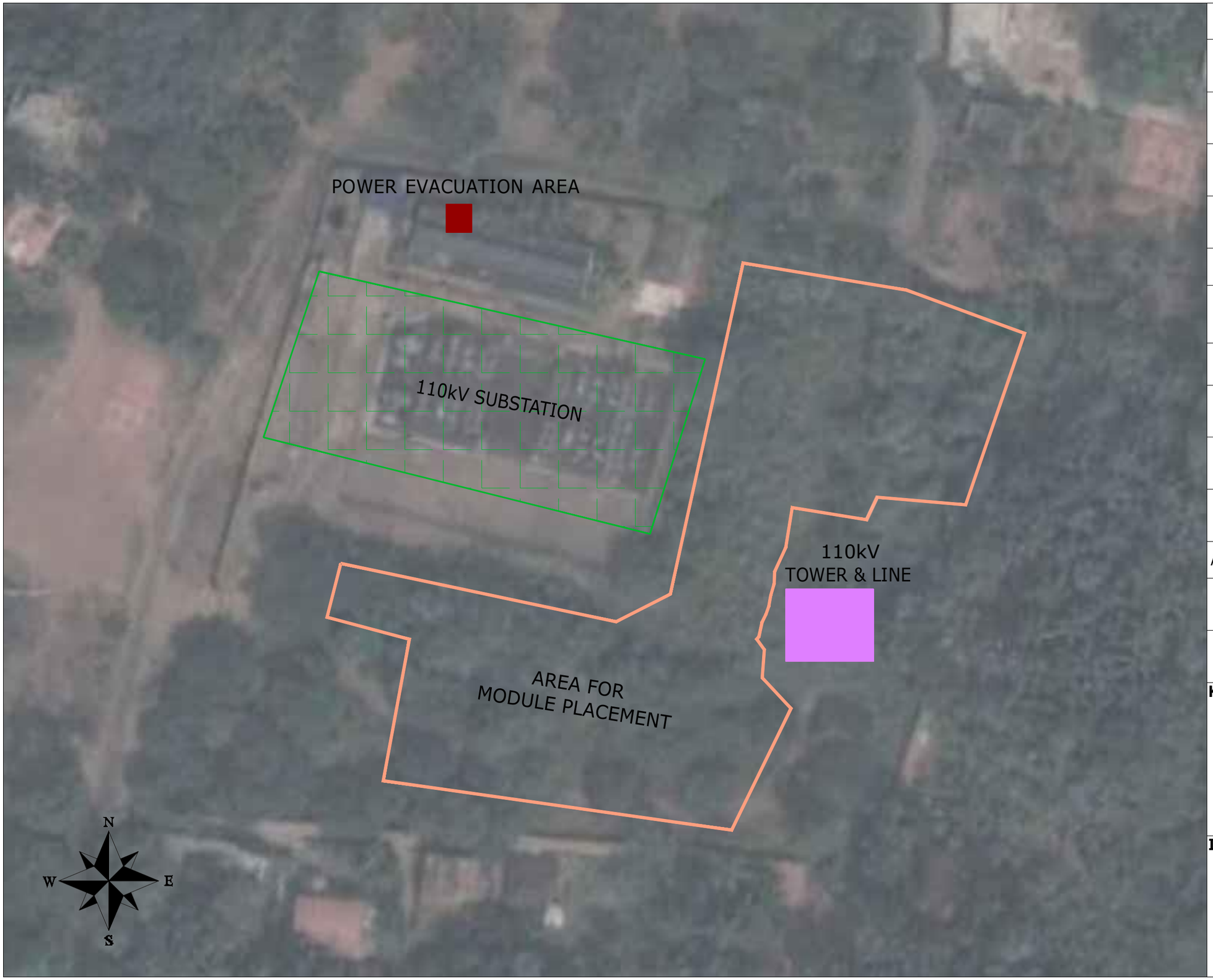
Title: Index of Drawings (T2 of 2)

Issued For: Approval

Drawing No.	Scale	Date
IL-KSEB11MW-CHEPLRY-COM-002	NTS	04/08/2023

Design By	Checked By	Approved By
NJ	PR	NJ

Rev.	Description	Date
1.0	For Approval	04/08/2023



LEGENDS	
	AREA FOR MODULE PLACEMENT
	110kV SUBSTATION
	110kV TOWER & LINE
	POWER EVACUATION AREA
SYSTEM DETAILS	
MODULES USED	72 CELLS POLYCRYSTALLINE - 335Wp
NUMBER OF MODULES	1350
DC SYSTEM RATING	450.00kWp
INVERTERS USED	[2] 250kW STRING INVERTER
AC SYSTEM CAPACITY	500.00kVA
ARRAY PITCH	10°
ARRAY AZIMUTH	9°
MOUNTING TYPE	TILT

