

Annual Rate Contract for Supply, Installation, Testing and Commissioning of Grid connected rooftop solar power plant System on RMC buildings with related comprehensive Electrical, Mechanical & Civil Work including all necessary equipments with 10 (Ten) years comprehensive O&M.

(E-Tender No.RMC/ROSHNI/RC solar power plant/2020-21)



Sr. No.	Event Description	Mile Stone Date
1	Start of download of E-tender	Dt. 09 /06 /2020 to Dt. 29 /06 /2020 up to 18:00 Hrs.
2	Last date of online submission of E-tender	Dt. 29 /06 /2020 up to 18:00 Hrs.
3	Last Date of submission of physical document EMD, Tender fee and other documents.	Dt. 02 /07 /2020 up to 18:00 Hrs.
4	Opening of on line technical bid and verification of physical documents - EMD, Tender fee and Other documents, (if possible).	Dt. 03 /07 /2020.
5	Opening of On-line price bid, (if possible).	Dt. 06/07/2020.
6	Validity of Bid	180 Days

TECHNICAL BID

Additional City Engineer
Roshni (Lighting) Department
Rajkot Municipal Corporation
Central zone office
DR. Ambedkar bhavan
Room No.08, 2nd Floor, Dhebar road , RAJKOT – 360 001

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1 E-Tender - Notice Inviting Tender

The E-Tenders are invited with two bid system basis by RAJKOT MUNICIPAL CORPORATION, Rajkot from competent Contractor/Manufacturers for the work of Annual Rate Contract for Supply, Installation, Testing and Commissioning of Grid connected rooftop solar power plant System with related comprehensive Electrical, Mechanical & Civil Work including all necessary equipments with 10 (Ten) years comprehensive O&M.

Sr. No.	Name of work	a) Estimated cost in Rs. b) EMD in Rs. c) E-TENDER fee in Rs.
10	Annual Rate Contract for Supply, Installation, Testing and Commissioning of Grid connected rooftop solar power plant System on RMC buildings with related comprehensive Electrical, Mechanical & Civil Work including all necessary equipments with 10 (Ten) years comprehensive O&M.	a) Rs. 65,00,000/- b) Rs. 65,000/- c) Rs. 3,000 / -

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6	Validity of Bid	180 Days

- 1.1 The bidder must submit the Demand Draft of Tender Fee and EMD of any Nationalized or schedule bank in India, in the name of RAJKOT MUNICIPAL CORPORATION" payable at Rajkot with physical submission of the tender documents, failing which the tender will be rejected.

- 1.2 The bidder must have experience of the similar nature of work in the Govt. and/or Semi Govt. Departments, as below,
 - 1.2.1 One work of similar nature of 50 % of the estimated cost in last seven years OR
 - 1.2.2 Two work of similar nature of 40 % of the estimated cost in last seven years.
- 1.3 Bidders must submit the authorization certificate from the manufacturer of Solar PV Module.
- 1.4 The bidder must have an average annual minimum turnover of Rs. 32,50,000/- During last seven financial years. The enhancement factor will be considered for calculation of turnover as per RMC norms. The bidder must submit the CA certified Turnover Certificate for last seven years.
- 1.5 Joint venture is not allowed for this project.
- 1.6 The bidder must be registered as an Electrical contractor with any state government or central government (Registration must be updated up to year 2020-21).
- 1.7 The bidder must submit the fresh bank Solvency Certificate of Rs. 12,00,000/-.
- 1.8 The bidder must submit the copy of PAN registration.
- 1.9 Declaration To be submitted on Non-Judicial Stamp Paper of Rs.100/- for NOT BLACK LISTED OR TERMINATED OR DEBARRED in any States, CPWD/ MES / Railways or any Government, Semi-Government or Private body. Also, no complaint is lodged against the Firm / Company, as per Appendix 10 of this tender document.
- 1.10 The bidder must submit the copy of the valid GST registration.
- 1.11 The bidder must submit the copy of the valid PF registration.
- 1.12 The bidder must submit the copy of Memorandum of Association or Partnership Deed, as the case may be.
- 1.13 Conditional tender shall not be accepted and will be rejected.
- 1.14 Acceptance of the tenders will rest with The commissioner, RAJKOT MUNICIPAL CORPORATION, Rajkot, who does not bind himself to accept the lowest tender and reserves the right to reject any or all tenders without assigning any reason thereof.
- 1.15 For any legal matter/disputes, the jurisdiction will be Rajkot only.
- 1.16 All the Tender documents/ bid documents/Amendments/Corrigendum/Addenda/copies/supporting documents must be self certified/signed with stamp at every pages by the bidder.

For any information or query regarding to this tender, agency may contact to,

Mr. P. C. Vekariya
Deputy Executive Engineer (Electrical)
Rajkot Municipal Corporation
Mo. +919624700449
Email :- pcvekariya@rmc.gov.in

E-tender shall duly completed in all respect shall be submitted online and one set (Print out) of tender documents including Amendments/corrigendum/addenda/copies if any, and other documents as required in this tender, duly stamped & signed in all pages shall be submitted with

physical submission at the following address by personally/speed post/RPAD on the date and time mentioned in tender notice. (Submission of physical documents only).

**Additional City Engineer
Roshni (Lighting) Department
Rajkot Municipal Corporation
Central zone office
DR. Ambedkar bhavan
Room No.08, 2nd Floor, Dhebarbhai road
RAJKOT – 360 001**

Last Date of downloading of e-tender is Dt. 07/ 03/2019 up to 18:00 hours Tender Document can be downloaded from website <https://rmc.nprocure.com> and <http://www.rmc.gov.in>

If any tender documents that are received after the specified last date and time of the submission, all such tender documents will be rejected on the basis of late submission without any other reasons assigned thereof.

**Additional City Engineer
Roshni Department
Rajkot Municipal Corporation**

2 ELIGIBILITY CRITERIA FOR THE BIDDERS:

- 2.1 The bidder must submit the Demand Draft of Tender Fee and EMD in the name of RAJKOT MUNICIPAL CORPORATION" payable at Rajkot with physical submission of the tender documents, failing which the tender will be rejected.
- 2.2 The bidder must have an experience of the similar nature of work in the Govt. and/or Semi Govt. Departments. as below,
 - 2.2.1 One work of similar nature of 50 % of the estimated cost in last seven years OR
 - 2.2.2 Two work of similar nature of 40 % of the estimated cost in last seven years.
- 2.3 Bidders must submit the authorization certificate from the manufacturer of Solar PV Module. At the time of physical verification bidder must show all these original documents, failing which the bid will be rejected.
- 2.4 The bidder must have an average annual minimum turnover of Rs. 32,50,000/- During last seven financial years. The enhancement factor will be considered for calculation of turnover as per RMC norms. The bidder must submit the CA certified Turnover Certificate for last seven years.
- 2.5 Joint venture is not allowed for this project.
- 2.6 The bidder must be registered as an Electrical contractor with any state government or central government.
- 2.7 The bidder must submit the fresh bank Solvency Certificate of Rs. 12,00,000/-.
- 2.8 The bidder must submit the copy of PAN registration.
- 2.9 Declaration To be submitted on Non-Judicial Stamp Paper of Rs.100/- for NOT BLACK LISTED OR TERMINATED OR DEBARRED in any States, CPWD/ MES / Railways or any Government, Semi-Government or Private body. Also, no complaint is lodged against the Firm / Company, as per Appendix 10 of this tender document.
- 2.10 The bidder must submit the copy of the valid GST registration.
- 2.11 The bidder must submit the copy of the valid PF registration.
- 2.12 The bidder must submit the copy of Memorandum of Association or Partnership Deed, as the case may be.
- 2.13 Conditional tender shall not be accepted and will be rejected.
- 2.14 Acceptance of the tenders will rest with The commissioner, RAJKOT MUNICIPAL CORPORATION, Rajkot, who does not bind himself to accept the lowest tender and reserves the right to reject any or all tenders without assigning any reason thereof.
- 2.15 For any legal matter/disputes The jurisdiction will be Rajkot.
- 2.16 All the Tender documents/ bid documents/Amendments/Corrigendum/Addenda/copies must be self certified/signed with stamp at every pages by the bidder.

- 2.17 Documents to be submitted with the Techno-commercial Bid: - The bidder shall submit supporting documents for the product offered by him in the bid as per following list.
- 2.17.1 Datasheets for electrical and mechanical properties indicating all the parameters specified in the detailed Scope of Work.
- 2.17.2 Specifications and Performance data at STC for SPV modules.
- 2.17.3 Graphs indicating:-
 - 2.17.3.1 Efficiency v/s. Temperature at incident irradi. For 200W/m², 400 W/m², 600W/m², 800W/m², 1000W/m².
 - 2.17.3.2 Efficiency v/s. Incident radiation at STC.
 - 2.17.3.3 I-V curves at various temperatures at STC, like, 6 ° C, 25 ° C, 35 ° C, 46 ° C as well as at various incident radiation for 200W/m²,400 W/m², 600W/m², 800W/m², 1000W/m².
 - 2.17.3.4 Temperature Vs Power at incident radiation. For 200W/m², 400 W/m², 600W/m², 800W/m², 1000W/m².
- 2.17.4 All IEC certificates and other certificate(s) as applicable.
- 2.17.5 Installation Manuals of Modules and Inverters.

The Bidders shall submit all the documents listed along with Technical Bid.

DY. EXE. ENGINEER

ADD. CITY ENGINEER

Signature of Tenderer with seal:

Date:

3 Instructions to bidders

COMMON TERMS AND SPECIAL CONDITIONS OF THE TENDER :-

- 3.1 The conditional tender will not be accepted and will be rejected outright.
- 3.2 The tender for this work of rate contract shall remain open for a period of 180 days from the last date of submission of the tender and the bidder shall not be allowed to withdraw or modify the offer on his own during this period. Any modifications or additions in terms and conditions of his tender not acceptable to The commissioner, RAJKOT MUNICIPAL CORPORATION, shall without prejudice to any right or remedy, be at liberty to forfeit in full said earnest money absolutely.
- 3.3 RMC reserves the right to reject all the tenders of the lowest or any other tender which in the judgment of the RMC and also does not appear to be in its best interest and the bidder shall have no cause of action or claim against the RMC of its officers, employees, successors for assignees for rejection of its tender.
- 3.4 It must be clearly and distinctly understood that the conditions of contract and specifications shall be rigidly enforced and no relaxation on the grounds of customs prevailing shall be allowed.
- 3.5 The quoted rates online in the Financial Bid shall be inclusive of all taxes, duties etc. and no claim in this context shall be entertained. Participants shall not be paid any extra amount due to increase in any type of Government Taxes. during implementation of contract. Any variations in taxes etc. shall be borne by the bidder.
- 3.6 It is considered that the bidder has fully acquainted himself with the local situations of RAJKOT MUNICIPAL CORPORATION area regarding materials, labor and other factors pertaining to work and studied the design, plans and estimates before submitting the tender. No further price escalation will be entertained in re-design of any of items related to this project.
- 3.7 It will be the responsibility of the bidder to arrange for necessary import license and clearance of Govt. of India/State government in time, if required, so that the imported plant or equipment could be utilized for the proposed work.
- 3.8 The work, shall be completed within the completion period as mentioned in the work order.
- 3.9 A work completion period of work order shall include, Approval of BOQ, Approval of detail drawings of electrical SLD including earthing, Approval of detail drawings of Solar PV arrays structure design, Inspection and Testing, GEDA registration, work of SITC, PGVCL registration, NOC from Electrical Inspector, and complete cleaning of site as per instruction of EIC.
- 3.10 The work of SITC is to be completed in all respects as per the time schedule from the date of written order to be commencing the work. Within this period, the bidder shall take approval of all documents & drawings and as per tender specification.