KSEB SIGN & SEAL

INKEL SIGN & SEAL

Client:
KSEB കേരളത്തിന്റെ ഊർജ്ജം
Kerala State Electricity Board Limited
Vydyuthi Bhavanam, Pattom,
Thiruvananthapuram-695 004

Project By:
inkel Creating Infrastructure
A PPP INITIATIVE OF GOVERNMENT OF KERALA
INKEL Limited
Door No.7/473 ZA-5&6, Ajiyal Complex, Post Office Road, Kakkanad, Cochin - 682030

Project Name: 450kWp SPV System at 110kV Substation,Cherpulassery

Notes:
1. All dimensions are in meters unless specified otherwise.

Title: Site Overview (PV1 of 4)

Issued For: Approval

Drawing No.	Scale	Date
IL-KSEB11MW-CHEPLRY-COM-003	NTS	04/08/2023

Design By	Checked By	Approved By
NJ	PR	NJ

Rev.	Description	Date
1.0	For Approval	04/08/2023

LEGENDS	
	AREA FOR MODULE PLACEMENT
	PV MODULE
SYSTEM DETAILS	
MODULES USED	72 CELLS POLYCRYSTALLINE - 335Wp
NUMBER OF MODULES	1350
DC SYSTEM RATING	450.00kWp
INVERTERS USED	[2] 250kW STRING INVERTER
AC SYSTEM CAPACITY	500.00kVA
ARRAY PITCH	10°
ARRAY AZIMUTH	9°
MOUNTING TYPE	TILT

KSEB SIGN & SEAL

INKEL SIGN & SEAL

Client:

Kerala State Electricity Board Limited
Vydyuthi Bhavanam, Pattom,
Thiruvananthapuram-695 004

Project By:

INKEL Limited
Door No.7/473 ZA-5&6, Ajiyal Complex, Post Office Road, Kakkanad, Cochin - 682030

Project Name: 450kWp SPV System at 110kV Substation,Cherpulassery

Notes:
1. All dimensions are in meters unless specified otherwise.

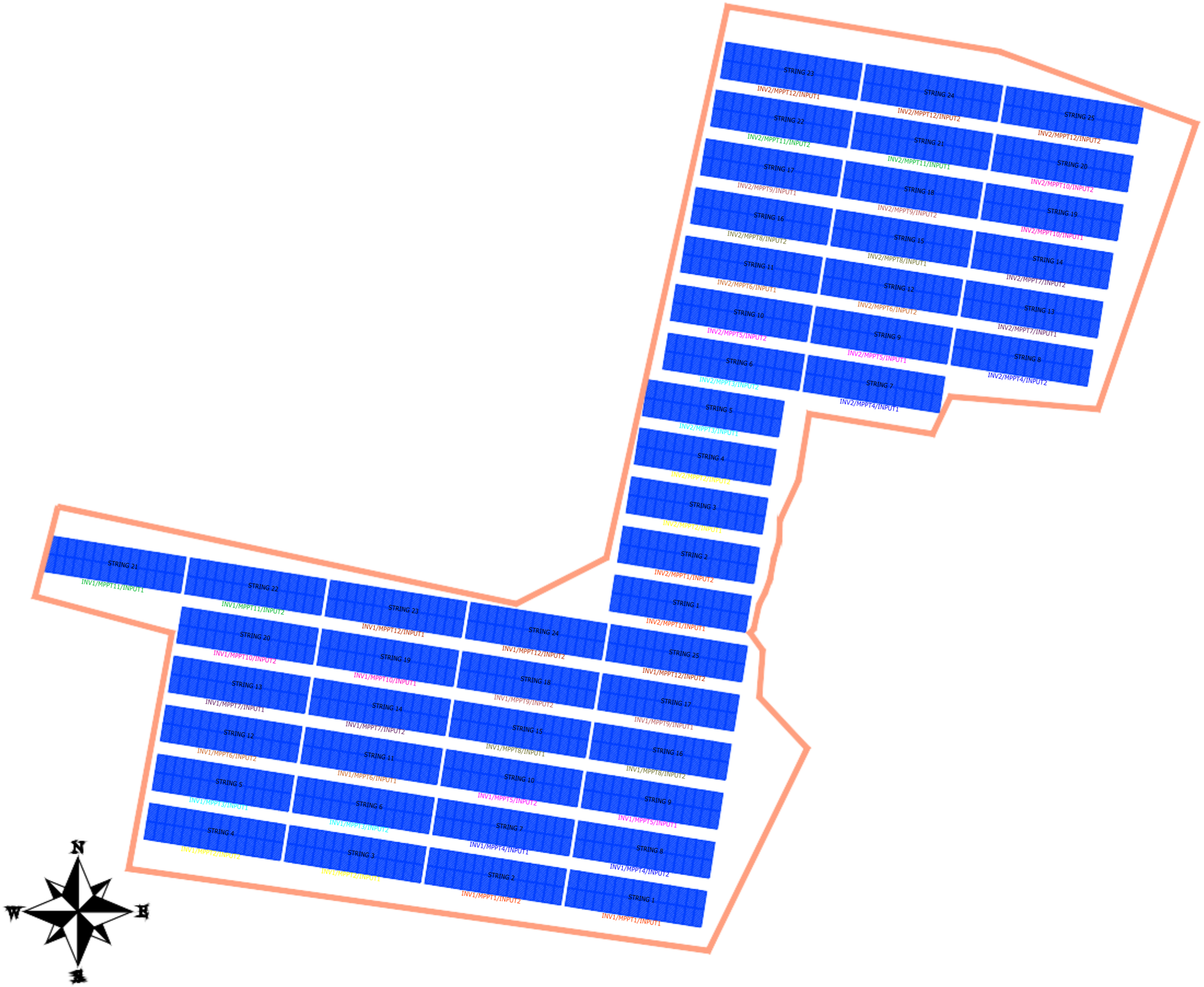
Title: PV Layout (PV2 of 4)

Issued For: Approval

Drawing No.	Scale	Date
IL-KSEB11MW-CHEPLRY-COM-004	NTS	04/08/2023

Design By	Checked By	Approved By
NJ	PR	NJ

Rev.	Description	Date
1.0	For Approval	04/08/2023



LEGENDS	
	AREA FOR MODULE PLACEMENT
	PV MODULE
SYSTEM DETAILS	
MODULES USED	72 CELLS POLYCRYSTALLINE - 335Wp
NUMBER OF MODULES	1350
DC SYSTEM RATING	450.00kWp
INVERTERS USED	[2] 250kW STRING INVERTER
AC SYSTEM CAPACITY	500.00kVA
ARRAY PITCH	10°
ARRAY AZIMUTH	9°
MOUNTING TYPE	TILT

KSEB SIGN & SEAL

INKEL SIGN & SEAL

Client:

Kerala State Electricity Board Limited
Vydyuthi Bhavanam, Pattom,
Thiruvananthapuram-695 004

Project By:

INKEL Limited
Door No.7/473 ZA-5&6, Ajiyal Complex, Post Office Road, Kakkanad, Cochin - 682030

Project Name: 450kWp SPV System at 110kV Substation,Cherpulassery

Notes:

Title: Stringing Layout (PV3 of 4)

Issued For: Approval

Drawing No.	Scale	Date
IL-KSEB11MW-CHEPLRY-COM-005	NTS	04/08/2023

Design By	Checked By	Approved By
NJ	PR	NJ

Rev.	Description	Date
1.0	For Approval	04/08/2023

LEGENDS	
	AREA FOR MODULE PLACEMENT
	PROPOSED INVERTERS LOCATION
	POWER EVACUATION AREA
SYSTEM DETAILS	
MODULES USED	72 CELLS POLYCRYSTALLINE - 335Wp
NUMBER OF MODULES	1350
DC SYSTEM RATING	450.00kWp
INVERTERS USED	[2] 250kW STRING INVERTER
AC SYSTEM CAPACITY	500.00kVA
ARRAY PITCH	10°
ARRAY AZIMUTH	9°
MOUNTING TYPE	TILT

KSEB SIGN & SEAL

INKEL SIGN & SEAL

Client:

Kerala State Electricity Board Limited
Vydyuthi Bhavanam, Pattom,
Thiruvananthapuram-695 004

Project By:

INKEL Limited
Door No.7/473 ZA-5&6, Ajiyal Complex, Post Office Road, Kakkanad, Cochin - 682030