- 3.11 Starting of work of SITC shall not be permitted before Approval of BOQ, Approval of detail drawings of electrical SLD including earthing, Approval of detail drawings of Solar PV arrays structure design by RMC, and Necessary Inspection and Testing of material at manufacturers site.
- 3.12 All fees, Royalty or rent of any land/ store house to store any material related to any project will be paid by bidder.
- 3.13 In execution of work, if any connection of electricity cable, telephone line, water supply line, underground drainage line, gas line or any private line of any private property will be cut or damaged by any person or machinery or equipment of bidder, all responsibility will be of bidder and bidder has to pay whatever charges incurred to joint/repairer it in proper workable condition.
- 3.14 A third party inspection (TPI)/PMC/PMS agency will be deployed by RAJKOT MUNICIPAL CORPORATION If necessary/As per requirements and cost of TPI/PMC/PMS for this project will be borne by RAJKOT MUNICIPAL CORPORATION.
- 3.15 **Inspection :-** All materials and workmanship shall be subject to inspection, examination and test by the Engineer in-charge/consultant/TPI/PMC/PMS at any and all times during manufacture and/or construction. The EIC shall have right to inspect defective material and workmanship or require its correction. Rejected workmanship shall be satisfactory replaced with proper material without additional charge therefore and the Contractor/bidder shall pro segregate and remove the rejected materials from the works. If the Contractor fails to proceed at once with the replacement of rejected materials and/or the corrections of defective workmanship, the EIC may remedy such work on the risk and the cost of the bidder, or may terminate the right of the Contract to proceed further with the Contractor shall furnish promptly without additional charge all reasonable facilities, labor, materials necessary for the safe and convenient inspection and a test that may be required by the Engineer in charge.
- 3.16 **Testing :-** The Contractor/bidder shall provide for all costs of routine testing of material. Contractor shall provide the all cost of the lodging and boarding for 2 persons for inspection and testing the all material & Equipments at manufacture's facility. The Contractor should dispatch material at site only after permission of EIC, after factory testing.
- 3.17 O & M period shall commence from the date of issue of satisfactory work completion certificate from EIC or report from TPI/PMC/PMS agency as the case may be.
- 3.18 For purpose of Routine cleaning of solar PV panels, A water is provided by RMC owner, Related piping and cleaning arrangements shall be done by bidder.

Special Conditions of the tender :-

- 3.19 Study the existing load pattern of the electrical load in the concern premises and design a grid interactive solar PV system to be installed on roof of the premises or on available

- space.
- 3.20 Provide in-house training in operation, testing, monitoring and maintenance of the plant. And submit operation and maintenance manuals.
 - 3.21 Supply, Installation testing and commissioning of solar grid interactive PV system with power import-export arrangement with PGVCL(DISCOM) with 10 years operation and comprehensive maintenance.
 - 3.22 Details of all the technical personnel whom the bidder shall engage for this work include their resume providing name, qualification, nature of work (field or office), mode of employment, previous experience shall be provided by bidder.
 - 3.23 A bidder shall produce, original documents for cross verification as and when requested by RMC.
 - 3.24 The contractor is expected to study the existing loads to arrive at a recommended capacity of PV system and submit an initial design report/Drawings. And it will be in accordance to latest technology, Gujarat solar power policy and subsequent amendments thereof.
 - 3.25 Performance Ratio/ Minimum Energy Guarantee of the Solar PV Plant: - The Complete SPV Plant shall be designed and installed so as to deliver maximum power under the climatic conditions/location of site. The Nominal/Name plate output rating of the plant shall form the basis of calculation of the Performance Ratio. Design of the SPV Plant shall be such that the losses and in-efficiencies shall be minimized to ensure highest Performance Ratio. The procedure for performance monitoring is based on the standard IEC 61724 – PV system performance monitoring: Guidelines for measurement, data exchange and analysis.
 - 3.26 Minimum Power generations guarantee (At the Inverter AC OUTPUT): - shall be provided by the Contractor/Bidder, for the Solar PV Plant System as follows, after considering various other factors likes, panel degradation, environmental factors and any other factors etc.
 - 3.26.1 For 1st year of Operation (After Installation/Commissioning/ Completion) - Minimum 4.0 Units per day/ KWp PV Panel Capacity installed, considering 365 days per year.
 - 3.26.2 Subsequent reduction in the Units generated shall be maximum 0.8% per year of subsequent operation. Monthly and Yearly Record of the Units generated shall be documented and submitted to EIC for verification. Same shall be documented and certified by the EIC.
 - 3.26.3 Any shortfall in the generated units as against guaranteed units on a per year basis shall be compensated by the Bidder/Contractor, through deduction made from his performance guarantee/SD of O & M period at the rate of Electricity Units paid by owner to the DISCOM multiplied by the shortfall in generation on a yearly basis as a penalty.
 - 3.27 General Conditions: applicable to all the systems.
 - 3.27.1 PV modules used in solar power plants/systems must be warranted for their output

- peak watt capacity, which should not be less than 90% at the end of 10 years and 80% at the end of the 25 years.
- 3.27.2 The BoS items/components of the SPV power plants/systems deployed must confirm to the latest edition of IEC/equivalent BIS standards.
- 3.28 Payment:- The payments to the successful bidder will be made as per following.**
- 3.28.1 70 % after supply of all plant, equipments, Modules/Inverters, etc. at site in good condition and after completion of Installation, Testing and commissioning of all work, after _____ on _____ submission of report for the same from TPI/PMC/PMS Agency (if deployed) or by EIC.
- 3.28.2 20 % after successful rebate from PGVCL (DISCOM) electricity bills of 04 months.
- 3.28.3 10 % of amount will be considered as performance guarantee, and will be released after successful completion of O & M period of 10 years and handing over the site to RMC. If the agency will submit FDR or Performance bank guarantee of 10 % for it, final payment of 10 % will be released as per condition no. 5.9.
- 3.29 Extension of the purchase/quantity: -
The quantity mentioned in the tender is tentative. The commissioner RMC is authorized to extend the quantity of the supply for further requirements and the bidder must supply the same as per the tender approved rates.
- 3.30 Penalty for SITC period:-**
- 3.30.1 The work, shall be completed within the completion period as mentioned in the work order, failing which penalty at the rate of 0.2 % per day of project value and subject to maximum of 10 % of project value shall be imposed as time is the essence of the contract.
- 3.30.2 For calculation of penalty, date of LoA/work order shall be the reference date.
- 3.31 Penalty for comprehensive O & M period:-
- 3.31.1 In case of any defect/fault accure in plant and generation stops during O & M period, the bidder shall repair/rectify it within 48 hours (forty eight hours) , after 48 hours (forty eight hours), penalty shall be charged as below :-
Penalty per day = KWP capacity of SPV plant x 04 (KWH) x Prevailing rate of kwh of DISCOM.
- 3.32 Guaranteed Generation :-**
- 3.32.1 The bidder shall be responsible for “Net Electrical Energy Generation Guarantee” for annual basis considering an average of 04 kwh (unit) per day per KWp capacity of SPV plant. The Contractor shall demonstrate “Actual Delivered Energy” at metering point as compared to the “Net Electrical Energy Generation Guarantee” for every year from the date of starting of O&M Period.
- 3.32.2 If for any Contract Year, it is found that the “Actual Generated Energy” is less than Net

Electrical Energy Generation Guarantee for the particular year, the Contractor shall pay the compensation to RAJKOT MUNICIPAL CORPORATION equivalent to Rs. Prevailing rate of kwh of DISCOM x nos. of kWh of under-generation. In addition, RAJKOT MUNICIPAL CORPORATION will recover from the Bidder This penalties shall be recovered from payments yet to be made by RAJKOT MUNICIPAL CORPORATION to the Contractor and/or from the security deposit/performance Guarantees for this project available with RAJKOT MUNICIPAL CORPORATION.

DY. EXE. ENGINEER

ADD. CITY ENGINEER

Signature of Tenderer with seal:

Date:

4 Scope of work

- 4.1 **OBJECTIVE AND SITE DESCRIPTION:** - In order to promote the efficient use of solar energy, RAJKOT MUNICIPAL CORPORATION is proposing to set up environmental friendly grid connected solar power plant system at various buildings and premises of Rajkot Municipal Corporation, thereby reducing use of state DISCOM grid power to help to reduce environmental impact of pollution and to increase the use green energy/non conventional source of energy.
- 4.2 Design, detailed engineering, manufacturing, testing, supply, erection and commissioning of solar power grid interactive SPV power plant with comprehensive operation and maintenance of 10 years at various buildings and premises of Rajkot Municipal Corporation. The SPV power plant should be designed, installed and commissioned as per technical specifications provided in this tender documents and in conformance with IS/ BIS/ IEC/ MNRE Standards.
- 4.3 Civil work with respect to grouting/ fixing the panels/ mounting structure on the roof of the identified premises of Rajkot Municipal Corporation.
- 4.4 Design, supply and erection of sufficient number of junction boxes for each array.
- 4.5 Supply of appropriate size cables on DC as well as AC side of inverter.
- 4.6 Supply and installation of appropriate size cables including interconnecting cables and cables from array to junction box, junction box to inverters, DC Distribution box, AC Distribution box, LT Panel and all required accessories e.g. lugs, jointing material, bolts, screws, clamps and cable trays.
- 4.7 Supply, installation and commissioning of all earthing and lightning protection equipment as per technical specifications in this tender documents.
- 4.8 Supply and installation of control equipment, remote monitoring system, with data loggers and data transmission system, required for monitoring of system.
- 4.9 Successful commissioning of plant and providing 04 months of successful operation report.
- 4.10 Provide necessary manpower for initial operation and maintenance as well as training to the RAJKOT MUNICIPAL CORPORATION (RMC) staff.
- 4.11 All necessary, statutory permissions/NOC required for installation of grid interactive system, required from any government or concerned agency(PGVCL, RMC, MNRE, GEDA, Energy and petrochemical department) should be sought by contractor.
- 4.12 Operation of PV system to generate optimal power output from the system for 10 years with monthly performance report generation.
- 4.13 Comprehensive Maintenance of System for a period of 10 years from the date of commissioning.
- 4.14 In future, if there is any changes in the state government policy restricting the export of power or net metering application, the bidder should made provision for blocking export of PV system generated power to grid using blocking diode or similar arrangement.
- 4.15 Liaison with PGVCL/GERC/GEDA and all concerned government agencies for seeking permission for operation of solar power peak grid interactive solar PV System as well as

- signing of power purchase agreement between RMC and PGVCL to export excess power to grid.
- 4.16 Ensure proper selection, procurement, installation and functioning of the bidirectional meter and other requisite interconnection components adhering to MNRE/ State guidelines, as applicable, to ensure success of net metering arrangement.
 - 4.17 To provide warranty for performance of module where the designed output should not be less than 90 % at the end of a period of 10 years and 80 % at the end of 25 years.
 - 4.18 Supply and installation of control equipment, remote monitoring system, with data loggers and data transmission system, required for monitoring of system. Necessary mobile SIM card provided by agency and its bill will be paid by bidder for ten years.
 - 4.19 Successful bidder have to prepare DPR for every plant for which work order is provided by RMC, according to this RC, and all procedures, formalities and correspondents with GEDA/MNRE department and it will be responsibility of bidder to sanction all necessary approvals, Further if needed bidder shall make procedure for proposal for grant/subsidy/CFA in GEDA/MNRE, If require this procedure will work parallel to the execution of the project or after completion of this project.
 - 4.20 The project cost of a grid connected rooftop PV system will include the hardware i.e., PV modules, Module mounting structures, inverters, meters, support structure, charge controllers, cables required to ensure smooth operation. It will also include cost of transportation, installation, connectivity, civil works, all type of taxes, and operation and maintenance for ten years along with warranty of the system.
 - 4.21 **WARRANTY :-** The mechanical structures, electrical works including Solar panels/ power conditioners/inverters/charge controllers/maximum power point tracker units/distribution boards/digital meters/ switchgear, etc. and overall workmanship of the SPV power plants/ systems must be warranted against any manufacturing/ design/ installation defects for a minimum period of 10 years.