Project Name: 450kWp SPV System at 110kV Substation,Cherpulassery

Notes:

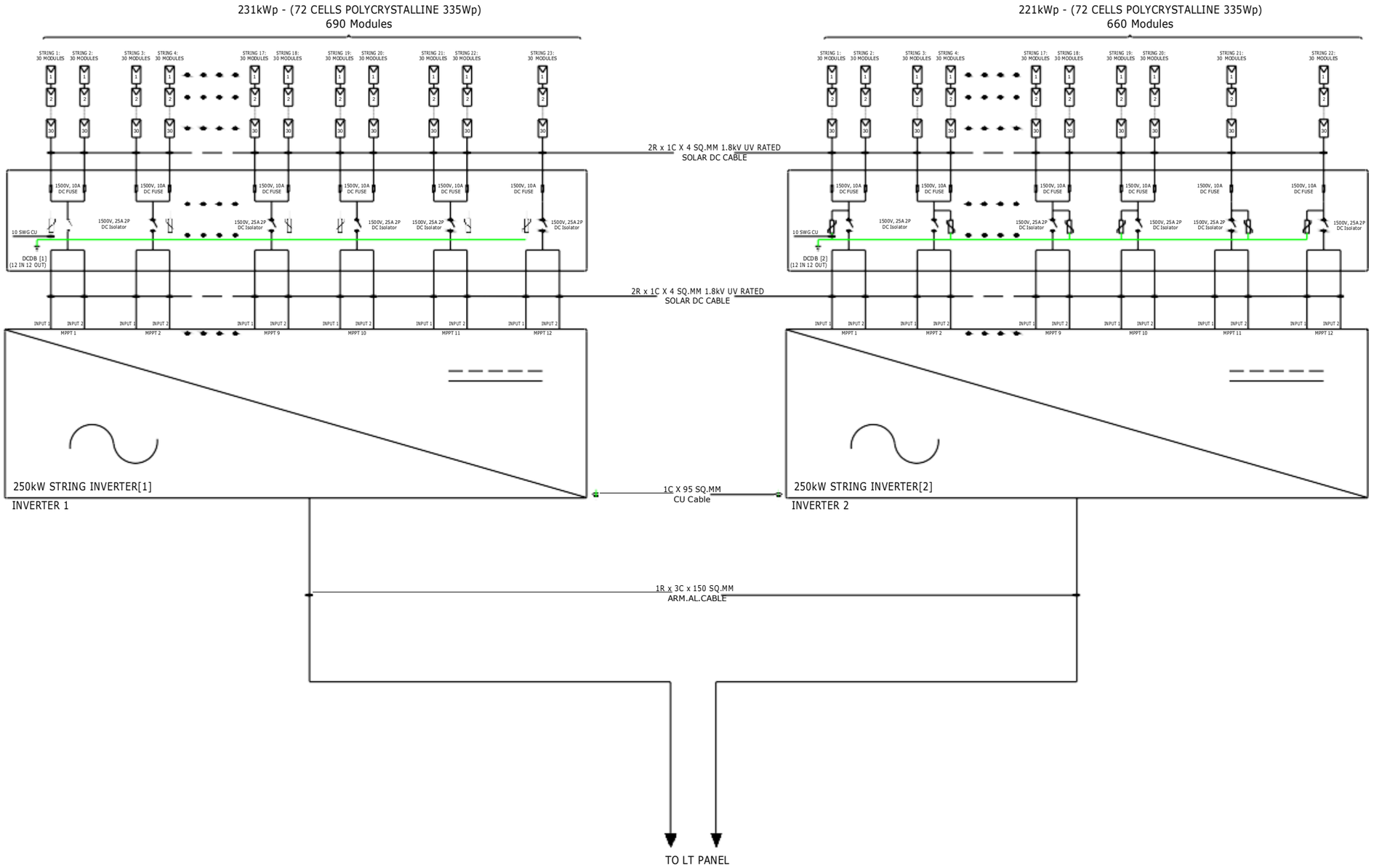
Title: Equipment Layout (PV4 of 4)