DY. EXE. ENGINEER

ADD. CITY ENGINEER

Signature of Tenderer with seal:

Date:

5 GENERAL CONDITIONS OF CONTRACT

5.1 Definitions:-In this Contract, the following terms shall be interpreted as indicated : -

- 5.1.1 "The Contract" means the agreement entered into between the Purchaser and the Bidder, as recorded in the Contract Form signed by the parties. Including all attachments & appendices thereto and all documents incorporated by reference therein.
- 5.1.2 "The Contract Price" means the price payable to the Bidder under the Contract for the full and proper performance of its contractual obligations.
- 5.1.3 "The Goods" means all of the equipment, machinery, and / or other materials which the supplier is required to supply to the Purchaser under the Contract.
- 5.1.4 "Services" means services ancillary to the supply of the Goods, such as transportation & insurance, and any commissioning, provision of technical assistance, training and other such obligations of the Bidder covered under the Contract.
- 5.1.5 "The Purchaser" means the Organization purchasing the Goods; and,
- 5.1.6 "The Bidder" or "The Bidder" or "The Agency" means the individual or firm supplying the Goods under this Contract.
- 5.1.7 "RMC" means RAJKOT MUNICIPAL CORPORATION.

5.2 **Standards:-** The Goods supplied under this Contract shall conform to the standards mentioned in the Technical Specifications, and, when no applicable standard is mentioned, to the authoritative standard appropriate to the Good's country of origin and such standards shall be the latest issued by the concerned institution.

5.3 **Patent Rights :** - The Bidder shall indemnify the Purchaser against all third-party claims of infringement of patent, trademark or industrial design rights arising from use of the Goods or any part thereof in India.

5.4 **Security Deposit :** - The successful bidder has to submit the Security Deposit @ 5% of Contract Value, in the form of Bank Guarantee or FDR (Nationalized/Scheduled Bank) of 16 months, before signing the contract for the period. The full security deposit amount shall be refunded, without any interest, after deduction of dues, taxes, penalties etc. (if any) after 16 months.

5.5 Signing of contract :-

The successful bidder shall be required to execute the contract agreement within 10 day of receipt of intimation to execute the contract, failing which the RMC will be entitled to reject the award and forfeit the Earnest Money Deposit. The person to sign the contract document shall be person as signing of tender documents.

The contract agreement shall be on the stamp paper of value of 4.90 % of the amount of security deposit, if security deposit is submitted in the form of bank F.D.R. The contract agreement shall be on the stamp paper of value of Rs. 100=00, if security deposit is submitted in the form of bank guarantee.

5.6 **Tools & Tackles:-** All tools and tackles required for the work shall have to be procured by

- the contractor at his cost. The contractor will have to maintain reliable sets of tools and tackles in adequate quantities so as to complete the job as expeditiously as possible.
- 5.7 **Inspections and Tests:** - The Purchaser (RMC) or its representative shall have the right to inspect and / or to test the Goods to confirm their conformity to the Contract. A successful bidder must send the material at site after prior approval of EIC.
- 5.8 **Transportation:** - Where the Bidder is required under the Contract to deliver the Goods, FOR-Site, transport of the Goods, up to and including the point of putting the Goods, including loading-unloading at site shall be arranged and paid for by the Bidder, and the cost thereof shall be included in the Contract Price. Where the Bidder is required to affect delivery under any other terms, for example, by post or to another address in the source country, the Bidder shall be required to meet all transport and storage expenses until delivery.
- 5.9 **Performance Guarantee and Guarantee Period:** - RMC will deduct 10 % amount as Performance Guarantee from the total amount of final bill prepared after the successful completion of every work under this rate contract or the bidder can submit the FDR of such value for the period of 120 months and the same will be returned to the contractor after completion of comprehensive O&M period. No interest will be paid on this. The successful bidder shall have to stand guarantee against bad workmanship and supply of poor quality and / or defective materials for a period of 10 years (120 months) after the date of successful energisation of the installation(s) and handing over the same to RMC. Any defect / discrepancy detected during this guarantee period will have to be made good by the contractor at his costs and risks. If, by any reason, RMC is required to rectify such defects/ discrepancies detected during this guarantee period, the entire cost involved will be released from the dues payable to the contractor/Bank Guarantee/FDR by RMC. In case of damage to the any parts of the project/system occurred due to external accidents, casualties or damages due to natural calamities, the bidder must restore the project or parts thereof without any additional payments towards the labor work, however, RMC will pay the bidder for the supply of the material as per the tender approved rates or as per prevailing SOR of RMC/SOR of R & B/ SOR of GWSSB or market rate during the whole Performance Guarantee Period.
- 5.10 **Delays in the Bidder's Performance :** - Delivery of the Goods and performance of Services shall be made by the Bidder in accordance with the time schedule specified by the Purchaser. In case of any such delay, RMC will impose the penalty @ 0.2 % of the contract value per day maximum up to 10% of the contract value given in the work order. However, if such delay is prolonged beyond the required realization of the project or an unexcused delay by the bidder in the performance of its delivery obligations shall render the bidder liable to any or all of the following sanctions: i) forfeiture of its performance security, ii) imposition of liquidated damages, iii) and / or termination of the contract for default. The commissioner, RMC reserves the rights to terminate the contract/Black list

- the agency/bidder or to take relevant actions during contract period (DSITC and Comprehensive O & M) without assigning any reason.
- 5.11 **Force Majeure:** - The Bidder shall not be liable for forfeiture of its performance security, liquidated damages or termination for default, if and to the extent that, its delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure. For purposes of this clause, "Force Majeure" means an event beyond the control of the Bidder not involving the Bidder's fault or negligence and not foreseeable. Such events may include, but are not restricted to, acts of the Purchaser either in its sovereign or contractual capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and freight embargoes. If a Force Majeure situation arises, the Bidder shall and promptly notify the Purchaser in writing of such condition and the cause thereof, Unless otherwise directed by the its obligations under the Contract as far as reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.
- 5.12 **Applicable Law:** -The Contract shall be interpreted in accordance with the Indian laws.
- 5.13 **Notices:-** Any notice given by one party to the other pursuant to the Contract shall be sent in writing in English or vernacular language (or by Letter/fax/email/scanned copy through email. Any notice shall be effective when delivered or on the notice's effective date, whichever is later.
- 5.14 **Taxes and Duties:-** Customs / import duty, excise duty, GST and any other taxes on finished products, sales tax on works contract and turnover taxes, if any, paid by the Contractor under any central, state or local government rules and regulations will be included to the Contract Price.
- 5.15 **Insurance:-** The Goods supplied under this Contract shall be fully insured by bidder against theft, loss or damage incidental to manufacture or acquisition, transportation, storage and delivery in the manner specified or directed by EIC. This project is with comprehensive O&M of ten years, any parts/spares/components of the whole project are stolen by any means, and contractor has to replace the same without any extra charges.
- 5.16 **Extra Item of Work :-** The extra work beyond tender item, if required to be executed during course of execution of regular work shall have to be carried out by the contractor as per the instructions and satisfaction of the Engineer-in-charge. This will be paid separately as per detail rate analysis made by the department based on market rate or prevalent SOR of RMC/SOR of R & B/ SOR of GWSSB. If in the interest of the RMC it is necessary to change either any site or the design of the proposed work the Contractor shall carry out the same at his quoted rates without charging any extra and he will be paid at the rates quoted by him and no claim for extra amount for subsequent changes made will be entertained.
- 5.17 **Measurement of Work:-** The measurements of work will be taken according to the usual method in use in the RAJKOT MUNICIPAL CORPORATION and no proposals to adopt

- alternative methods will be accepted.
- 5.18 **No claim to any payment or for restriction of work:-** In the case of any delay in the supply of materials, RMC shall grant such extension of time for the completion of the works as shall appear reasonable in accordance with the circumstances of the case. The decision of concerned officer of RMC for such Extension of Time shall be accepted as final by the successful bidder.
- 5.19 **Action and compensation in case of bad work:-** If, at any time before the expiry of defects Liability period, it shall appear to officials of the OWNER, that any work has been executed with unsound, imperfect or unskilled workmanship or with materials or inferior quality or that any materials or articles provided by him for the execution of the work are unsound, or of a quality inferior to that contracted for or are otherwise not in accordance with the contract, the Contractor shall be bound forthwith to rectify, or remove and reconstruct the work so specified in whole or in part as the case may require, or if so required shall remove the materials or articles so specified in whole or in part and provide other proper and suitable materials or articles at his own charge and cost, and in the event of his failing to do so within a period to be specified by the OWNER in the written intimation aforesaid, the Contractor shall be liable to pay compensation at the rate of one percent on the amount of the estimate of the rectification for every day not exceeding ten days during which the failure so continues, and in the event of any such failure as aforesaid continuing beyond ten days, the OWNER may rectify or remove, and re-execute the work or remove and replace the materials complained of, as the case may be at the risk and expense in all respects of the Contractor.
- 5.20 **Defect Liability Period :-** The Contractor shall be responsible to make good and remedy at his own expense for any defect which may develop or may be noticed before the period mentioned hereunder from the certified date of completion. The Engineer-in-charge shall give the Contractor a notice in writing/in verbal about the defects and the Contractor shall make good the same within 48 hours of receipt of the notice. In the case of failure on the part of the Contractor, Engineer-in-charge may rectify or remove or re-execute the work at the risk & cost of the Contractor. The Engineer-in-charge shall be entitled to appropriate the whole or any part of the amount of the security deposit towards the expenses, if any, incurred by him in rectification, removal or re-execution. The Defects Liability period shall be as under: (a) The period shall be 120 months from the date of start of O & M period.
- 5.21 **Setting out the Works:-** The Contractor shall be responsible for the true and proper setting out of the works in relation to original points, lines and levels of reference given by the Engineer in writing or shown on the Drawings and for correctness, subject as above mentioned in the position, levels, dimensions and alignment of all parts of the works and for the provision of all necessary instruments, appliances and labour in connection therewith.

- 5.22 **Amenities to be Preserved:-** The Contractor shall cause the least possible interference with the existing amenities, whether natural or manmade. No tree shall be felled without permission of the Engineer's Representative and clearance of the site shall generally be kept to the minimum necessary for the works and temporary works.
- 5.23 **Safety Measures and Services:-** The Contractor shall be responsible for the safety of all workmen and other persons entering or in the works and shall take all measures necessary to ensure their safety to the approval of the Engineer's Representative. Contractor shall provide and maintain at his own expenses all lights, guards, fencing and necessary watchmen when and where necessary or as required by Owner / Engineer for the protection of the works or for the safety and convenience of those employed on the works and the public.
- 5.24 **Liability of accidents to persons;-** In the case of an accident, in respect of which compensation may become payable under Workmen's Compensation Act, the contractor is fully responsible for such event and payments thereof.
- 5.25 **Clearing Site on Completion:-** On completion of the Works, the Contractor shall clear away and remove from the site all Constructional Plant, surplus materials, rubbish, Temporary Works of every kind and leave the whole of the site and the works clean and in a workmanlike condition to the satisfaction of The Engineer-in-charge.
- 5.26 **Safe custody of stores:-** The bidder will be entirely responsible for all the erected structures and materials used by him for the works and the executed portion of the works till it is officially taken over by RMC. It would be the responsibility of the bidder to keep the insurance policy alive throughout the entire period of execution and till the installation is handed over to RMC for any loss, damage or theft of materials and/or erected works before taking over by RMC.
- 5.27 **ST, IT & PT clearance etc:-** The bidder is responsible for ST, IT and PT or any other tax clearance.
- 5.28 **Labor license:-** The bidder will have to abide by the provisions of contract labor (Regulation & Abolition) Act. 1970.
- 5.29 **Accidents:-** RMC shall neither be responsible nor shall be liable to pay any compensation for any accident caused to any worker / public arising out of execution of work / O & M period/executed portion of work till it is finally taken over and handed over to RMC/Appropriate Authority.
- 5.30 **Stoppage of work:-** RMC shall not be responsible nor be liable to pay any compensation for any interruption of work in the field due directly to war, strike, civil commotion, lockout, risk, earthquake tempest, lightning, flood, cyclone etc. which occur beyond its control. Similarly, RMC also would neither be held responsible nor liable for compensation for stoppage of contractor's work in the field arising out of resistance / resentment of local public.

5.31 **Non-interference with existing services:-** During execution, the erection contractor shall be required to take all precautionary measures not to interfere/dash/disturb with any service line for electrical, water or similar other service. In case such things happen incidentally, the same has to be made good at his own cost. The successful bidder must coordinate with the other concerned authority/agency for smooth execution of the work.

DY. EXE. ENGINEER

ADD. CITY ENGINEER

Signature of Tenderer with seal:

Date:

6 TECHNICAL SPECIFICATIONS

The different works of grid connected roof top solar power plants under this rate contract shall be commissioned as per the technical specifications given below.

6.1 DEFINITION:- The Grid Connect Solar Power Generating System consists of mainly three components viz. the solar photovoltaic (SPV) array, module mounting structure and the power conditioning unit (PCU)/ inverter. The SPV array converts the solar energy into DC electrical energy. The module mounting structure holds the modules in required position and the DC electrical energy is converted to AC power by the PCU, which is connected to the power grid. The AC power output of the inverter is fed to the AC distribution board through metering panel and isolation panel. The 415 V AC -3Ø output of the system can be utilized or synchronizing with the grid, can be exported to the grid.

6.2 PV MODULE TECHNICAL SPECIFICATION :-

Sr. No.	Description	Rating	Remarks
01	Type of PV Cell	Poly crystalline silicon photo voltaic	Test report to be submitted
02	Power rating at STC	320 Wp or higher (where STC is Standard Testing Condition with air mass AM1.5, irradiance 1000W/m ² , and cell temperature 25°C).Module capacity less than 310wp should not be accepted.	Test report to be submitted
03	The efficiency of all photovoltaic modules	As per relevant IEC standard	Test report to be submitted
04	Open-circuit voltage (Voc) at STC	As per relevant IEC standard	Test report to be submitted
05	Maximum power voltage (Vmp) at STC	As per relevant IEC standard	Test report to be submitted
06	Short-circuit current (Isc) at STC	As per relevant IEC standard	Test report to be submitted
07	Temperature coefficient of power	As per relevant IEC standard	Test report to be submitted
08	Minimum Operating Life	25 Years	-----
09	Maximum allowable degradation of PV modules	The power output at STC for all the PV modules shall not drop below 90% of rated power output at STC during the first 10 year and it shall not drop below 80% during the subsequent 15 years after the date of sup	Test report to be submitted

6.3 OVERALL PV MODULE DESIGN SPECIFICATIONS:-

- 6.3.1 Modules shall be designed for maximum system voltage of 1000 VDC or higher as per IEC 61730 and each module shall be of Poly crystalline silicon photo voltaic cell– 320 wp or higher.
- 6.3.2 Modules shall be designed for maximum reverse current of as per standard.
- 6.3.3 Modules shall be designed for maximum wind load as per Safety standard IEC 61730.
- 6.3.4 Permitted module temperature on continuous duty shall be As per standard.
- 6.3.5 The front surface of the module shall consist of impact resistant, low iron; high energy yield anti reflective and superior transmittance tempered or toughened glass with minimum required thickness. It shall also have tough multi layered polymer back sheet for environment protection against moisture and provide high voltage electrical insulation.
- 6.3.6 The PV module front glass shall be such that it shall facilitate regular cleaning by water as well as with powder or equivalent chemical.
- 6.3.7 Frame design shall be unique & rugged with high mechanical strength for easy installation.
- 6.3.8 The solar cell shall have surface with anti-reflective coating to help absorb more light in all weather conditions.
- 6.3.9 The PV module(s) shall be PID free. The PV module(s) shall support negative earthing at inverter side or in the electrical system, without affecting the performance of PV modules throughout plant life.
- 6.3.10 Bidder to indicate in their bid for the type of earthing required positive or negative pole to maintain the performance PV modules in entire life along with detail technical explanation through proper documents.
- 6.3.11 Suitable encapsulates and sealants shall be used to fix the frames and junction box to protect the silicon cells from environmental effects. The encapsulation arrangement shall also ensure complete moisture proofing for the entire life of solar modules. The SPV modules should have suitable encapsulation and sealing arrangements to protect the silicon cells from environment. Construction of the module shall allow daily washing without leakage of water inside the PV cell.
- 6.3.12 The module frame shall be made of Aluminum (with Anodize finish), which shall be electrolytically compatible with the structural material used for mounting the modules with sufficient numbers of grounding/installation points.
- 6.3.13 The Interconnected cells shall be laminated in vacuum to withstand adverse environmental conditions.
- 6.3.14 Solar PV module shall have module safety class-II and should be highly reliable, light weight and must have a service life of more than 25 years.
- 6.3.15 The bidder should provide the authorized module datasheet of OEM.
- 6.3.16 Bidder should submit copy of IEC certificates of the module(s) available with them.
- 6.3.17 The Bidder shall submit list of serial number or ID of all modules supplied under this contract along with the above parametric data for each module with authorized signature by competent authority at the end of supply in hard copy and soft copy.
- 6.3.18 The Bidder is advised to check and ensure the availability of modules prior to submitting the RFP document.

- 6.3.19 Design memorandum for PV modules having details of PV module construction details, erection philosophy, maintenance philosophy, body earthing, connector details etc shall be submitted.
- 6.3.20 The PV modules used must qualify to the latest edition of IEC for PV module qualification test or equivalent BIS standards Crystalline silicon solar cell modules IEC 61 215 /IS14286, in addition, the module must confirm to IEC 61730 part -2 requirements for construction and part – 2 requirements for testing, for safety qualification or equivalent IS.
- 6.3.21 Non conformity to specifications due to faulty manufacturing and/or inspection processes. If the solar module(s) fails to confirm to this technical specifications requirements, the manufacture/bidder will repair or replace the solar module(s), at the Owners sole option.
- 6.3.22 The solar modules shall be tested with relevant Applicable IEC dust standards.
- 6.4 PV MODULE CERTIFICATION:** -The modules shall carry the following certifications:-
- 6.4.1 The module must mandatorily meet the requirement laid by SECI/,MNRE or any other designated agency appointed by Government of India or Government of Gujarat.
- 6.4.2 The SPV modules used in the On grid solar power projects to the latest edition of the following IEC PV module qualification test or equivalent BIS standards.
- 6.4.3 Crystalline Silicon Solar Cell Modules –IEC 61215 (2nd Edition) : Design qualification and type approval.
- 6.5 OTHER CONDITIONS (BOUNDARY CONDITIONS/ INTERFACE WITH OTHER PACKAGES) FOR PV MODULES :-**
- 6.5.1 Modules shall be packaged in pallet such that the mismatch losses within the modules shall be less than as per standard.
- 6.5.2 Module packing shall be optimized so that the mismatch losses within the whole lot supplied under this contract are minimized.
- 6.5.3 Agency shall depute their representative during PV module unloading and erection at each site to ensure proper handling and installation of modules.
- 6.6 MODULE JUNCTION BOX:-**
- 6.6.1
- 6.6.2 The Junction boxes are to be provided in the PV array for termination of connecting cables. The junction boxes shall be made of GRP/FRP/Powder coated aluminum/Cast aluminum alloy with full dust, water and vermin proof arrangement with IP 67 or higher protection class and shall be designed for long life out door operation in harsh environment as per relevant standard specification and protected against surges. All wires/ cables must be terminated through cable lugs. The JB's shall be such that input and output termination can be made through suitable cable glands. Cable ferrules must be fitted at the cable termination points for identification.
- 6.6.3 Copper bus bars/Terminal blocks housed in the junction box with suitable termination threads conforming to IP 67 standard and relevant IEC standards, hinged door with EPDM rubber gasket to prevent water entry. Single/double compression cable glands. Provision of necessary earthing. It should be placed at height from ground level as per relevant IEC/BIS standards, for ease of accessibility. Junction box shall consist of a semi-permeable membrane to allow entry/ escape of air in/ from the junction box but block the entry of moisture and water. The Junction box shall be weather proof.
- 6.7 SOLAR DC/AC CABLE:** - Cables of appropriate size to be used in the system shall have the following characteristics: -
- 6.7.1 Shall meet IEC 60227/IS 694, IEC 60502/IS1554 standards.
- 6.7.2 Temp. Range: –10oC to +80oC.

- 6.7.3 Voltage rating 660/1000V.
 - 6.7.4 Excellent resistance to heat, cold, water, oil, abrasion, UV radiation.
 - 6.7.5 Flexible.
 - 6.7.6 Sizes of cables between 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. The cables (as per IS) should be insulated with a special grade PVC compound formulated for outdoor use.
 - 6.7.7 Cable Routing/ Marking: All cable/wires are to be routed in a GI cable tray and suitably tagged and marked with proper manner by good quality ferule or by other means so that the cable easily identified.
 - 6.7.8 The Cable should be so selected that it should be compatible up to the life of the solar PV panels i.e. 25years.
 - 6.7.9 The ratings given are approximate. Bidder to indicate size and length as per system design requirement. All the cables required for the plant provided by the bidder. Any change in cabling sizes if desired by the bidder/approved after citing appropriate reasons. All cable schedules/layout drawings approved prior to installation.
 - 6.7.10 Multi Strand, Annealed high conductivity copper conductor PVC type 'A' pressure extruded insulation or XLPE insulation. Overall PVC/XLPE insulation for UV protection Armored cable for underground laying. All cable trays including covers to be provided. All cables should conform to latest edition of IEC/ equivalent BIS Standards for indoor/outdoor installations IS/IEC 69947. PVC/XLPE insulated cables for working Voltage up to and including 1100 V ,UV resistant for outdoor installation IS /IEC 69947.
 - 6.7.11 The size of each type of DC/AC cable selected shall be based on minimum voltage drop however; the maximum drop shall be limited as per relevant IEC/BIS standards for DC cables and the maximum drop shall be limited as per relevant IEC/BIS standards for AC cables.
- 6.8 SOLAR CABLE CONNECTOR:-**
- 6.8.1 The connector shall be rated for system voltage & current.
 - 6.8.2 The connector shall be rated for IP65 / IP67 or higher in closed condition.
- 6.9 Warranties against performance degradation:-** The bidder shall offer warrantee as per following conditions.
- 6.9.1 The power output at STC for all the PV modules shall not drop below 90% of rated power output at STC during the first 10 year and it shall not drop below 80% during the subsequent 15 years after the date of completion. If, Module(s) fail(s) to exhibit performance as stated above during entire life span of 25 years, either due to normal degradation or defect in module(s) circuit, junction box(es), connections etc., the Contractor will have to either replace or repair such underperforming/ defective PV Module(s) with no extra cost to RMC within maximum 10 days from date of intimation though e-mail or written notice.
- 6.10 TECHNICAL SPECIFICATION OF MMS :-** Technical Specifications for MMS shall be as per following.