Issued For: Approval

Drawing No.	Scale	Date
IL-KSEB11MW-CHEPLRY-COM-006	NTS	04/08/2023

Design By	Checked By	Approved By
NJ	PR	NJ

Rev.	Description	Date
1.0	For Approval	04/08/2023



ELECTRICAL DETAILS

DC SYSTEM RATING @ STC	450kWp		
INVERTER RATING	500kW		
MODULES USED	[1350]POLYCRYSTALLINE MODULE -335Wp		
POWER RATING @ STC	335Wp	MODULE EFFICIENCY	17%
VOC @ STC	46.15V	MPP.V	39.00V
ISC @ STC	9.09A	MPP.I	8.60A
MAX. ARRAY VOLTAGE	1500Vdc		
INVERTER MODEL	[2] 250kW STRING INVERTER		
INVERTER CAPACITY	500kW		
MAX. MPPT OPERATING VOLTAGE	1500V	NO.OF DC INPUTS	24
AC OUTPUT VOLTAGE	800V	MAX. INPUT CURRENT	30A per MPPT
MAX. AC POWER	250kW	MAX.OUTPUT CURREN	180.5A

KSEB SIGN & SEAL

INKEL SIGN & SEAL

Client:
Kerala State Electricity Board Limited
Vydyuthi Bhavanam, Pattom,
Thiruvananthapuram-695 004

Project By:
INKEL Limited
Door No.7/473 ZA-5&6, Ajiyal Complex, Post Office Road, Kakkanad, Cochin - 682030

Project Name: 450kWp SPV System at 110kV Substation,Cherpulassery

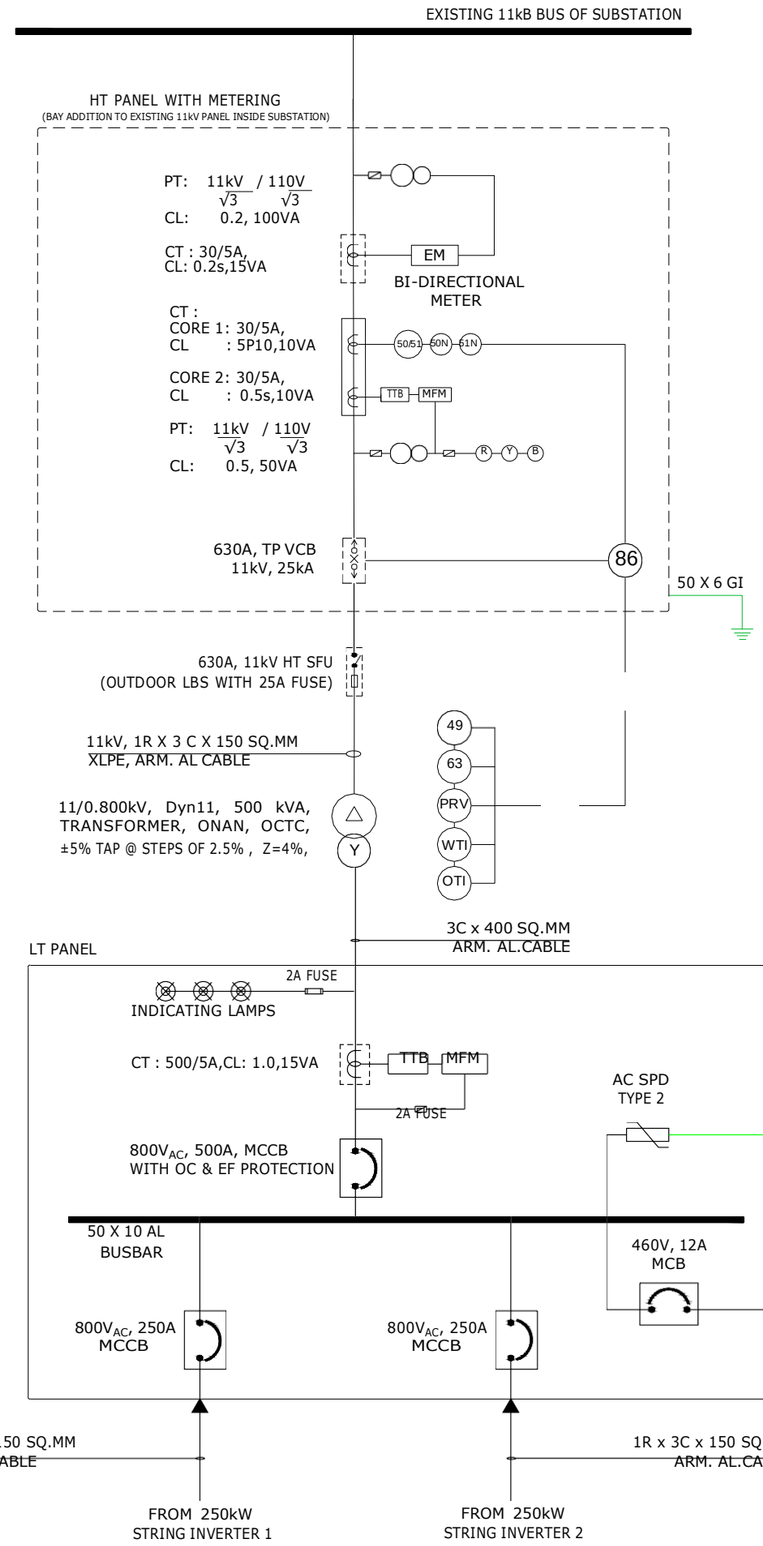
Notes:
1. The make and model of the components specified in the electrical details are subjected to change considering the availability at the time of procurement & installation.

Title: DC SLD (E1 of 2)
Issued For: Approval

Drawing No.	Scale	Date
IL-KSEB11MW-CHEPLRY-COM-007	NTS	04/08/2023

Design By	Checked By	Approved By
NJ	PR	NJ

Rev.	Description	Date
1.0	For Approval	04/08/2023



LEGEND

	DROP OUT (DO) FUSE
	AIR BREAK (AB) SWITCH
	POTENTIAL TRANSFORMER
	AIR CIRCUIT BREAKER (ACB)
	LIGHTING ARRESTER
	TRANSFORMER
	CURRENT TRANSFORMER
MFM	MULTI FUNCTION METER
A	DIGITAL AMMETER
50	INSTANTANEOUS OVER CURRENT RELAY
49	WINDING TEMP HIGH TRIP OIL TEMP HIGH TRIP
63	BUCHOLZ RELAY
51	AC INVERSE TIME OVER CURRENT RELAY
86	MASTER TRIP RELAY
51N	NEUTRAL AC INVERSE TIME EARTH OVER CURRENT RELAY
50N	NEUTRAL INSTANTANEOUS OVER CURRENT RELAY
	VACUUM CIRCUIT BREAKER (VCB)
OTI	OIL TEMPERATURE INDICATOR
WTI	WINDING TEMPERATURE INDICATOR
TTB	TEST TERMINAL BLOCK
PRV	PRESSURE RELEASE VALVE

ELECTRICAL DETAILS

DC SYSTEM RATING @ STC	450kWp		
INVERTER RATING	500kW		
MODULES USED	[1350]POLYCRYSTALLINE MODULE -335Wp		
POWER RATING @ STC	335Wp	MODULE EFFICIENCY	17%
VOC @ STC	46.15V	MPP.V	39.00V
ISC @ STC	9.09A	MPP.I	8.60A
MAX. ARRAY VOLTAGE	1500Vdc		
INVERTER MODEL	[2] 250kW STRING INVERTER		
INVERTER CAPACITY	500kW		
MAX. MPPT OPERATING VOLTAGE	1500V	NO.OF DC INPUTS	24
AC OUTPUT VOLTAGE	800V	MAX. INPUT CURRENT	30A per MPPT

AC CABLE SCHEDULE

DESCRIPTION	CABLE SIZE	TOTAL LENGTH	VOLTAGE DROP
INVERTER TO LT PANEL	3C X 150 SQ.MM AC AL CABLE	20m	0.10%
LT PANEL TO TRANSFORMER	3C X 400SQ.MM AC AL CABLE	30m	0.27%
TRANSFORMER TO POINT OF EVACUATION	3C X 150SQ.MM AC AL CABLE	160m	0.02%

KSEB SIGN & SEAL

INKEL SIGN & SEAL

Client:
Kerala State Electricity Board Limited
Vydyuthi Bhavanam, Pattom,
Thiruvananthapuram-695 004

Project By:
INKEL Limited
Door No.7/473 ZA-5&6, Ajiyal Complex, Post Office Road, Kakkanad, Cochin - 682030

Project Name: 450kWp SPV System at 110kV Substation,Cherpulassery

Notes:
1. The make and model of the components specified in the electrical details are subjected to change considering the availability at the time of procurement & installation.

Title: AC SLD (E2 of 2)
Issued For: Approval

Drawing No.	Scale	Date
IL-KSEB11MW-CHEPLRY-COM-008	NTS	04/08/2023

Design By	Checked By	Approved By
NJ	PR	NJ

Rev.	Description	Date
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