Sr.No.	Parameter	Specification
1	Type of Structure	Single/multi pole supporting with Seasonal Tilt mechanism
2	Total nos. of seasonal tilt positions required	03
3	Material of Structure	Structural Steel as per IS 2062 with Hot Dip

		Galvanizing having minimum thickness of 80 micron and quality as per galvanizing standard IS – 4759
4	Acceptable make of Structural Steel	reputed make shall be allowed.
5	Material of Fasteners / foundation bolts	SS 304.
6	PV Modules per MMS	as per relevant IEC/BIS standards.
7	Module Type	Poly-crystalline – 320 Wp or higher.
8	Direction of Module facing	South facing.
9	Protection against wind	The Mounting structure shall be so designed to withstand the speed for the wind zone of the location where a PV system is proposed to be installed

6.11 EARTHING AND SURGE PROTECTIONS:-

6.11.1 Surge Protection Device (SPD): Internal surge protection shall consist of three MOV type arrestors connected from +ve and –ve terminals to earth (via Y arrangement) 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 during failure mode of MOV, extinguishing DC arc safely in order to protect the installation against fire hazards. Nominal discharge current (In) at 8/20 micro seconds shall be minimum 10 kA with maximum discharge (Imax) at 8/20 micro seconds minimum 20 kA with visual indication (through mechanical flag) in modules to monitor the life of SPD.

6.12 EARTHING FOR PV ARRAY:-

- 6.12.1 The photovoltaic modules, BOS and other components of power plant requires adequate earthing for protecting against any serious faults as guided by IEC 60364.
- 6.12.2 The Earthing for array and HT/LT power system shall be made with Suitable size of bore type chemical earthing including accessories.
- 6.12.3 Necessary provision shall be made for bolted isolating joints of each earthing pit for periodic checking of earth resistance.
- 6.12.4 Each string/ array and MMS of the plant shall be grounded properly. The array structures are to be connected to earth pits as per IS standards. Necessary provision shall be made for bolted isolating joints of each earthing pit for periodic checking of earth resistance.
- 6.12.5 The complete earthing system shall be mechanically & electrically connected to provide independent return to earth. For each earth pit, a necessary test point shall be provided.
- 6.12.6 In compliance to Rule 11 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.
- 6.12.7 The Bidder shall submit the detailed specifications of the array earthing.
- 6.12.8 Nos. of earthing must be as per standard rules.

6.13 LIGHTNING PROTECTION FOR PV ARRAY:-

- 6.13.1 The source of over voltage can be lightning or other atmospheric disturbance. Main aim of over voltage protection is to reduce the over voltage to a tolerable level before it reaches the PV or other sub-system components as per IEC 60099.
- 6.13.2 The protection against induced high-voltages shall be provided by the use of metal oxide varistors (MOVs).

- 6.13.3 Necessary concrete foundation for holding the lightning conductor in position to be made after giving due consideration to shadow on PV array, maximum wind speed and maintenance requirement at site in future.
- 6.13.4 The lightning conductor shall be earthed through flats and connected to the earth mats as per applicable Indian Standards with earth pits. Each lightning conductor shall be fitted with individual earth pit as per required Standards including accessories, and providing masonry enclosure with cast iron cover plate, watering pipe and chemical Earthing.
- 6.13.5 If necessary more numbers of lightning conductors may be provided.
- 6.13.6 The Bidder shall submit the drawings and detailed specifications of the PV array lightning protection equipment.
- 6.13.7 Nos. of lightning protection must be as per standard rules.

6.14 GRID ISLANDING: -

- 6.14.1 In the event of a power failure on the electric grid, it is required that any independent power-producing inverters attached to the grid turn off in a short period of time. This prevents the DC-to-AC inverters from continuing to feed power into small sections of the grid, known as "Islands." Powered Islands present a risk to workers who may expect the area to be unpowered, and they may also damage grid-tied equipment. This SPV plant system shall be equipped with islanding protection. In addition to disconnection from the grid (due to islanding protection) disconnection due to under and over voltage conditions shall also be provided.
- 6.14.2 A manual disconnect 4-pole isolation switch beside automatic disconnection to grid would have to be provided at utility end to isolate the grid connection by the utility personnel to carry out any maintenance. This switch shall be locked by the utility personnel.

6.15 MECHANICAL COMPONENTS:-

- 6.15.1 Metallic frame structure of galvanized steel with stands to be fixed on the roof/terrace to hold the SPV module (s) above roof level and clearance between roof/terrace level and PV module shall be kept as per relevant IEC/BIS norms. Concrete foundations of appropriate weight and depth for elevated structures mounted directly on the roof/terrace; bolted with anchor bolts of appropriate strength for elevated structures mounted on RCC foundation.
- 6.15.2 Civil Foundation for Solar PV Module Mounting Structure (MMS): The foundations shall be designed considering the weight and distribution of the structure and assembly, and a maximum wind speed. Seismic factors for the site to be considered while making the foundation design. Foundations shall be made in accordance with the Indian Standard Codes, with the help of Registered Structural Designer having substantial experience in similar work. Bidder shall submit the detailed structural design analysis along with calculations and bases / standards.
- 6.15.3 Successful bidder shall design and construct appropriate civil foundations for MMS, prefabricated structures, etc. The design of RCC foundation shall be approved by RMC.
- 6.15.4 The frame structure should have provision to adjust at necessary angle of inclination to the horizontal, so that it can be installed at the specified tilt angle i.e. inclined at necessary degree to horizontal facing to south. All hardware, nuts, bolts should be SS - 304.

6.16 METERING :- Meters suitable for synchronization with LT side of the plant shall be as below.

- 6.16.1 The bidder has to provide suitable unidirectional meter of PGVCL approved make/as per PGVCL norms, for measurement of energy generation as per requirement/as per biasing

of inverters. And it shall be tested at DISCOM laboratory. Necessary liaison and payments of the same are to be made by bidder. The bidder will be reimbursed the payments against the proof of the payments for testing only. Cost of meter is born by bidder.

6.16.2 The bidder has to provide suitable bidirectional meter of PGVCL approved make/ as per PGVCL norms for measurement of Export/Import of energy generation as per requirements of DISCOM/Existing DISCOM connection. And it shall be tested and approved at DISCOM laboratory. Necessary liaison and payments of the same are to be made by bidder. The bidder will be reimbursed the payments against the proof of the payments for testing only. Necessary nos. of modems shall be supplied by bidder. Cost of meter and modems is born by bidder.

6.17 PCU/ARRAY SIZE RATIO:-

6.17.1 The combined wattage of all inverters/PCU shall be 1.2 times higher rated capacity of power plant under STC.

6.17.2 Dual Maximum power point tracker shall be integrated in the PCU/inverter to maximize energy drawn from the array.

6.18 Power Conditioning Unit/Inverter :- As SPV array produce direct current electricity, it is necessary to convert this direct current into alternating current and adjust the voltage levels to synchronies and match with the grid voltage. Conversion shall be achieved using an electronic Inverter and the associated control and protection devices. All these components of the system are termed the "Power Conditioning Unit (PCU)". In addition, the PCU shall also house MPPT (Maximum Power Point Tracker), an interface between Solar PV array & the Inverter, to the power conditioning unit. Inverter output should be compatible with the grid frequency. Typical technical features of the inverter. The details of the Power Conditioning Unit/Inverter are as given below and it Must additionally conform to the relevant national/international Electrical Safety Standards.

Capacity and Nos. of inverters/PCU or string of inverters shall be decided by EIC of RMC as per capacity of grid connected SPV plant in work order, installed under this rate contract.

Main Technical specifications of Power Conditioning Unit/Inverter are as under :-

Sr.No.	Description	Requirement
1	Purpose	The power conditioner unit shall convert DC produced by SPV array to AC and adjust the voltage & frequency levels to suit the Grid.
2	Grid supervision	All three phases shall be supervised with respect to rise / fall in programmable threshold values of frequency & the power section of the plant. The plant shall get disconnected / connected from the grid in case of a grid fault / after normal grid conditions have resumed. The grid supervision must comply with VDEW or other relevant/equivalent regulations.
3	Type & technology	IGBT based. (Utilize A circuit topology and components suitable for meeting the specifications).
4	Control	Microprocessor (Smart inverter)
5	Output voltage on AC side	415 V +10%, - 15% V AC PCU/ Solar Inverter voltage range should be reconfigured as per site requirements

6	Output Frequency	50 Hz
7	Grid frequency synchronization range.	+/- 3 Hz or more
8	DC system voltage	The electrical safety of the array installation is of the utmost importance. Array electrical configuration shall be in such a way that, the MPPT shall operate with maximum efficiency, between the low and high temperature of the site.
9	Maximal Current ripple	5% PP
10	Power Factor	>0.9
11	Ambient temperature	-10 to +60 deg C
12	Housing cabinet.	<p>(a) PCU is housed in suitable switch cabinet, with more than IP 66 for outdoor/indoor applications.</p> <p>(b) Weatherproof, rodents & insect proof.</p> <p>(c) Components and circuit boards mounted inside the enclosures clearly identified with appropriate permanent designations, which shall also serve to identify the items on the supplied drawings.</p> <p>(d) All doors, covers, panels and cable exists shall be designed to limit the entry of dust and moisture. All doors shall be equipped with locks. All openings shall be provided with grills or screens with openings.</p>
13	Electrical safety protections	<p>(a) General :- The PCU shall include appropriate self protective and self diagnostic feature to protect itself and the PV array from damage in the event of PCU component failure or from parameters beyond the PCU's safe operating range due to internal or external causes. The self-protective features shall not allow signals from the PCU front panel to cause the PCU to be operated in a manner which may be unsafe or damaging. Faults due to malfunctioning within the PCU, including commutation failure, shall be cleared by the PCU protective devices and not by the existing site utility grid service circuit breaker.</p> <p>(b) Over/Under voltage :-</p> <ul style="list-style-type: none"> ➤ Mains (Grid) over-under voltage and frequency protection. ➤ Over voltage protection against atmospheric lightning. ➤ Protection against voltage fluctuations in the grid itself and internal faults in the power conditioner, operational errors and switching transients. ➤ MOV type surge arrestors on AC and DC terminals for over voltage protection from lightning-induced surges. <p>(c) Accidental open circuit :- Full protection against accidental open circuit and reverse polarity at the input.</p> <p>(d) Internal Faults :- Inbuilt protection for internal faults including excess temperature, commutation failure,</p>

		<p>overload and cooling fan failure is obligatory</p> <p>(e) - Deleted -</p> <p>(f) Earth Fault Supervision :- An integrated earth fault detection device is provided to detect eventual earth fault on DC side and shall send message to the supervisory system.</p> <p>(g) Disconnection & Islanding: -</p> <ul style="list-style-type: none"> ➤ Disconnection of the PV generator in the event of loss of the main grid supply is achieved by in built protection within the power conditioner. This may be achieved through rate of change of current, phase angle, unbalanced voltages, or reactive load variants. ➤ Operation outside the limits of power quality as described in technical data sheet shall cause the power conditioner to disconnect the grid. Additional parameters requiring automatic disconnection are: <ul style="list-style-type: none"> - Neutral voltage displacement. - Over current. - Earth fault & - Reverse power. <p>In each of the above cases, tripping time shall be less than 0.5 seconds. Response time in case of grid failure due to switch off or failure based shutdown should be well within time as per relevant IEC/BIS standards.</p> <p>(h) Automatic reconnection after the Grid failure is resorted :- PCU has facility to reconnect the Inverter automatically to the grid following restoration of grid, subsequent to grid failure condition.</p> <p>(i) Anti-islanding (Protection against Islanding of grid): The PCU shall have anti islanding protection in conformity to IEEE 1547/UL 1741/ IEC 62116 or equivalent BIS standard.</p>
14	Array Ground fault	Provided
15	Operator interface	LCD/LED and keypad operator interface, Menu driven.
16	Fault conditions	Automatic fault conditions reset for all parameters like voltage, frequency and /or black out.
17	Control Logic Failure detection	via watch dog timers.
18	Parameter access	All parameters accessible through an industry standard communication link.
19	Inverter efficiency	> 93% for output ranging from 20% to full load,(as per IEC standard) Idling current at no load shall not exceed 2% of the full load current.
20	Parallel operation with Grid	Provided & capable of interrupting line-to-line fault currents and line to ground fault currents.
21	Unbalanced output load	PCU is able to withstand an unbalanced output load to the extent of 30%.
22	Shut down /	Shut down / standby mode with its contact open under

	Standby mode	<p>the following conditions before attempting an automatic restart after an appropriate time delay; insufficient solar power output.</p> <p><i>a) Insufficient solar power input :</i> When the power available from the PV array is insufficient to supply the losses of the PCU, the PCU shall go to a standby/shutdown mode. The PCU control shall prevent excessive cycling during rightly shut down or extended periods of insufficient solar radiation.</p> <p><i>b) Utility -Grid over or under voltage :</i> The PCU shall restart after an over or under voltage shutdown when the utility grid voltage has returned to within limits for a minimum of two minutes.</p> <p><i>c) Utility-Grid over or under frequency_:</i> The PCU shall restart after an over or under frequency shutdown when the utility grid voltage has returned to the within limits for minimum of two minutes.</p>
23	THD	THD shall be <5%, (For voltage <3% and for current <5%)
24	Circuit separation	<u>High voltage & power</u> circuits separated from low voltage & control circuits.
25	Internal wiring	Standard Cu wiring, with flame resistant insulation.
26	Cabling practice	<p>a) Cables :PVC Cu cables as per relevant international (IEC) Standards.</p> <p>b) Cable connections : suitable terminations.</p> <p>c) PVC channel with covers to house the cables.</p>
27	High voltage test	PCU with stand high voltage test of 2000 Vrms between either the input or the output terminals and the cabinet (chassis).
28	EMI (Electromagnetic interface)	PCU shall not produce EMI which cause malfunctioning of electronic & electrical instruments including communication equipments which are located within the facility in which the PCU is housed.
29	Display on front panel & indicators	<p>a) instantaneous PCU ac power output and the DC voltage current and power input.</p> <p>b) Accuracy of display : 3% of full scale factor or better.</p> <p>c) Display visible from outside the PCU enclosure.</p> <p>d) Operational status of the PCU, alarms, trouble indicators and AC and DC disconnect switch positions.</p> <p>e) shall also be communicated by appropriate messages or indicator lights on the front cover of the PCU enclosure.</p>
30	Emergency OFF	Emergency OFF button is located at an appropriate position on the unit
31	Grounding	PCU includes ground lugs for equipment and PV array groundings. The DC circuit ground is a solid single point ground connection.
32	Exposed surfaces	Exposed surfaces of ferrous parts are thoroughly cleaned, primed, and painted and suitably protected to survive a nominal 30 years design life of the unit.

33	Factory Testing	<ul style="list-style-type: none"> a) Tested to demonstrate operation of its control system and the ability to be automatically synchronized and connected in parallel with a utility service, prior to its shipment. b) Operation of all controls, protective and instrumentation circuits, demonstrated by direct test if feasible or by simulation operation conditions for all parameters that can not be directly tested. c) Demonstration of utility service interface protection circuits and functions, including calibration and functional trip tests of faults and isolation protection equipment. d) Operation of start up , disconnect and shutdown, controls also to be tested and demonstrated, stable operation of the PCU and response to control signals shall also be tested and demonstrated. e) Factory testing include measurement of phase currents, efficiencies, harmonic content and power factor. All tests shall be performed 25, 50, 75 and 100% of the rated nominal power. f) Factory test report (FTR) : Should be supplied with the unit after all tests. The FTR shall include detailed description of all parameters tested qualified and warranted.
34	Test certificates	The PCU/ inverters should be tested from the MNRE approved test centers / NABL /BIS /IEC accredited testing- calibration laboratories. In case of imported power conditioning units, these should be approved by international test houses.
35	Operating Modes	<ul style="list-style-type: none"> a) Night or sleep mode: where the Inverter is almost completely turned off, with just the timer and control system still in operation(No load losses Less than 1 % of rated power). b) Standby mode: where the control system continuously monitors the output of the solar generator until pre-set value is exceeded. c) Operational of MPP tracking mode: the control system continuously adjust the voltage of the generator to optimize the power available. The power conditioner shall automatically re-enter standby mode input power reduces below the standby mode threshold. Front panel display d) providing the status of the PCU, including AC power output & DC current voltage and power input, and unit fault indication.
36	Codes & Standards	<ul style="list-style-type: none"> a) The power conditioning units / inverters should comply with applicable IEC/ equivalent BIS standard for efficiency measurements and environmental tests as per standard codes IEC 61683/IS 61683 and IEC 60068- 2(1,2,14,30) /Equivalent BIS Std. b) The charge controller (if any) / MPPT units environmental

		testing should qualify IEC 60068-2(1, 2, 14, 30)/Equivalent BIS std. The junction boxes/enclosures should be more than IP 66 for outdoor/indoor and as per relevant IEC specifications.
37	Inverter / Array Size ratio	The ratio of the Inverter continuous power rating and the array peak power rating shall be between 80 to 90% or any other value found more suitable. This is because better overall annual yield can be obtained by allowing the Inverter to operate for longer periods closer to optimal efficiency.
38	Dual MPPT	Dual Maximum power point tracker is integrated in the power conditioner unit to maximize energy drawn from the array. The MPPT shall be micro processor based to minimize power losses. The MPPT shall have provision (manual setting) for constant voltage operation.
39	Data Logging System	<p>a) All major parameters available on the digital bus and logging facility for energy auditing through the internal microprocessor and can be read on the digital front panel at any time the current values, previous values for up to a month and the average values.</p> <p>b) The following parameters shall be accessible via the operating interface display :</p> <ul style="list-style-type: none"> - AC voltage AC output current Output power DC input voltage. - DC input current Time active Time disabled Time Idle temperatures <p>c) Converter status.</p> <p>d) Protective function limits (VIZ-AC over voltage, AC under voltage, Over frequency, under frequency, ground fault, PV starting voltage, PV stopping voltage, over voltage delay, under voltage delay over frequency, ground fault delay, PV starting delay, PV stopping delay.</p>
40	Arrangements for Generation Data Collection through Remote Monitoring System.	<p>a) A remote monitoring system shall be included with this SPV plant.</p> <p>b) Usually such monitoring systems are connected and synchronized with the inverters.</p> <p>c) Such monitoring services are provided by many leading inverter manufacturers and also third party service providers.</p> <p>d) The monitoring system should transmit the following data in real-time to a central server and store it :-</p> <ul style="list-style-type: none"> ▪ DC currents, voltages and power. AC currents, voltages and power. Generated daily, monthly, yearly, and cumulative KWH ▪ Ambient temperature, Error logs. <p>e) This data may be transmitted either using the available LAN or GSM/GPRS/Wi-Fi or any other mode of connectivity available at the site.</p>

		<p>f) The contractor shall be responsible for data connectivity for monitoring up to the warranty/ O&M period of the PV system, after which, the Contractor shall transfer all ownership rights, SIM card, account information, passwords, instructions, Dongle etc. to RMC</p> <p>g) The contractor shall ensure that RMC is aware of the contracts required to maintain connectivity post-warranty/ O&M period.</p> <p>h) This data shall be accessible by RMC through a secure login account.</p> <p>i) The stored data should be represented through hourly, daily, monthly, etc. graphs and easily downloadable in .csv or .xls format.</p>
41	Make Of PCU/Inverters.	<p>ABB, SCHINDLER, GROWATT, DELTA, KAKO, only (The PCU/Inverter shall be of makes as above and sales/service/spares support and strictly complying to latest applicable IEC/BIS Standards. The make of the inverter shall be selected such that service and spares support is readily available in India. Standard OEM Guarantee/Warranty for the PCU/Inverter shall be provided. A copy of the backup Guarantee/Warranty letter must be produce with bid documents from the OEM for providing such support for the project.)</p>

6.19 DC Distribution Board (DCDB):-

- 6.19.1 In case of single inverter, a DCDB shall be provided in between AJB and PCU.
- 6.19.2 The **DCDB** shall be outdoor/ indoor-type (as per site requirement) with IP 65 degree of protection, dust, vermin, insect and rodent proof. Suitable canopy shall be provided for the DCDB. The door shall be provided with locking arrangement. Location of the DCDB shall be decided in conjunction with concerned EIC.
- 6.19.3 A DC MCCB of rating 1.5 times the short circuit current of the PV array shall be provided at the output of the bus-bar, for connection to the PCU. All switchgear equipment shall be standard make only. And main switch should be provide for maintenance.
- 6.19.4 It is expected that the cables be secured in position within DCDB using the best engineering practices and methods to avoid any stray cable running loose within DB. Wherever the cable enters or exits the panel through hole in panel covers, proper bushing and glanding has to be done.
- 6.19.5 Use of suitable quality of bolts, screws and nuts to stay protected against corrosion due to humid atmospheric condition.

6.20 AC Distribution Board (ACDB):-

- 6.20.1 An ACDB shall be provided in between PCU and Load point.
- 6.20.2 The **ACDB** shall be outdoor/ indoor-type (as per site requirement) with IP 65 degree of protection, dust, vermin, insect and rodent proof. Suitable canopy shall be provided for the ACDB. The door shall be provided with locking arrangement. Location of the DCDB shall be decided in conjunction with concerned EIC.
- 6.20.3 It shall have a necessary 3-ph., 4-pole MCCB/ACB/Contactors of Rating 1.5 times the rated output current of the PCU, for connection to Grid of DISCOM.

- 6.20.4 To provide proper glanding and bushing wherever cable passes through the panel wall/ door.
- 6.20.5 Use of corrosion resistant nuts, bolts and screws.
- 6.21 L.T. AC Bus & Panel :-** AC power converted by the inverter is transferred and fed through the appropriate size of cables, suggested by EIC, to 415 V 3- phase LT AC bus/L.T. panel of electrical installation of building as per requirements.
- 6.22 LT Air Circuit Breaker/MCCB :-** Appropriate & adequate Capacity 415V,3-phase,4-pole AC indoor/out door air Circuit Breaker with control circuit and protection relay circuit, fuses, annunciators and remote operating and controlling facility or Appropriate & adequate Capacity 415V,3-phase,4-pole AC indoor/out door MCCB as per capacity of SPV plant and site requirements.
- 6.23 INTEGRATION OF PV POWER WITH GRID: -** The output power from SPV would be fed to the inverters which converts DC produced by SPV array to AC and feeds it into the main electricity grid after synchronization. In case of grid failure, or low or high voltage, solar PV system shall be out of synchronization and shall be disconnected from the grid. 04 pole isolation of inverter output with respect to the grid must be provided.
- 6.24 TOOLS & TACKLES AND SPARES :-**
- 6.24.1 After completion of installation & commissioning of the power plant, necessary tools & tackles are to be kept at site by the bidder for maintenance purpose. List of tools and tackles to be supplied by the bidder for approval of specifications and make from RMC.
- 6.24.2 A list of requisite spares in case of PCU/inverter comprising of a set of control logic cards, IGBT driver cards etc. Junction Boxes. Fuses, MOVs / arrestors, MCCBs etc along with spare set of PV modules be indicated, which shall be supplied along with the equipment. A minimum set of spares shall be maintained in the plant itself for the entire period of warranty and Operation & Maintenance which upon its use shall be replenish.
- 6.25 DANGER BOARDS AND SIGNAGES: -** Danger boards should be provided as and where necessary as per IE Act. /IE rules as amended up to date. Text of the signage may be finalized in consultation with EIC of RMC.
- 6.26 FIRE EXTINGUISHERS: -** Portable fire extinguisher in the Inverter room for fire caused by electrical short circuits shall be provided if suggested by EIC.
- 6.27 DRAWINGS & MANUALS: -**
- 6.27.1 Two sets of Engineering, electrical drawings and Installation and O&M manuals are to be supplied. Bidders shall provide complete technical data sheets for each equipment giving details of the specifications along with make/makes in their bid along with basic design of the power plant and power evacuation, synchronization along with protection equipment.
- 6.27.2 For complete electro-mechanical works, bidders shall supply complete design, details, drawings, bill of material mentioning the quantity of each of the item consisting in the system for approval to RMC before progressing with the installation work.

6.28 PLANNING AND DESIGNING: -

- 6.28.1 The bidder should carry out Shadow Analysis at the site and accordingly design strings & arrays layout considering optimal usage of space, material and labor. The bidder should submit the array layout drawings along with Shadow Analysis Report to RMC for approval.
- 6.28.2 RMC reserves the right to modify the landscaping design, Layout and specification of sub-systems and components at any stage as per local site conditions/requirements.
- 6.28.3 The bidder shall submit preliminary drawing for approval & based on any modification or recommendation, if any. The bidder has to submit 02 sets of final drawing for formal approval to proceed with construction work.

6.29 DRAWINGS TO BE FURNISHED BY BIDDER AFTER WORK ORDER :-

- 6.29.1 The Contractor shall furnish the following drawings for to obtain approval.
- 6.29.2 General arrangement and dimensioned layout.
- 6.29.3 Schematic drawing showing the requirement of SPV panel, Power conditioning Unit(s)/ inverter, Junction Boxes, AC and DC Distribution Boards, meters etc.
- 6.29.4 Structural drawing along with foundation details for the structure.
- 6.29.5 Itemized bill of material for complete SPV plant covering all the components and associated accessories.
- 6.29.6 Layout of solar Power Array.
- 6.29.7 Shadow analysis of the roof.

6.30 SAFETY MEASURES: - The bidder shall take entire responsibility for electrical safety of the installation(s) including connectivity with the grid and follow all the safety rules & regulations applicable as per Electricity Act, 2003 as amended up to date and CEA guidelines etc.

6.31 DISPLAY BOARD :- The bidder has to display a board at the site, mentioning the following:-

- 6.31.1 Plant Name, Capacity, Location, Type of Renewable Energy plant, Date of commissioning, details of DISCOM, Financial Assistance details from SECI/MNRE/Govt. grant etc. and suggested by EIC.

6.32 Approved vender List :-

Sr. No.	Product	Vendor(s)
(1)	Inverter	ABB, Schneider, GROWATT, DELTA, KAKO, Havells
(2)	LT switch gear.	Siemens, L & T, Schneider, ABB, C & S.

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7 Scope of work for O & M :-

7.1 Operation and Maintenance Guidelines for works of Grid Connected SPV Plant under this rate contract :-

- For the optimal operation of a SPV plant, maintenance must be carried out on a regular basis by agency.
- All the components should be kept clean. It should be ensured that all the components are fastened well at their due place.
- Maintenance guidelines for agency for various components viz. solar panels, inverter, wiring etc. are discussed below:-

7.2 SOLAR PANELS:-

- a) The SPV panels must be cleaned at least once every seven days.
- b) Any bird droppings or spots must be cleaned immediately.
- c) Use water and a soft sponge or cloth for cleaning.
- d) Do not use detergent or any abrasive material for panel cleaning.
- e) Iso-propyl alcohol may be used to remove oil or grease stains.
- f) Do not spray water on the panel if the panel glass is cracked or the back side is perforated.
- g) Wipe water from module as soon as possible.
- h) Use proper safety belts while cleaning modules at inclined roofs etc.
- i) The modules should not be cleaned when they are excessively hot. Early morning is particularly good time for module cleaning.
- j) Check if there are any shade problems due to vegetation or new building. If there are, make arrangements for removing the vegetation or moving the panels to a shade-free place.
- k) Ensure that the module terminal connections are not exposed while cleaning; this poses a risk of electric shock.

7.3 CABLES AND CONNECTION BOXES :-

- a) Check the connections for corrosion and tightness.
- b) Check the connection box to make sure that the wires are tight, and the water seals are not damaged.
- c) There should be no vermin inside the box.
- d) Check the cable insulating sheath for cracks, breaks or burns. If the insulation is damaged, replace the wire.
- e) If the wire is outside the building, use wire with weather-resistant insulation.
- f) Make sure that the wire is clamped properly and that it should not rub against any sharp edges or corners.
- g) If some wire needs to be changed, make sure it is of proper rating and type.

7.4 INVERTER :-

- a) The inverter should be installed in a clean, dry, and ventilated area which is separated from, and not directly above, the battery bank.
- b) Remove any excess dust in heat sinks and ventilations. This should only be done with a dry cloth or brush.
- c) Check that vermin have not infested the inverter. Typical signs of this include spider webs on ventilation grills or wasps' nests in heat sinks.

- d) Check functionality, e.g. automatic disconnection upon loss of grid power supply, at least once a month.
- e) Verify the state of DC/AC surge arrestors, cable connections, and circuit breakers.

7.5 SHUTTING DOWN THE SYSTEM :-

- a) Disconnect system from all power sources in accordance with instructions for all other components used in the system.
- b) Completely cover system modules with an opaque material to prevent electricity from being generated while disconnecting conductors.
- c) To the extent possible, system shutdown will not be done during day time or peak generation.

7.6 Inspection and maintenance schedule for agency:-

Component	Activity	Description	Interval
PV Module	Cleaning	Clean any bird droppings/ dark spots on module	Immediately
	Cleaning	Clean PV modules with plain water or mild dishwashing detergent. Do not use brushes, any types of solvents, abrasives, or harsh detergents.	At least once every seven days. (If PV modules are not cleaned within seven days, than penalty will be imposed at the rate of Rs. 200=00 per day per site)
	Inspection	Use infrared camera to inspect for hot spots; bypass diode failure	Annual
PV Array	Inspection	Check the PV modules and rack for any damage. Note down location and serial number of damaged modules	Monthly
	Inspection	Determine if any new objects, such as vegetation growth, are causing shading of the array and move them if possible.	Monthly
	Vermin Removal	Remove bird nests or vermin from array and rack area.	Monthly
Junction Boxes	Inspection	Inspect electrical boxes for corrosion or intrusion of water or insects. Seal boxes if required. Check position of switches and breakers. Check operation of all protection devices.	Monthly
Wiring	Inspection	Inspect cabling for signs of cracks, defects, loose connections, overheating, arcing, short or open circuits,	Monthly

		and ground faults.	
Inverter	Inspection	Observe. Instantaneous operational indicators on the faceplate of the inverter to ensure that the amount of power being generated is typical of the conditions. Inspect Inverter housing or shelter for physical maintenance, if required.	Monthly
Inverter	Service	Clean or replace any air filters.	As needed
Instruments	Validation	Spot-check monitoring instruments with standard instruments to ensure that they are operational and within specifications.	3 - Months
Plant	Monitoring	Daily Operation and Performance Monitoring	Daily

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8 Reference standards :-

Quality certification and standards for grid-connected rooftop solar PV systems are essential for the successful implementation of this technology. This grid-connected solar PV system/plant must confirm to the relevant standards and certifications given below:-

Solar PV modules/panels	
IEC 61215/ IS 14286	Design Qualification and Type Approval for Crystalline Silicon Terrestrial Photovoltaic (PV) Modules
IEC 61853- Part 1/ IS 16170: Part 1	Photovoltaic (PV) module performance testing and energy rating –: Irradiance and temperature performance measurements, and power rating
IEC 61730-1,2	Photovoltaic (PV) Module Safety Qualification – Part 1: Requirements for Construction, Part 2: Requirements for Testing
IEC 62804	Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation. IEC TS 62804-1: Part 1: Crystalline silicon (mandatory for applications where the system voltage is > 600 VDC and advisory for installations where the system voltage is < 600 VDC)
IEC 62759-1	Photovoltaic (PV) modules – Transportation testing, Part 1: Transportation and shipping of module package units
Solar PV Inverter	
IEC 62109-1, IEC 62109-2	Safety of power converters for use in photovoltaic power systems – Part 1: General requirements, and Safety of power converters for use in photovoltaic power systems Part 2: Particular requirements for inverters. Safety compliance.
IEC/IS 61683 (as applicable)	Photovoltaic Systems – Power conditioners: Procedure for Measuring Efficiency (10%, 25%, 50%, 75% & 90-100% Loading Conditions)
BS EN 50530 (as applicable)	Overall efficiency of grid-connected photovoltaic inverters: This European Standard provides a procedure for the measurement of the accuracy of the maximum power point tracking (MPPT) of inverters, which are used in grid-connected photovoltaic systems. In that case the inverter energizes a low voltage grid of stable AC voltage and constant frequency. Both the static and dynamic MPPT efficiency is considered.
IEC 62116/ UL 1741/ IEEE 1547	Utility-interconnected Photovoltaic Inverters - Test Procedure of Islanding Prevention Measures

(as applicable)	
IEC 60255-27	Measuring relays and protection equipment – Part 27: Product safety requirements
IEC 60068-2 (1, 2, 14, 27, 30 & 64)	Environmental Testing of PV System – Power Conditioners and Inverters a) IEC 60068-2-1: Environmental testing - Part 2-1: Tests - Test A: Cold b) IEC 60068-2-2: Environmental testing - Part 2-2: Tests - Test B: Dry heat c) IEC 60068-2-14: Environmental testing - Part 2-14: Tests - Test N: Change of temperature d) IEC 60068-2-27: Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock e) IEC 60068-2-30: Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle) f) IEC 60068-2-64: Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance
IEC 61000 – 2,3,5 (as applicable)	Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC) testing of PV Inverters
Fuses	
IS/IEC 60947 (Part 1, 2 & 3), EN 50521	General safety requirements for connectors, switches, circuit breakers (AC/DC): a) Low-voltage Switchgear and Control-gear, Part 1: General rules b) Low-Voltage Switchgear and Control-gear, Part 2: Circuit Breakers c) Low-voltage switchgear and Control-gear, Part 3: Switches, Disconnectors, switch-Disconnectors and fuse-combination units d) EN 50521: Connectors for photovoltaic systems – Safety requirements and tests
IEC 60269-6	Low-voltage fuses - Part 6: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems
Surge Arrestors	
IEC 62305-4	Lightening Protection Standard
IEC 60364-5-53/ IS 15086-5 (SPD)	Electrical installations of buildings - Part 5-53: Selection and erection of electrical equipment - Isolation, switching and control
IEC 61643-11:2011	Low-voltage surge protective devices - Part 11: Surge protective devices connected to low-voltage power systems - Requirements and test methods
Cables	
IEC 60227/IS 694, IEC 60502/IS 1554 (Part 1 & 2)/ IEC69947	General test and measuring method for PVC (Polyvinyl chloride) insulated cables (for working voltages up to and including 1100 V, and UV resistant for outdoor installation)

BS EN 50618	Electric cables for photovoltaic systems (BT(DE/NOT)258), mainly for DC Cables
Earthing /Lightning	
IEC 62561 Series (Chemical earthing)	IEC 62561-1 Lightning protection system components (LPSC) - Part 1: Requirements for connection components IEC 62561-2 Lightning protection system components (LPSC) - Part 2: Requirements for conductors and earth electrodes IEC 62561-7 Lightning protection system components (LPSC) - Part 7: Requirements for earthing enhancing compounds
Junction Boxes	
IEC 60529	Junction boxes and solar panel terminal boxes shall be of the thermo-plastic type with IP 65 protection for outdoor use, and IP 54 protection for indoor use
Performance monitoring	
IEC 61724	

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Date:

9 Technical Formats (to be submitted by bidders)

Appendix 1 : Details of Bidder

01. Name of bidder :-
02. full address :-
03. Name of contact person with phone, fax nos. and email address :- :-
04. Whether the firms is a Joint Stock Co., Undivided Hindu Family, Individual or Registered Partnership Firm. (Attested copy of Deeds or Articles of Association to be enclosed) :-
05. Name or person holding the Power of Attorney. (Attested copy of Power of Attorney to be enclosed):-
06. Name of Bankers and Full Address :-
07. Details of Technical and Supervisory Staff proposed to be deployed on this Project.
 - a. Name
 - b. Qualification
 - c. Status
 - d. Experience in years
 - e. Date of Joining the Firm

Signature of Bidder with seal:

Date:

Appendix 2 : CHECKLIST SHEET TO BE FILLED UP BY VENDORS

Sr. No.	Technical Specifications/Description	RMC's Requirement as per Tender	Compliance from Vendor. (Please mention YES OR NO against each point).
1	EMD	
2	Tender Fee	
3	The cover of technical bid documents shall be duly sealed, & super scribed the name of work.	As per requirements of this tender document.	
4	All tender documents signed and sealed at every page	As per requirements of this tender document.	
5	Documents regarding Tech. & Financial Qualification.	As per requirements of this tender document.	
6	Solar PV Module	As per requirements of technical specification sheet of this tender document.	
7	PCU/Inverter	As per requirements of technical specification sheet of this tender document.	
8	AC and DC Cabling/Terminations and Sizing	To be complied in totality as per Technical Specifications sheet.	
9	Array Junction Box/AC Junction Box/ACDB/DC Combiner Box/Fuses/Terminal Blocks	To be complied in totality as per Technical Specifications sheet.	

Signature of Bidder with seal:

Date:

Appendix 3 : LIST OF MAINTENANCE TOOLS AND TACKLES

The Bidder shall give below the list of necessary maintenance tools and tackles :-

SR. NO.	PARTICULARS	NUMBERS

Signature of Bidder with seal:-

Date:-

Appendix 4 - TENDER DECLARATION FORM

To

Name of work :- _____

Reference :- _____

Dear Sir,

- a) I/We the undersigned have carefully gone through and clearly understood the e-Tender documents comprising Notice Inviting e-Tenders, Articles of Agreement, Scope of work, Definition of terms, Instructions to e-Bidder, Conditions of Contract, Special Conditions of Contract, Appendixes, Specifications, furnished by RAJKOT MUNICIPAL CORPORATION, RAJKOT. I/We have satisfied myself/ourselves as to the location of site.

I/We do hereby offer to execute and complete the whole of the work within the time specified all in accordance with the specifications, designs, drawings and instructions in writing referred to in the said documents and with such materials as are provided for, at the respective rates which I/we have quoted in the (PRICE BID) or at such other rates as may be fixed under the provisions of these conditions.

In the event of this e-tender being accepted I/we agree to enter into an agreement as and when required and execute the contract, according to your Form of Agreement or in default where of I/we bind myself/ourselves to forfeits the 'Earnest Money Deposit'.

I/We understand that if I/We shall not enter in agreement within ten days or decided by RMC from the date of receipt of letter of acceptance, you will forfeit the Earnest Money paid by me/us and take necessary action as deemed fit.

I/We have enclosed a DRAFT as an "Earnest Money Deposit", for the sum of Rs. _____ the full value of which is to be absolutely forfeited to the Employer should I/We fail to commence the works specified. Otherwise the Employer shall retain the said sum, as on account of such 'Security Deposit' as provided for in the aforesaid documents.

I/We agree not to employ Sub-contractors other than those that may be approved in accordance with conditions in the aforesaid documents.

I/We understand that you are not bound to accept the lowest or any e-tender, which you may receive.

I/We shall refer all disputes arising out of or relating to the agreement to the arbitration in accordance with conditions of contract.

I/We am/are bound to execute the job if the work order is issued within 180 days from the date of opening of the e-tender.

I/We agree to pay the Government Income-Tax, GST, Sales Tax (Central and State) Sales tax on Construction, Octroi duties and other taxes prevailing from time to time on such items on which the same are leviable and the rates quoted by me/us are inclusive of the same.

Date: _____

Yours faithfully,

Signature of Bidder with seal:

Date:

Address:

Appendix 8

FORM OF CONTRACT AGREEMENT

THIS AGREEMENT made this _____ day of _____ by and between the RMC hereinafter called RMC and _____ hereinafter called "The Contractor".

WITNESSETH

Whereas, RMC has caused Specifications Drawings and other Contract documents to be prepared for certain works described as _____ and

Whereas Contractor has offered to perform the proposed works in accordance with the terms of the Contract Documents.

Now, therefore, in consideration of the natural covenants and Agreements of the parties herein contained and to be performed, contractor hereby agrees to complete the works at prices and on the Terms and Conditions herein contained and RMC hereby employees the contractor and agrees to pay him the contract prices provided herein for the fulfillment of the works and the performance of the covenants set forth herein.

The further terms, conditions and covenants of the contract, are set forth in the following exhibit parts each of which is attached hereto and by this reference made a part hereof.

- (a) The said tender and Appendix there.
- (b) The Pre-qualification criteria of bid (Volume I).
- (c) The general and special Conditions of Contract.
- (d) The instructions to the bidder.
- (e) The Guarantee Bond.
- (f) The technical specifications and Drawings.
- (g) The corrigendum/addenda/Amendments.
- (h) The Price Bid (Volume II)
- (i) All Correspondence

The consideration of the payments to be made by the RMC to the Contractor as hereinafter mentioned, the contractor hereby covenants with the RMC to execution the works in conformity with the provision of the Contract.

The RMC hereby covenants to pay the contractor in consideration of the diligent and proper execution of the works the contract price at the time and in the manner prescribed by the Contract.

IN WITNESS WHEREOF, this Agreement has been executed in duplicate on the day and year first above written. _____

Signature of Bidder with seal:

Date:

Appendix 9

FORM OF PERFORMANCE SECURITY (BANK GUARANTEE)

To: _____ (name of Employer)
_____ (address of Employer)

WHEREAS _____ (name and address of Contractor) (hereinafter called "the Contractor") has undertaken, in pursuance of Contract No. _____ dated _____ to execute _____ (name of Contract and brief description of Works) (hereinafter called "the Contract");

AND WHEREAS it has been stipulated by you in the said Contract that the Contractor shall furnish you with a Bank Guarantee by a recognized bank for the sum specified therein as security for compliance with his obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor such as Bank Guarantee;

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you as principal obligator, on behalf of the Contractor, unconditionally and irrevocably guarantee the payment of an amount to total of _____ (amount of Guarantee)

_____ (amount in words), such sum being payable in the types and proportions- of currencies in which the Contract Price is payable, and we undertake to pay you, upon your first written demand and without cavil or argument, any sum or sums within the limits of _____ (amount of Guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

We further agree that no change or addition to or other modification of the terms of the Contract or of the Works to be performed there under or of any of the Contract documents which may be made between you and the Contractor shall in any way release us from any liability under this guarantee, and we hereby waive notice of any such change, addition or modification.

this guarantee shall be valid until the date of issue of the performance certificate.

SIGNATURE AND SEAL OF THE GUARANTOR

Name of Bank _____
Address _____
Date _____

Appendix 10

DECLARATION FOR NOT NOT BLACK LISTED OR TERMINATED OR DEBARRED

Note: The Declaration submitted earlier to this office will not be considered as such a fresh Declaration shall have to be done as on the milestone dates of this tender document

(Declaration To be submitted on Non-Judicial Stamp Paper of Rs.100/-)

DECLARATION

I/We hereby declare that I/ We am/ are not partner(s) black listed or terminated or debarred or connected with firm black listed or terminated or debarred in any States, CPWD/ MES / Railways or any Government, Semi-Government or Private body. Also, no complaint is lodged against the Firm / Company.

At present I/We am/are registered as approved contractor(s), firms in _____

State, CPWD/MES/Railways.

We, the partners/ owners of this firm, hereby give an undertaking that we are jointly and severally responsible to meet all the liabilities ever and above the business of this firm and make good the above financial loss sustained by the Rajkot Municipal Corporation as a result of our abandoning the works entrusted to us.

Seal and Signature of the Bidder

Annual Rate Contract for Supply, Installation, Testing and Commissioning of Grid connected rooftop solar power plant System on RMC buildings with related comprehensive Electrical, Mechanical & Civil Work including all necessary equipments with 10 (Ten) years comprehensive O&M.

(E-Tender No.RMC/ROSHNI/RC solar power plant/2018-19/)



Sr. No.	Event Description	Mile Stone Date
1	Start of download of E-tender	Dt. 09 /06 /2020 to Dt. 29 /06 /2020 up to 18:00 Hrs.
2	Last date of online submission of E-tender	Dt. 29 /06 /2020 up to 18:00 Hrs.
3	Last Date of submission of physical document EMD, Tender fee and other documents.	Dt. 02 /07 /2020 up to 18:00 Hrs.
4	Opening of on line technical bid and verification of physical documents - EMD, Tender fee and Other documents, (if possible).	Dt. 03 /07 /2020.
5	Opening of On-line price bid, (if possible).	Dt. 06/07/2020.
6	Validity of Bid	180 Days

Price BID

Additional City Engineer
Roshni (Lighting) Department
Rajkot Municipal Corporation
Central zone office
DR. Ambedkar bhavan
Room No.08, 2nd Floor, Dhebar road , RAJKOT – 360 001

Price Bid (to be submitted online only)

Sr. No.	Work description	Category	Base Price Rs. /KWP.	Percentage rate Equal / above / below
01	Annual Rate Contract for Supply, Installation, Testing and Commissioning of Grid connected rooftop solar power plant System on RMC buildings with related comprehensive Electrical, Mechanical & Civil Work including all necessary equipments with 10 (Ten) years comprehensive O&M.	Above 01 kwp and up to 10 kwp	Rs. 54,000/-% (Equal / above / below)
02		Above 10 kwp and up to 75 kwp	Rs. 48,000/-	<u>(to be submitted online only)</u>

I / WE agree to carry out the above said work at**(to be submitted online only)**..... % Equal / above / below on the tender rate shown on schedule.

DY. EXE. ENGINEER

ADD. CITY ENGINEER

Signature of Tenderer with seal:

Date: