MAHARASHTRA STATE POWER GENERATION CO. LTD

62MW$_{AC}$ CRYSTALLINE GRID INTERACTIVE SOLAR PV POWER PROJECT

BID SPECIFICATION FOR

Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra, India under Local Competitive Bidding from prospective Bidders.

Local Competitive Bidding Bid Specification No:

RFX No -3000036625

CHIEF ENGINEER (RE-P&P)
MAHARASHTRA STATE POWER GENERATION CO. LTD.
HDIL Tower, A-Wing,4th Floor, Bandra (East), Mumbai - 400051
Email: cespgd@mahagenco.in, dycespgd@mahagenco.in
Phone No: 91-22-26582424 Extn:353/357

MAHARASHTRA STATE POWER GENERATION CO. LTD.

NOTIFICATION OF INVITATION OF BIDS

Competitive Bidding for selection of EPC Contract for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MW$_{AC}$ Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra, India under Local Competitive Bidding from prospective Bidders.

(TO BE SUBMITTED ONLINE DULY FILLED IN AND DIGITALLY SIGNED)

The Maharashtra State Power Generation Co. Ltd., Mumbai, India (MAHAGENCO) invites online Bids (Two Bid System i.e. separate bid for technical/commercial and price bid) from eligible Bidder s for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MW$_{AC}$ Cumulative Capacity Crystalline Solar PV TechnologyGrid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra, India.
Details are as under

Sr. No.	Project Location	Latitude, Longitude	Project Capacity (AC), MW	Area, Hectares	Substation Location
1	Village: Paras, Taluka: Balapur, District: Akola, Maharashtra	20.71,76.80	62 MW	**103**	220 kV Paras MSETCL Substation
TOTAL CAPACITY			**62 MW (AC)**		

Bid specification shall be available for download on website https://eprocurement.mahagenco.in after acceptance of vendor registration fee (Rs.5000/- exclusive of applicable tax) and tender fees (Rs.11800/- inclusive of Applicable GST) through online payment gateway at https://eprocurement.mahagenco.in

1.	Start date of acceptance of tender fee by MAHAGENCO & download of tender document	17.04.2023 at 12.00 Hrs. IST
2.	Site visit	29.04.2023 to 04.05.2023
3.	Pre-bid conference	10.05.2023 at 11.00 Hrs. IST
4.	Last date of acceptance of queries/comments from bidders	12.05.2023 at 17.00 Hrs. IST
5.	Issue of amended bid document	24.05.2023 at 17.00 Hrs. IST
6.	Last date of online sale of Bid Document	31.05.2023 at 15.00 Hrs. IST
7.	Last date for Submission of Online Bid	01.06.2023 at 12.00 Hrs. IST
8.	Last date of submission of physical support documents	01.06.2023 at 15.00 Hrs. IST
9.	Due date for opening of techno-commercial bids	02.06.2023 at 12.00 Hrs. IST
10.	Due date for opening of Price bid	Will be intimated later

MAHAGENCO reserves the right to cancel/withdraw this Invitation for Bids without assigning any reason for such decision.

CHIEF ENGINEER (RE-P&P)

NOTE: This is an e-tender. Offers shall be submitted and processed in electronic mode only. Physical copies of required document will additionally need to be supplied for verification. The instructions to bidder/terms and conditions appearing in this specification only shall be applicable.

Contents

Definitions

i. In the RFP the following expression shall, unless the context otherwise requires, have the meaning thereby respectively assigned to them.

ii. "**Affiliate**" shall mean a company that either directly or indirectly controls or is controlled by or is under common control of the same person which controls the concerned party; and control means ownership by one company of at least twenty six percent (26%) of the voting rights of the other company

iii. "**Applicable Tariff**" shall have the same meaning as defined in the Contract;

iv. "**Appropriate Commission**"/"**Commission**"/"**MERC"** shall mean the Maharashtra Electricity Regulatory Commission (MERC).

v. "**Approval**" shall have the same meaning as defined in the Contract.

vi. "**Array**" means a collection of electrically connected photovoltaic (PV) modules.

vii. "**Array Current**" means the electrical current produced by a PV array when it is exposed to sunlight.

viii. "**Backup Meter**" means the meter installed, operated and maintained by the Solar Power Company, which shall be connected to the same core of the current transformer (CT) and voltage transformer (VT) to which the Main Meter is connected and shall be used for accounting and billing of electricity in case of failure/repair/maintenance of Main Meter.

ix. "**Base Tariff Rate**" will be discovered later for this tender only.

x. "**Bid(s)/ Tender(s)**" shall mean Non-Financial Bid and Financial Bid submitted by the Bidder, in response to the RFP, in accordance with the terms and conditions of the RFP.

xi. "**Bidder"** means the Bidding Company or Bidding Consortium. Any reference to the Bidder includes Bidding Company / Bidding Consortium/ Consortium, Member of a Bidding Consortium including its successors, executors and permitted assigns and Lead Member of the Bidding Consortium jointly and severally, as the context may require.

xii. "**Bidding Company**" shall refer to such single company that has submitted the Bid in accordance with the provisions of the RFP.

xiii. "**Bidding Consortium**" means group of bidding companies with one company clearly identified as lead member within the group, who shall be responsible for ensuring the completion of all the Projects and the successful fulfillment of all the rights and performance of all the duties and obligations of such Consortium.

xiv. "**Bidding Process**" shall mean the process adopted by MAHAGENCO for awarding of the contract including but not restricted to inviting Bids, selecting Solar Power Company and adopting the terms and conditions stated in the contract.

xv. "**Bid Deadline**" shall mean the last date and time for submission of Bid in response to this RfP

xvi. "**Bid Security**" shall mean the unconditional and irrevocable bank guarantee submitted along with the Bid by the Bidder under Clause1.8 of SECTION -I of this RfP, as per the prescribed.

xvii. Deleted

xviii. "**BoM**" means the Bill of Materials.

xix. "**Business Day**" shall mean with respect to Parties, a day other than Sunday or a statutory holiday, on which the banks remain open for business in the State of Maharashtra;

xx. "**Bypass Diode**" means a diode connected across one or more solar cells in a photovoltaic module such that the diode will conduct if the cell(s) become reverse biased. Alternatively, diode connected anti-parallel across a part of the solar cells of a PV module. It protects these solar cells from thermal destruction in case of total or partial shading of individual solar cells while other cells are exposed tofull light.

xxi. "**Capacity Utilization Factor**" or "**CUF**" shall be based on Contracted Capacity as per respective site location and shall have the same meaning as provided in MERC (Terms and Conditions for Determination of RE Tariff) Regulations, 2010 as amended from time to time. Formula for calculating the CUF is (plant output in kWh / (installed plant capacity in kW * 365X24).

xxii. "**Commercial Operation Date (COD) / Scheduled COD**" shall have the same meaning as defined in the Contract.

xxiii. "**Commissioning"** shall have the same meaning as defined in the Contract.

xxiv. "**Consents, Clearances and Permits**" shall mean all authorizations, licenses, approvals, registrations, permits, waivers, privileges, acknowledgements, agreements, or concessions required to be obtained from or provided by any concerned authority for the purpose of setting up of the SPP for supply of power.

xxv. "**Contract**" shall mean the agreement signed between MAHAGENCO and the Successful Bidder including its recitals and schedules, amended or modified from time to time in accordance with terms thereof.

xxvi. "**Contract Performance Guarantee**" shall have the meaning as per Clause1.21 of SECTION -I of this RfP and as defined in the Contract.

xxvii. "**Contract Period**" shall have the same meaning as defined in the Contract.

xxviii. "**Contract Year**" shall have the same meaning as defined in the contract.

xxix. "**Contracted Capacity**" shall have the same meaning as defined in the Contract.

xxx. "**Crystalline Silicon**" means a type of PV cell made from a single crystal or polycrystalline sliceof silicon.

xxxi. "**Day**" means a calendar day beginning and ending at 12.00 midnight IST.

xxxii. "**Delivery Point/ Point of Interconnection**" shall mean the point at the 220 kV Bus of the MSETCL Paras thermal power Substation.

xxxiii. "**Detailed Drawings**" means the execution drawings, which will be furnished by the Solar Power Company for execution of the work that will form part of the contract.

xxxiv. Deleted.

xxxv. "**Effective Date**" shall have the same meaning as defined in the Contract.

xxxvi. "**Efficiency**" means the ratio of output power (or energy) to input power (or energy), expressed in Percent.

xxxvii. "**Electrical Grid**" means an integrated system of electricity distribution, usually covering a large area.

xxxviii. "**Electricity Laws**" shall mean the Electricity Act, 2003 and the rules and regulations made thereunder

from time to time along with amendments thereto and replacements thereof and any other Law pertaining to electricity including regulations framed by the Appropriate Commission

xxxix. "**Fill Factor (FF)**" means for an I-V curve, the ratio of the maximum power to the product of the open-circuit voltage and the short-circuit current. Fill factor is a measure of the "squareness" of the I-V curve.

xl. "**Financial Bid**" shall mean Envelope II of the Bid, containing the price offered to MAHAGENCO by the Bidder as per this RFP.

xli. "**Final Acceptance Test**" shall have the same meaning as defined in the Contract.

xlii. "**Financial Year**" or "**Fiscal Year**" runs from April 1 of the any year through March 31 of the next year.

xliii. "**Financially Evaluated Entity**" shall mean the company which has been evaluated for the satisfaction of the financial requirement set forth in Clause1.14.2 of SECTION -I of this RFP.

xliv. [Deleted]

xlv. "**Frequency**" means the number of repetitions per unit time of a complete waveform, expressed in Hertz (Hz).

xlvi. "**Grid**" means term used to describe an electrical utility distribution network.

xlvii. "**Grid Code**" / "**IEGC**"/ "**State Grid Code**" shall mean the Grid Code specified by the Central Electricity Regulatory Commission under Clause (h) of Sub-section (1) of Section 79 of the Electricity Act and/or the State Grid Code as specified by the Maharashtra State Electricity Commission, referred under Clause (h) of Sub-section (1) of Section 86 of the Electricity Act 2003, as applicable

xlviii. "**Grid Connected PV System**" means a PV system in which the PV array acts like a central generating plant, supplying power directly to the grid.

xlix. "**Grid Interactive**" means a grid connected system which can feed in power to the grid as per the relevant Indian grid standards.

l. "**Goods and Service Tax**" or "**GST**" shall means taxes or cess levied under the Central Goods and Services Tax Act, Integrated Goods and Services Tax Act, Goods and Services Tax (Compensation to States) Act and various State/Union Territory Goods and Services Tax Laws and applicable cesses, if any under the laws in force (hereinafter referred to as relevant GST Laws) w.e.f. 01.07.2017, which shall be fully complied with by Bidders.

li. The "**Government**" shall mean the Government of Maharashtra or the Government of India, as the case may be.

lii. "**GTP**"/ "**Guaranteed Technical Parameters**" shall mean a document confirming all technical and physical parameters of a component or system, which shall be stamped and signed by the manufacturer / supplier of the particular item and the Bidder .

liii. "**IEC**" means International Electro technical Commission; is the world's leading organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

liv. "**Indian Governmental Instrumentality**" shall mean the Government of India, Governments of state(s) of Maharashtra state in India, where the Solar Power Company, MAHAGENCO and the Solar Power Plant are located and any ministry, department, board, authority, agency, corporation, commission under the direct or indirect control of Government of India or any of the above state

Government(s) or both, any political sub-division of any of them including any court or Appropriate Commission(s) or tribunal or judicial or quasi-judicial body in India but excluding the Solar Power Company and MAHAGENCO.

lv. "**Insolation**" means the solar radiation incident on an area over time, equivalent to energy and usually expressed in kilowatt-hours per square meter.

lvi. "**Inverter**"/ "**Power Conditioning Unit** (**PCU**)"/ "**Power Conditioning System** (**PCS**)" means in a PV system, an inverter converts DC power from the PV array to AC power compatible with the utility and AC loads.

lvii. "**Irradiance**" means the solar power incident on a surface; usually expressed in kilowatts per square meter. Irradiance multiplied by time equals Insolation.

lviii. "**Junction Box**" means a PV generator junction box is an enclosure on the module where PV strings are electrically connected and where protection devices can be located, if necessary.

lix. "**KV**" shall mean Kilovolts;

lx. "**Kilowatt** (kW**)"** means one thousand watts; a unit of power.

lxi. "**Kilowatt Hour** (**kWh**)" means one thousand watt-hours, a unit of energy. Power multiplied by time equals energy.

lxii. "**Law**" shall mean all laws including Electricity Laws in force in India and any statute, ordinance, regulation, notification or code, rule, or any interpretation of any of them by an Indian Governmental Instrumentality and having force of law and shall further include without limitation all applicable rules, regulations, orders, notifications by an Indian Governmental Instrumentality pursuant to or under any of them and shall include without limitation all rules, regulations, decisions and orders of the Appropriate Commission.

lxiii. "**Letter of Award** (**LOA**)" means the letter from MAHAGENCO conveying its acceptance of the bid submitted by the Successful Bidder subject to such reservations/ conditions as may have been stated therein.

lxiv. "**MAHAGENCO"/"MSPGCL"/"Owner**" shall mean Maharashtra State Power Generation Company Limited.

lxv. "**Maintenance-Free Battery**" means a sealed battery to which water cannot be added to maintain electrolyte level.

lxvi. "**MEDA**" means Maharashtra Energy Development Agency, assistance to state and central Govt. to promote and develop new and renewable sources of energy and technologies and to promote and implement energy conservation

lxvii. "**Module**" means the smallest replaceable unit in a PV array. It is an integral, encapsulated unit containing a number of PV cells.

lxviii. "**Month**" shall mean a period of thirty (30) days from (and excluding) the date of the event, where applicable, else a calendar month.

lxix. "**Maximum Power Point (MPP)"** means the point on the current-voltage (I-V) curve of a module under illumination, where the product of current and voltage is maximum.

lxx. "**Maximum Power Point Tracker (MPPT)**" means the means of a power conditioning unit that automatically operates the PV-generator at its MPP under all conditions.

lxxi. "**MSEB Holding company**" shall mean MSEB Holding Company Limited, holds all the stake in the

MSPGCL, MSEDCL and MSETCL companies

lxxii. "**MSEDCL**"/ "**MAHADISCOM**" shall mean Maharashtra State Electricity Distribution Company Limited.

lxxiii. "**MSETCL**"/ "**MAHATRANSCO**" shall mean Maharashtra State Electricity Transmission Company Limited;

lxxiv. "**MW**" shall mean Megawatt;

lxxv. "**NABL**" shall mean National Accreditation Board for Testing and Calibration Laboratories, an autonomous body under the aegis of Department of Science and Technology, Government of India.

lxxvi. "**Newly Incorporated Company**" shall mean a company which has been in existence for less than a year.

lxxvii. "**Net worth**" the total wealth of an individual, company, or household, taking account of all financial assets and liabilities.

lxxviii. "**Onshore Supplies/Services**" shall mean indigenous supplies/services.

lxxix. "**Offshore Supplies/ Services**" shall mean supplies/services procured from outside India.

lxxx. "**Operation and Maintenance**"/ "**O&M**" shall have the same meaning as defined in the Contract.

lxxxi. "**Open Circuit Voltage**" means the maximum voltage produced by an illuminated photovoltaic cell, module, or array with no load connected. This value will increase as the temperature of the PV material decreases.

lxxxii. "**Parent Company/Holding Company**" shall mean a company that holds at least fifty one percent (51%) of the paid-up equity capital directly or indirectly in the Bidding Company or in the Memberof a Bidding Consortium, as the case may be.

lxxxiii. "**Peak Watt (Wp)**" means the amount of power a photovoltaic module will produce at standard test conditions (normally 1000 W/m2 and 25° cell temperature).

lxxxiv. Deleted

lxxxv. "**Photovoltaic System**" means an installation of PV modules and other components designed to produce power from sunlight and meet the power demand for a designated load or feed energy to the grid.

lxxxvi. "**Plant, Equipment, Machinery, Material**" means and includes plant and machineries to be provided by the Contractor/or its Sub-Contractor(s) under the contract.

lxxxvii. "**Power Factor**" means the Cosine of the phase angle between the voltage and the current waveformsin an AC circuit. This is used as a designator for inverter performance. A power factor of 1 indicates current and voltage are in phase and power is equal to the product of Volt-Amperes (no reactive power).

lxxxviii. "**Price Bid**" shall mean the total Bid price per MU quoted by the bidder for setting up the Solar PV Project inclusive of all the taxes & duties

lxxxix. "**Project Completion**" shall have the same meaning as defined in the Contract.

xc. "**PMC**"/ "**Project Management Consultant/ Owner's Engineer**" shall mean the agency and/ or person(s) so designated by MAHAGENCO to overlook, supervise & monitor project work, approve the drawings, report & witness for various testing's, inspection of material at factory & site, check the Quality of work and to certify the work of the Solar Power Company's work so as to ensure compliance with the project's scope of work and terms of the contract.

xci. "**Project Manager / Site - in - Charge**" means the Project Manager appointed by MAHAGENCO or its duly authorized representative to direct, supervise and be in-charge of the works for the purpose of

the contract.

xcii. "**Pyranometer**" means an instrument used for measuring global solar irradiance.

xciii. "**Qualification Requirements**" shall mean the qualification requirements as set forth in Clause 1.14 section-I of this RFP.

xciv. "**Rated Module Current**" means the current output of a PV module measured at standard test conditions of 1,000 w/m2 and 25°C cell temperature.

xcv. "**Reactive Power**" means the sine of the phase angle between the current & voltage waveforms in an AC system.

xcvi. "**Request for Proposal (RFP)**" means this entire document issued to the Bidders, which gives out Instruction to Bidders, Tender Specification and any other addendum/revisions issued thereof.

xcvii. "**Revised Scheduled COD**" shall have the same meaning as defined in the Contract.

xcviii. "**RFP**" shall mean this Request for Proposal dated [INSERT RfP DATE] along with all formats and RFP Documents attached hereto and shall include any modifications, amendments alterations or clarifications thereto.

xcix. "**RFP Documents**" shall mean the following documents to be entered into by the parties to the respective agreements in connection with the supply of power:

(a) Contract Agreement

(b) Amendment issue on pre bid

(c) Various amendment

(d) Annexures

(e) Pre bid query

c. "**Scheduled COD**" or "**Scheduled Commercial Operation Date**" or "SCOD" means 12 (Twelve) months from the date of handing over of project land proposed for 62 MW Solar Power Project at Paras, Dist. Balapur, Maharashtra.

ci. "**Successful Completion of O&M period**" means contractor shall fulfill following conditions:

1. The actual Units (kWh) generated during 5 years of the operation and maintenance is expected to be more than or equal to Quoted Electrical Energy Generation (QEEG) in the bid offer by the bidder.
2. EPC Contractor shall demonstrate that Solar Plant Generation at the end of 5th year is more than quoted 6th yearly guaranteed generation quoted for contracted capacity of 62 MW_{AC}.

cii. "**Short Circuit Current**" means the current produced by an illuminated PV cell, module, or array when its output terminals are shorted.

ciii. "**Site**" means the land on, under in or through which the works are to be executed or carried out and such lands as may be agreed upon between MAHAGENCO and the Solar Power Company as being reasonable and necessary for carrying out of the works.

civ. "**Successful Bidder/Contractor**" shall mean the Bidder whose Bid has been accepted by MAHAGENCO and to whom Letter of Award (LOA) has been issued and shall include such successfulBidder's legal representatives, successors and permitted assigns.

cv. "**Specifications**" means collectively all the terms and stipulations contained in this document including the conditions of contract, technical provisions and attachments thereto and list of corrections and amendments.

cvi. "**Standard Test Conditions**" means conditions under which a module is typically tested in a laboratory: (1) Irradiance intensity of 1000 W/M2 (2) AM1.5 solar reference spectrum and (3) cell (module) temperature of 25°C.

cvii. "**String**" means a number of modules or panels interconnected electrically in series to produce the operating voltage required by the load.

cviii. "**Sub-Contractors/ Sub-Vendors**" refers to a party or parties having direct contract with the Contractor and to whom any part of the contract has been sublet by the Contractor with the consent in writing of MAHAGENCO.

cix. "**Subsystem**" means any one of several components in a PV system (i.e., Array, controller, batteries, inverter, load).

cx. "**Sun Path Diagram**" means graphical representation of the Sun's height and azimuth

cxi. "**System Operating Voltage**" means the Array output voltage under load. The system operating voltage is dependent on the load or batteries connected to the output terminals.

cxii. "**Tests on Completion**" shall mean all such tests as are prescribed by the specification to be made by the Contractor to the satisfaction of the MAHAGENCO before the plant and equipment are taken over by the MAHAGENCO and this also includes those tests not specifically mentioned in the specification but required under various BIS codes and relevant Electricity Acts and Rules. The Contractor has to show the report to the MAHAGENCO on the test site conditions.

cxiii. "**Tilt Angle**" means the angle of inclination of a solar collector measured from the horizontal.

cxiv. "**Transformer (Step-up)**" means a transformer that converts the generator's low-voltage electricityto higher voltage levels for transmission to the grid or load center.

cxv. "**Uninterrupted Power Supply (UPS)**" means the designation of a power supply providing continuous uninterruptible service. The UPS will include batteries.

cxvi. "**Ultimate Parent Company**" mean a company which directly or indirectly owns at least fifty one percent (51%) paid up equity capital in the Bidding Company or Member of a Consortium, (as the case may be) and/or in the Financially Evaluated Entity and such Bidding Company or Member of a Consortium, (as the case may be) and/or the Financially Evaluated Entity shall be under the direct control or indirectly under the common control of such company;

cxvii. "**Utility (Grid) Interactive Inverter**" means an inverter that can function only when tied to the utility grid, and uses the prevailing line-voltage frequency on the utility line as a control parameter to ensure that the PV system's output is fully synchronized with the utility power.

cxviii. "**Vendor's Credentials**" shall mean, unless specifically mentioned otherwise, the copies of Purchase Orders / Supply Invoices or Chartered Accountant's certificate clearly stating the extent of meeting eligibility criteria.

cxix. "**Watt (W)**" means the unit of electrical power. The power developed when a current of one ampere flows through a potential difference of one volt.

cxx. "**Watt Hour (Wh)**" means a unit of energy equal to one watt of power connected for one hour.

cxxi. "**Week**" means seven consecutive calendar days.

cxxii. "**Working day**" shall mean the part of the day devoted or allotted to work.

cxxiii. "**Working Time**" shall mean Working time is any period in which employ are working.

cxxiv. The terms and expressions not herein defined shall have the same meaning as assigned to them in the relevant Acts and/or Regulations as the case may be.

SECTION - I

INTRODUCTION

I. SECTION I :- INTRODUCTION

1.0. NOTICE INVITING TENDER

Bids are invited by Maharashtra State Power Generation Co. Ltd., 'HDIL Tower' 4th floor, Bandra (East), Mumbai 400051 through this Request for Proposal ("RfP" or "Bid proposal") Number XXXXXXXXXXXXXX for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra, India under Local Competitive Bidding from prospective Bidders.

1.1. BACKGROUND

The Ministry of New and Renewable Energy has announced a revised policy for "Flexibility in Generation of Thermal Power station through Bundling with Renewable Energy" and was released on 12th April 2022. Under this policy, MSPGCL has planned to install 62 MW (AC) grid interactive crystalline PV solar power plant at Village Paras, Taluka Balapur, District Akola in the state of Maharashtra, India.

Land Details:-

Sr. No.	Project Location	Latitude, Longitude	Project Capacity (AC), MW	Area, Hectares	Substation Location
1	Village: Paras, Taluka: Balapur, District: Akola, Maharashtra	20.71,76.80	62 MW	103	220 kV Paras MSETCL Substation
TOTAL CAPACITY			**62 MW (AC)**		

1.2. BRIEF DESCRIPTION OF BIDDING PROCESS: (Only Through E-Tendering Mode)

Bidder shall bear all costs for preparation and submission of his tender. MSPGCL will not be responsible for or pay for any expenses or losses, which might be incurred or suffered by any Bidder in connection with submission of tender. A prospective Bidder requiring any clarifications on the tender documents may request online to Chief Engineer (RE-P&P), Email id: dycespgd@mahagenco.in or cespgd@mahagenco.in

On the date and time specified in the tender notice, following procedure will be adopted for opening of the Tender. Bidder is also requested to follow the online E-tendering procedure.

1.3. VENDOR REGISTRATION FEE, TENDER FEE AND CONTENTS OF BIDDING DOCUMENTS:

1.3.1. Each bidder shall register itself at the website address https://eprocurement.mahagenco.in on online payment of the vendor registration fees Rs. 5000/- + GST Extra as applicable before the last date for registration mentioned in the notification of invitation of bids ("NIT").

Vendor registration fee is non- refundable.

1.3.2. Bidder is required to pay online non-refundable Tender fee of Rs. 10000 + GST i.e. Rs. 11,800/- on or before the last date of payment of tender fees. Overseas bidders shall submit vendor registration fee and tender fee through international debit/credit card.

1.3.3. The services required, bidding procedures and contract terms are prescribed in the Bid Specification. The bid specification includes the following sections and Annexure which shall collectively with the invitation for bids, and any amendments and modifications to the bid specifications notified by the MAHAGENCO be referred to as the "Bid Specification"

XXXXXXXX

Instructions to bidder Section	Section – I
Technical specification	Section – II
General Terms & Conditions	Section – III
Special Terms & Conditions	Section -IV
Annexure	**Annexure 1 to 23**

1.4. CLARIFICATION OF BID SPECIFICATION:

Any prospective Bidder (subject to having paid the vendor registration and tender fees) who requires any clarification in respect of the Bid Specification may notify the MAHAGENCOin writing or by email enclosing therewith copy of successful online payment transaction against tender fee at the MAHAGENCO's contact details given below up to (Time) Hrs. (Date) The clarifications received after (Date) shall not be entertained. The MAHAGENCO's response (including an explanation of the query but without identifying the source of enquiry) shall be published by way of revision of the Bid Specification on website https://eprocurement.mahagenco.in The Bidders in their own interest may inform the MAHAGENCO in written about the payment of tender fee by them and their detailed correspondence address with name of contact person, e-mail address etc. so that such clarifications can be sent to them by post/e-mail as may be possible. However, MAHAGENCO's responsibility is restricted to only publishing such clarifications on above mentioned website.

Bidder through the own cost and time visit the site. Ignorance of the site visit it is risk and cost of Bidder. The Bidder shall carefully examine the Bid Specification and fully inform and satisfy itself as to all the conditions and matters which may in any way affect to work or cost thereof. Failure to furnish all information required by the Bid Specification or to submit a bid not substantially responsive to the Bid Specification in every respect will be at Bidder 's risk and may result in the rejection of the bid. A Bidder if, find any discrepancies or omissions in the Bid Specifications or have any queries with respect to any provision of the Bid Specifications, he shall at once notify to the MAHAGENCO at below mentioned address:

Chief Engineer (RE-P&P)
Maharashtra State Power Generation Co. Ltd.,
HDIL Tower, A- Wing, 4th Floor,
Bandra (East), Mumbai – 400051.
Phone: 022-26582424 Ext. 357 & 353. / Mobile no. 8879770741
Email: dycespgd@mahagenco.in & cespgd@mahagenco.in

1.5. REVISION OF BID SPECIFICATION:

At any time prior to the deadline for submission of bids, the MAHAGENCO may, for any reason, whether at its own initiative revise the Bid Specification. Every time the Bid Specification is revised, the revisions/amendments/revised bid Specifications shall be published on website https://eprocurement.mahagenco.in in seven (7) days prior to last date of bid submission (the revision no. of the Bid Specification shall be accordingly enhanced). Such revisions shall be binding on all the prospective bidders irrespective of whether they have paid the tender fees prior to the revision or not.

In order to give prospective bidders reasonable time to take the revisions into account for preparing their Bids, the MAHAGENCO may, at its discretion, extend the deadline for the submission of bids. The MAHAGENCOs decision about the extension of deadline of submission shall be final and binding on the bidders and no correspondence shall be entertained in this regard.

1.6. PREPARATION AND SUBMISSION OF BID

1.6.1. Preparation of Bid

Before submitting bid, the bidder should inspect and examine the site and its surroundings and should satisfy himself as to the nature of the ground and subsoil, the quantities and natureof work, materials necessary for completion of the work and their availability, means of access to site and in general shall himself obtain all necessary information as to risks, contingencies and other circumstances which may influence or affect his offer. No consequent extra claims on any misunderstanding by bidder which shall not entertained by the Mahagenco.

The bid prepared by the bidder, as well as all correspondence and documents relating to the bid exchanged by the bidder with the MAHAGENCO shall be written in English. Supporting documents and printed literature furnished by the bidder may be in any other language, provided they are accompanied by the accurate translation in English duly certified by an official translator engaged by a court in the jurisdiction of the bidder and notarized. For the purposes of interpretation and evaluation of the bid, the translation in English shall govern and be binding on the bidder.

Bidder shall take into account any corrigendum published on the tender document before submitting their bids.

Please go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Please note the number of covers in which the bid documents have to be submitted, the number of documents - including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.

Bidder, in advance, shall get ready the bid documents to be submitted as indicated in the tender document / schedule and generally, they can be in PDF formats. Bid documents may be scanned with reasonable.

1.6.2. Documents comprising the Bid:

Following documents shall constitute the documents comprising the Bid.

a) The techno-commercial Bid, the price Bid and the Physical Support Documents;
b) Latest revision of Bid Specification published by MAHAGENCO & responses to the pre-bid queries.
c) Undertakings and Documentary evidence in accordance with Qualifying Requirement set out in **Clause 1.14 of Section-I** and the relevant annexure

establishing that the bidder is eligible to Bid and is qualified to perform contract.

d) Bid security (EMD) furnished in accordance with **Clause 1.8, Section – I.**
e) The documents submitted under the **Annexure-15** of RfP along with declaration of undertaking.
f) Copy of original money receipt against online payment of tender fee as per **Clause 1.3 above**.
h) Bidder shall upload only under Price Bid section of online Bid the scan copy of detailed prices break up along with applicable taxes & duties. (Note: Physical submission of this document shall liable for rejection of bid)

1.6.3. **Bid Form and Bid Schedules:**

The bidder shall complete the Bid Form and the appropriate price schedule furnished in the Bid Specification. Bidder shall quote the Total Bid price per MU required for setting up the Solar PV Project in the financial part of bid. Bids shall be fully in accordance with the requirements of this document and the Technical Specifications attached thereto.

Only a bidder, who has paid the vendor registration and tender fees as stipulated in **Clause 1.3** above, will be eligible to participate in the bidding. Bids received from those bidders, who have not made payment of vendor registration and tender fees, will not be accepted. If the bidder is a consortium, the consortium may tender its Bid if the online payment is made against vendor registration and tender fees by the lead member.

Multiple Bids by the same person (individually or as a part of a consortium) are not allowed for the same item. Any person that controls (directly or indirectly) a bidder or a member of the bidding consortium, any other persons which are controlled (directly or indirectly) by the `aforementioned person, or any person that is controlled (directly or indirectly) by such bidder or member of bidding consortium, shall not bid on its own or as a member of a consortium for the same item for which the bidder or the bidding consortium has submitteda bid.

For the purpose of this clause the term 'person' means any individual, company, corporation, partnership (whether limited or unlimited), proprietorship, trust or other body (whether incorporated or not), Hindu undivided family, union or association and in case of a trust shall include the trustee or the trustees for the time being. For the purposes of this clause the term 'control' as applied to any person, means the possession, directly or indirectly, of the power to direct or cause the direction of the management or policies of that person whether through ownership of voting securities, by contract, or otherwise.

Documents to be submitted offline:

In accordance with the terms & conditions of Instructions to bidders as per the above clause 1.6.2, bidder shall submit the documents in original as part of response to tender for verification (duly signed and affixing the company's seal on each page in a single envelope) before the due date & time of physical support documents submission as per NIT, to the office of **The Chief Engineer (RE-P&P), MAHAGENCO. (Address stated under the use no. 1.4.)**

If there is any shortfall in submitted physical support documents, the employer may obtain it from the bidder. However, no additional physical support documents (Hard Copies) shall be accepted by Mahagenco, other than uploaded documents or supplementary documents under e-tendering process.

In any case, Bidder shall not submit hard copies of "Price bid as per above clause no 1.6.2-h" along with above physical documents submission, otherwise bid shall be Summarily Rejected.

Documents to be submitted online:

In accordance with the terms and conditions of Instructions to bidders, offer/bid comprising of soft / scan copies of documents stated at above clause no 1.6.2 shall be submitted and processed strictly in electronic mode only.
Bidders are required to go through the Guidelines provided at Mahagenco's following E-tendering web site: https://eprocurement.mahagenco.in/

Bidder has to strictly follow the procedure of the E-tendering process.

1.7. BID PRICE AND BID CURRENCY

The bidder shall quote his lowest prices inclusive of all taxes & duties for Design, engineering, supply, erection, testing and commissioning of 62 MW_{AC} Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant at Paras, Taluka Balapur, District Akola in the state of Maharashtra with associated power evacuation infrastructure arrangement including 5 years' operation & maintenance of same.

1.7.1. Bidder shall be quote the following information in their bid for specified technical scope of work under Section – II,

a) Price (L) in INR per MU inclusive of all applicable taxes & duties.

b) Guaranteed Annual Generation (G) in MU > G'. (G' is as per clause no. 1.22 of Section IV)

c) DC/AC ratio = Cumulative DC capacity of the solar arrays / Cumulative rated AC capacity of inverters at reference ambient temperature as per specification

d) Contract Price will be calculated using following formula,

Contract Price (X) = Price per MU (L) in INR x Guaranteed Annual Generation (G) in Million Units

1.7.2. This charges/fees shall be inclusive of all taxes, current service taxes, incidentals, overheads, traveling expenses, printing and binding of Reports, expenditure related to presentations to be made during the execution of assignment, sundries and all other expenditure for execution of this services as per "Terms of Reference or RFP", indicated in the tender Document and also the tasks the consultant may think shall be carried out in order to meet the objectives of the assignment.

1.7.3. Any rise in the taxes and fees will not be paid extra subjected to the Clause. No. 1.36 of Variations in section III of General terms & conditions.

1.7.4. The Contract Price shall be paid as per the milestone payments as prescribed in the RfP.

1.7.5. Income Tax and Profession Tax, any other tax as per Statutory Provisions of Govt. of India and Maharashtra State shall be deducted by the Employer from each invoice. A certificate in this regard shall be provided by the Employer.

1.7.6. The bidder shall quote fixed price inclusive of all the applicable taxes providing the tax breakup. The bid price shall be the sum total of lump sum price quoted by the bidder for

entire scope of work. The bidder shall indicate the Bid Price in Indian Rupees only.

1.7.7. Price bid shall be submitted on-line only at https://eprocurement.mahagenco.in. Physical submission of price bid shall not be accepted & such bids shall be liable for rejection.

Note: Bidder shall not include counter conditions anywhere in the bid proposal as conditional proposal shall be summarily rejected.

1.8. BID SECURITY (EMD)

1.8.1. Each Bidder shall be required to submit Bid Security/ Earnest Money Deposit (EMD) of **Rs. 62 Lakhs (Rs. Sixty Two lakhs only)** along with bid in the form of bank guarantee as per Annexure - 12, issued by any branch of Bank mentioned in list attached. In the case of a Consortium, the Lead Member shall furnish the Bid Security as stipulated in the RfP, on behalf of the Consortium Members as per the ConsortiumAgreement. The Bid Security shall be valid for a period of 180 days (6 months) from the date of submission of the Bid (online). It is to be noted that the Bid Security to be provided must be issued from the list of Banks provide in the Annexure 20 payable at Mumbai only. The Bid Security must be payable in currency of India & on stamp paperof Rs.500/-

Scanned copy of the Bid security (as Annexure 12) shall be uploaded/submitted on-line on the website https://eprocurement.mahagenco.in and original copy shall be submitted in physical to office of The Chief Engineer (RE-P&P) Mumbai, failing of which may result in rejection of bid.

1.8.2. No interest will be paid on bid security irrespective of mode of submission.

1.8.3. Existing permanent bank guarantee if any submitted by any Bidder with the MAHAGENCO shall not be considered for exemption from the payment of bid security (EMD) against this bidding or Security – cum-Performance Guarantee to be provided in terms of this RFP.

1.8.4. Any bid not accompanied by Bid security (EMD) or having submitted shorter amount than specified under Clause 1.8.1 above or the bank guarantee taken from the bank which is not listed in the Annexure 20, such bids shall be summarily to disqualified.

1.8.5. The Bid submitted by a Bidder shall be treated invalid and the Bid security (EMD) shall be forfeited:

i) If the Bidder withdraws/ modify his bid within the bid validity specified in the Bid Specification.

OR

ii) The successful Bidder fails to submit performance guarantee (PBG) and/ or to execute contract agreement within the prescribed period in accordance with the instructions to the Bidder.

OR

iii) If the Bidder being the successful Bidder fails to furnish the acceptance of Letter of Award, within the specified time limit of 7 days from issue of LOA.

OR

iv) If the Bidder gives any wrong / false information /documents in the bid for making the bid qualified (eligible).

OR

v) Bidder fails to taken over the project land in specified time limit.

The EMD of the successful Bidder shall be returned/ released after,

a. When the Bidder has signed the Contract Agreement pursuant to Instruction to Bidders

AND

b. Acceptance of LOA by the Bidder

AND

c. The submission of bank guarantee towards contract performance securityby the Bidder and on acceptance of the same by the MAHAGENCO.

Unsuccessful bidder's EMD will be discharged/returned as promptly as possible but in any case within one month beyond the validity of the bid.

1.8.6. In the exceptional circumstances, prior to expiry of the original validity period of the bank guarantee furnished as Bid Security, MAHAGENCO may request the Bidders to extend the period of validity for an additional period. In such case the Bidders shall provide the extended bid securities no later than ten (10) days prior to the expiry of the Bid Security. MAHAGENCO reserves the right to reject the Bid submitted by any Bidder who fails to extend the validity of the Bid Security in line with the provisions of this clause.

1.9. VALIDITY OF BID

Offers/bids shall be valid for a period of at least 180 days from the date of opening of techno- commercial Bid. **Bids with shorter validity shall be liable for rejection at the direction of MAHAGENCO.**

Extension of validity of proposal:

If it becomes necessary, MAHAGENCO may request the parties, in writing, to extend validity of proposals. The parties shall have the right to refuse such extension without forfeiting their proposal security. In case a party extends the validity then it shall also extend the validity of its Proposal Security for corresponding period.

1.10. PAYMENT TERMS

Payment shall be made in INR only. Detailed Payment terms are stipulated under Clause 1.35, Section - III of Bid Specifications. Bidders shall note that no other payment terms are acceptable.

1.11. SIGNING OF BIDS

1.11.1. Bid shall be submitted along with the tender documents and duly filled in withall sections /Annexure/Appendixes/ schedules etc. the online offer shall be signed by the bidder/ lead member as per this clause. Physical supporting documents shall be signed by the authorized person of the bidder/ lead member as per Format of Authorization.

1.11.2. The foreign bidders shall indicate in his bid, the name of Indian firm, if any, who will be acting as his representative in India for the purpose of liaison of contract and receiving of payments and will have to submit the form of authorization for Indian representative as per the Format of Authorization. Such authorized Indian firm will have to submit the form of Authorized Indian representative as per Annexure - 6 duly singed by a person authorized by the bidder. Appointment of such Indian representative shall be subject to acceptance by the MAHAGENCO.

1.12. SUBMISSION OF BIDS

1.12.1. Each Bidder shall carefully examine the Bid Specification and shall independently fully inform and satisfy itself as to all the conditions and matters which may, in any way affect the work specified in the Bid Specifications or costs thereof. Failure to furnish all information required by the Bid Specifications or to submit a bid not substantially responsive to the Bid Specification in every respect will be at the Bidder's risk and may result in the rejection of the Bid.

1.12.2. Each Indian as well as overseas Bidder shall obtain Digital Signature Certificate (meant for e-tendering) from the list of Licensed Certifying Authorities approved by the controller of Certifying Authorities provided on the website https://eprocurement.mahagenco.in The Bidder in whose name the Digital Signature Certificate / Registration is obtained can only fill up the tender online as the same is not transferable.

1.12.3. Each Bidder shall register itself at the website address https://eprocurement.mahagenco.in on payment of the vendor registration fees of Section -I to the MAHAGENCO before the last date for registration mentioned in the notification of invitation of bids ("NIT").

1.12.4. Each BIDDER shall arrange to pay the vendor registration and tender fee of Section-I to the MAHAGENCO by the last date for payment of tender fee indicated in NIT.

1.12.5. Each Bidder shall use the user ID and password, to login to the system and view the Bid Specification. Each Bidder is required to go through (on-line) the Bid Specifications thoroughly before bidding.

1.12.6. Bidder s shall then fill the details required for the Techno-commercial bid and Price bid within the timelines indicated in NIT for submission of the Techno-commercial bid. Subsequent to making the techno-commercial Bid, the Bidder shall provide the MAHAGENCO with physical copies of the required documents that have been uploaded in scanned form.

1.12.7. It is mandatory for the Bidder to submit the Bids through e-tendering platform and the Bidders are required to provide the "Physical Support Documents" duly signed and sealed, within the timelines specified.

1.12.8. The Bidder shall send the "Physical Support Documents" in an envelope superscripted to the address given in **Clause 1.4 of section -I: "Physical Support Documents"**
SPECIFICATION No: xxxxxxxxxxx
NAME OF THE Bidder

1.12.9. Each Bidder shall submit their Price Bid within the time-period indicated in NIT on the e-tendering platform.

1.12.10. Any discrepancy between the data/ details/ documents of the bids submitted by the Bidder in the on- line bid and the Physical Support Documents shall not be allowed and any such discrepancy shall make the bid submitted by the Bidder liable to be rejected. No further communication in the matter shall be entertained by the MAHAGENCO.

1.12.11. It shall be noted that the Price Bid can be made only through the e-tendering platform. **No physical price bids shall be submitted. In case a Bidder submits physical price Bids, such Bids shall be summarily rejected.**

1.12.12. BIDDERs are requested to fill up/submit the online Bid data in the formats / space provided in the Bid Specification itself. The Bidder s shall take a print of the filled-upBid (for the Bidder 's record) before the submit key is pressed on-line. It may not be possible to take a print thereafter.

1.12.13. Bids are to be submitted online and physical support documents shall be submitted in sealed condition only. As such, physical support documents sent by fax/telegram/ e-mail etc. or submitted in open condition shall not be accepted.

1.12.14. Timely submission of offer: It is advisable to submit the digitally signed offer sufficiently in advance of due date & time so as avoid last minute trafficking at server. Offer received after the due date and time of submission shall not be accepted. In case, the due date of opening of tender happens to be holiday, the offer shall be opened on the next working day at the same time.

1.13. ASSISTANCE TO BIDDERS

1.13.1. Conditional Tender will be rejected outright considering it as non-responsive offer and Tender will be liable to be rejected outright if it is found that;

"The Bidder proposes any alternation in the assignment specified in the tender or in time allowed for completing the assignments or indicate any other unacceptable condition".

1.13.2. After the public opening of tenders information relating to the examination, clarification, evaluation and comparisons of tenders and recommendations concerning the award of contract shall not be disclosed to Bidders or any other(s).

1.13.3. Any efforts by the Bidder to influence MAHAGENCO, in the process of examination, clarification, evaluation and comparison of tenders and decisions concerning award of contract may result in the rejection of the Bidder’s tender.

1.13.4. To assist in the examination, evaluation and comparison of tenders, MAHAGENCO may ask Bidders, individually for clarifications of their tenders. The request for clarification and the response shall be in writing **or** Email. Where there is discrepancy between amounts in figures and words, **the amount in words will govern.**

1.13.5. Prior to the expiration of the prescribed period of tender validity or such extended period MAHAGENCO will notify the successful Bidder, by Email or registered letter confirming in writing that his tender has been accepted. The notification of award will constitute the formation of the contract upon the furnishing of performance security by the successful Bidder.

1.13.6. All the communication during the period of the tender should be in written only and any other communication alternatives such as telephone calls, mobile calls etc. is forbidden.

1.13.7. All costs, charges and expenses including stamp duty in connection with contract as well as preparations and completion of agreement shall be borne by the Bidders.

1.13.8. Mahagenco does not bind itself to accept the lowest or any of the bids and reserves the right to accept any bid or reject any or all bids without assigning any reasons therefore.

1.14. QUALIFYING REQUIREMENTS FOR 62MW$_{AC}$ SOLAR PROJECT:

1.14.1. **Experience**

Technical Experience:

Ground mounted solar PV plant having Cumulative installed capacity of 25 MW or higher capacity out of which single solar project of 12 MW or higher capacity is running successfully for at least six (6) months prior to the date of techno-commercial bid opening **AND** O&M Experience of solar power plant of the same technology as offered in bid of Minimum 12 MW or higher capacity of individual project for the period of 6 months prior to the date of techno-commercial bid opening.

OR

The Bidder should have executed in last 10 years an industrial project either as developer or as EPC contractor in the area of Power / Steel / Oil / Gas / Petrochemical / Fertilizer cement / coal / mining including coal handling plant and/or any other Process Industry, with 220 kV power line connectivity for value of at least **Rs. 125 Crs**. or more in a single project or work respectively.

i. In case of a BIDDER /Member of Consortium seeking experience qualification on the basis of technical capability of its Parent Company, the Parent Company shall have minimum 51% stake in the Bidder /Member of Consortium for first 2 years and minimum 26% stake in the BIDDER /Member of Consortium for next 3 years of O&M.

ii. Parent Company shall be construed as reference to any company or corporation of which the other company or corporation is a Subsidiary i.e. at least 51% stake in the subsidiary is held by the Parent Company.

iii. In case of a bidder/Member of Consortium seeking experience qualification on the basis of technical capability of its Ultimate Parent Company, the Ultimate Parent Company shall have minimum 51% stake in the Parent Company of the Bidder/Member of Consortium for first 2 years and minimum 26% stake in the Parent Company of the Bidder/Lead Member for next 3 years of O&M.

1.14.2. **Financial Criteria**

A) Net worth

i. The net worth of the tenderer/ bidder as on 31st March of previous financial year shall be **Positive**. The tenderer who does not satisfy the Net Worth criteria stipulated herein on its own would be required to furnish along with its Bid a letter or undertaking from their holding company pledging unconditional and irrecoverable financial support for execution of the contract by the tenderer in case of award provided that the Net Worth of such holding company as on 31st

March of previous financial year should be at least equal to or more than paid up capital of the holding company.

ii. In case where audited results for the last preceding financial year are not available, certification of financial statement from a practicing Chartered Accountant shall also be considered acceptable.

iii. Please note that, Net Worth means sum of the paid up share capital and free reserves. Free reserves shall mean all reserves credit out of the profit and share premium account but not include reserves credited out of the revaluation of assets, write back of depreciation provision and amalgamation. Further, any debit balance of profit and loss account and miscellaneous expenses to the extent not adjusted or written off, if any, shall be reduced from reserves and surplus. Other income shall not be considered for arriving at annual turnover.

iv. The Bidder should submit the documentary evidence in respect of above. In case audited results for the last preceding financial year are not available, certification of financial statement from practicing Chartered Accountant shall be acceptable.

v. For the purposes of meeting financial requirements only unconsolidated audited annual accounts shall be used. However, audited consolidated annual accounts of the BIDDER may be used for the purpose of financial requirements provided the Bidder has at least twenty-six percent (26%) equity in each company whose accounts are merged in the audited consolidated account and provided further that the financial capability of such company (of which accounts are being merged in the consolidated accounts) shall not be considered again for the purpose of evaluation of the Bid.

vi. If Bid is submitted by a Consortium, the Net worth requirement is to be met by Lead Member of the Consortium. The Bidder may seek qualification on the basis of financial capability of its Parent Company for the purpose of meeting the Qualification Requirements. In the case of the Bidder being a Bidding Consortium, Lead Member may seek qualification on the basis of financial capabilities of its Parent Company. In such an event, the Bidder would be required to furnish along with its bid, a Letter of Undertaking from the Parent Company, supported by Board Resolution, as per Annexure 11, pledging unconditional and irrevocable financial support for the execution of the Contract by the Bidder incase of award.

vii. Parent Company shall be construed as reference to any company or corporation of which the other company or corporation is a Subsidiary i.e. at least 51% stake in the subsidiary is held by the Parent Company.

viii. In case of a Bidder seeking qualification on the basis of financial capability of its Parent Company, the Parent Company shall have minimum 51% stake in the Bidder/Lead Member for construction period and also first 3 years of O&M and minimum 26% stake in the Bidder /Lead Member for next 2 years of O&M.

ix. In case of a bidder/Member of Consortium seeking experience qualification on the basis of technical capability of its Ultimate Parent Company, the Ultimate Parent Company shall have minimum 51% stake in the Parent Company of the Bidder/Member of Consortium for first 2 years and minimum 26% stake in the Parent Company of the Bidder/Lead Member for next 3 years of O&M.

B) Turnover

The average annual turnover during preceding three consecutive financial years of the Bidder /consortium shall be at least **Rs. 235 Crores** or equivalent US $(Conversion rate will be as on bid submission date) from the Bidder 's

business as an EPC Bidder / developer of Projects in India or from Solar Power Generation Projects in any country. If Bid is submitted by a Consortium the Turnover requirement is to be met by Lead Member of the Consortium. The Bidder may seek qualification on the basis of financial capability of its Parent Company for the purpose of meeting the Qualification Requirements. In the case of the Bidder being a Bidding Consortium, Lead Member may seek qualificationon the basis of financial capabilities of its Parent Company. In such an event, the Bidder would be required to furnish along with its bid, a Letter of Undertaking from the Parent Company, supported by Board Resolution, as per annexure provided, pledging unconditional and irrevocable financial support for the execution of the Contract by the Bidder in case of award. Parent Company shall be construed as reference to any company or corporation of which the othercompany or corporation is a Subsidiary i.e. at least 51% stake in the subsidiary is held by the Parent Company.

1.15. CONSORTIUM / JOINT VENTURE

In case Bidder on his own does not meet the financial & technical experience qualifying criteria stipulated in any of the points above, the Bidder can bid through a Consortium/ Joint Venture.

i. Consortium/JV shall fulfill qualifying criteria stipulated in point 1.14.1, 1.14.2, 1.16, 1.17, 1.19 & 1.20 herein.
ii. Documentary proof regarding Consortium/JV shall be submitted along with the bid in the prescribed format.
iii. The Consortium/JV partners shall jointly and severally be responsible for execution of the contract and the warrantees/guarantees for theproject.
iv. The Consortium/JV arrangement shall continue till 90 days beyond the expiry of Five years O&M contract.
v. The members in the Consortium shall be limited to THREE only.
vi. One of the Consortium partners who will be responsible on behalf of the Consortium shall be designated as the lead member. Necessary "Power of Attorney" and "Deed of Agreement" shall be executed in this regard.

1.16. JOINT VENTURE

In case the bidder is joint venture Company, each promoter shall have minimum 26% equity in Joint Venture Company

1.17. REGISTERED OFFICE

Bidder or one of the consortium/JV partners shall have registered office in India.

1.18. EXCLUSIVITY

1.18.1. The Bidder can either submit the bid in his individual capacity or in Consortium /JV with other partner.

1.18.2. The partners in the Bidding Consortium/ JV shall not separately participate as independent Bidders or as members of any other Consortium /JV in this Bidding process. All bids in contravention of this shall be rejected.

1.19. INSURANCE

The bidder / lead member shall bear the responsibility to arrange for project insurance along with PV modules and other major components of the project. This insurance encompassing all the probable risks associated with the proposed Solar Power Project. All the expenses in relation to such insurance of the project will have to be borne by the bidderfor the contract period, as per clause no. 12 in contract agreement.

1.20. TRACK RECORD

The Bidder shall have the good track record and shall not have been blacklisted/Banned for the participation in tender issued by the entity, government/ semi government organization in any country as on date of submission of bid. The bidder shall submit an affidavit to that effect. **MAHAGENCO, may reject the bid**, if such affidavit is not furnished or contact may be terminated if any information found incorrect at any later stage.

1.21. ~~PERFORMANCE GURANTEE~~

1.22. PROJECT DEVELOPMENT COMPETENCE

1.22.1. The bidder shall submit declaration of proposed vendors for material and equipment's along with their credentials and supporting documents for the items such as: PV modules, MMS structure, DC cables, String Monitoring system, inverters, transformers for the capacity for which the bidder is bidding for.

1.22.2. The Bidder shall also submit the list of technical personnel who will be deployed for the block of along with their technical qualifications and experience in Solar PV field.

1.22.3. The details of the consultants / in house capabilities to be deployed for design, engineering, installations and supervision shall be submitted to MAHAGENCO prior to start of the work.

1.22.4. Sub-Contractors/Vendors: Details and list of the sub-Contractor/Vendors along withdetails of experience and technical qualification will have to be submitted to MAHAGENCO before engagement of sub-Contractors/Vendors. Details of O&M agency to be submitted during bid submission.

1.23. TECHNICAL REQUIREMENTS OF PV MODULE FOR USE IN GRID SOLAR POWER PLANT

1.23.1. PV Module Qualification**:**

The PV modules used in the grid solar power projects must qualify to the latest edition of any of the following IEC PV module qualification test or equivalent BIS standards. In particular, they must meet the IEC 61215 standards. In addition, PV modules must qualify to IEC 61730 for safety qualification testing.

PV modules should be from latest Approved List of Models and Manufacturers (ALMM) of Solar Photovoltaic Modules published by MNRE.

1.23.2. **Authorized Test Centers**

The PV modules must be tested and approved by one of the IEC authorized test centers. In addition, a PV module qualification test certificate as per IEC standard, issued by ETDC, Bangalore or Solar Energy Centre will also be valid. MAHAGENCO will review the list of authorized testing laboratories/centers from time to time.

1.23.3. **Warranty**

a) The mechanical structures, electrical works and overall workmanship of the grid

solar power plant must be warranted for a minimum of 12 years.

b) PV modules used in grid solar power plants must be warranted for output wattage, which shall not be less than 90% at the end of 12 years and 80% at the end of 27 years.

1.23.4. **Identification and Traceability**

Each PV module used in solar power project must use an RF identification tag This tag must be fixed only by the module manufacturer in the factory at the time of testing and before dispatch of modules. The following information must be mentioned in the RFID used on each module (This can be inside or outside the laminate, but must be able to withstand harsh environmental conditions).

i. Name of the manufacturer of PV Module
ii. Name of the manufacturer of Solar cells
iii. Month and year of the manufacture (separately for solar cells and modules)
iv. Country of origin (separately for solar cells and module)
v. I-V curve for the module
vi. Wattage, Im, Vm and FF for the module
vii. Unique Serial No. and Model No of the module
viii. Date and year of obtaining IEC PV module qualification certificate
ix. Name of the test lab issuing IEC certificate
x. Other relevant information on traceability of solar cells and module as per ISO 9001 and ISO 14001.
xi. All grid solar PV power plants must install necessary equipment to continuously measure solar radiation, ambient temperature, wind speed and other weather parameters and simultaneously measure the generation of DC power as well as AC power generated from the plant. They will be required to submit this data to MAHAGENCO online and/or through a report on regular basis every month for the entire duration of Contract period.

1.24. RIGHT TO ACCEPT/ REJECT

Tenders from bidders will be admitted to the procedure provided that none of the following reasons for exclusion apply:

1.24.1. The bidder is a state-controlled company in the partner country that is not legally or economically independent, or that is not subject to commercial law, or that is a public authority dependent on the contracting agency or the project executing agency or the recipient of the loan/financing amount;

1.24.2. The bidder or individual members of the bidder's staff or a sub bidder has economic links or family ties with personnel of the contracting agency who are involved in preparing the tender documents, awarding the contract or supervising the execution of the contract, insofar as the conflict of interests could not be resolved to MAHAGENCO's satisfactionin advance of the contract award and execution phase;

1.24.3. The bidder is or was involved as a consultant in the preparation or implementation of the project. The same applies to an enterprise or an individual that is closely connected to the bidder under a company group or a similar business link, or to several enterprises or individuals associated correspondingly. (exception: ln BOT projects or turnkey projects a participation of future suppliers or manufacturers may even be desirable);

1.24.4. The bidder or individual members of the bidder's staff or a sub Bidder are not or were not during the last 12 months prior to publication of the invitation to tender indirectly or

directly linked to the project in question through employment as a staff member or advisor to the contracting agency, and are not or were not able in this connection to influence the award of the contract for services, or the bidder is not or was not otherwise able to influence the award of the contract for services.

1.24.5. MSPGCL reserves the right to reject any or all of the responses to RfP or cancel the RfP or annul the bidding process for any project at any stage without assigning any reasons whatsoever and without thereby any liability

1.25. BID EVALUATION CRITERIA AND SELECTION PROCEDURE OF THE BIDDER.

The bids of all bidders shall be evaluated in **two stages** as under;

1.25.1. **Techno-commercial evaluation of the bids**

At this stage, bids of each bidder will be evaluated on the basis of terms & conditions of RfP viz. bid security (EMD), the correctness & validity of required undertaking/agreements/Board resolutions/experience certificates/technical data sheets /annexure/ certificates/financial documents/ performance certificates/vendor credentials documents etc. submitted by bidder under prescribed format according to the RfP, Bidders financial & technical capability as per qualifying requirement, confirmation of technical specifications of the major equipments offered by the bidders, the guaranteed generation offered by the bidder.

For evaluation of bid, the bidder shall submit the audited financial statement of previous financial year i.e.FY-2021-22 having UDIN no.

Bidder whose bid found complete in all respect and in line with RfP terms & conditions without any deviations and which offers the required equipments/material along with guaranteed electrical energy generation as per the technical specifications mentioned in the RfP will be considered technically qualified bidder.

1.25.2. **Price Bid Evaluation**

a. Only after the Technical Evaluation has been finalized, the price bids of those bidders that qualified during the evaluation of the technical bids shall be opened.

b. Bidder shall quote the Total Bid price per MU required for setting up the Solar PV Project in the financial part of bid.

c. The minimum generation (**G'**) and their point of power measurement is shown below:

Sr. No	Project capacity	Point of interconnection / measurement	Minimum Annual Generation (**G'**)
1	62 MW (AC)	220 kV Side for Paras MSETCL Substation	122.25 MU

d. Bidders shall quote the following information in their bid:

1. Quoted Price (L) in INR per MU inclusive of all applicable taxes & duties.
2. Quoted Guaranteed Annual Generation (G) in MU $\geq$ **G'**.
3. DC/AC ratio = Cumulative DC capacity of the solar arrays /cumulative rated AC capacity of inverters at reference ambient temperature as per specification

e. Project Contract Price (X) = (L) x (G) in INR .

- Where, 3% of Contract price will be treated as O& M Contract price, which will paid in 60 monthly bills i.e. for the O& M period of 5 Years.

f. Bidder with lowest L will be considered the Successful Bidder.

g. L1 Bidder is the bidder who has quoted lowest price per MU inclusive of all applicable taxes and duties for Quoted Guaranteed Electric Energy Generation (QGEEG) as per above clauseno. 1.25.2. (d) & (e).

h. If quoted lowest price per MU inclusive of all applicable taxes and duties is equal for more than one bidder for Quoted Guaranteed Electric Energy Generation (QGEEG), then following Tie Breaker will be applicable i.e.

- **Bidder with highest QGEEG will be considered as "L1-Bidder"**

i. And**,** if more than one bidder has quoted the same lowest tariff per MU inclusive of all applicable taxes and duties and same Quoted Guaranteed Electric Energy Generation (QGEEG) than the bids will be arranged in **chronological order**. Hence the **bidder who has quoted earlier than other bidder will be "L1 Bidder"**

j. The QGEEG in MUs will be considered up to **two (2**) decimals only.

k. Only L1 bidder shall submit signed hard copy of detail price break up for EPC cost, Mandatory Spares and O&M costs consider as mentioned above for 5 years within 10 Days from the date of LoA acceptance.

All costs shall include ex-works price and all taxes & duties as applicable. The break up needs to be made available to MAHAGENCO with [a] supply of material ,with applicable taxes & duties rate.[b] supply of services, with applicable taxes & duties rate.
The price break up to be provided in compliance to GST Act.

SECTION II:

TECHNICAL SPECIFICATION

II. SECTION II: TECHNICAL SPECIFICATIONS.A: -
GENERAL SCOPE OF WORK

1.0. OBJECTIVE

The main objective of this project is Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra, India.

1.1. DETAILS OF PROJECT SITES

62 MW_{AC} Solar PV Project Site is situated at Paras, Dist.- Akola, Maharashtra, India. The available land is 103 hectares, barren and firm soiled having Latitude 20.71 & Longitude 76.80. The land is in possession of MAHAGENCO and free from any litigation and encroachment. Bidders are requested to visit at site for actual assessment before quoting the bid.

The scope of work includes Design, Engineering, Supply, Erection, Testing and Commissioning of 62MW_{AC} Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra, India.

1.2. SCOPE OF WORK

It includes Design, engineering, supply, erection, testing and commissioning of 62MW_{AC} Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on turnkey basis.

- The Equipment and Materials for 62 MW_{AC} Crystalline Solar PV Technology and Grid Interactive Solar PV Power Plant with associated power evacuation system shall include but not limited to the supply, erection and testing & commissioning of the 62 MW_{AC} Cumulative capacity
- Array Junction boxes/string combiner box and Fuse boxes / circuit breakers of approved make.
- Power Conditioning Units (PCU) each of minimum capacity 1000 kW to 6847 kW shall be utilized in 62 MW_{AC} Crystalline Solar PV Technology. Total number of PCUs shall be as per the inverter capacity used.
- Capacity of each Transformers shall be in the range suitable for inverter capacity & as

per applicable IS/IEC, oil filled/dry type, each of primary side voltage rating will bein accordance with AC output of Inverter & secondary voltage will be 33kV and Associated Switchgear of approved make shall be utilized. Total number of transformers shall be as per the designed numbers of units according to the inverter capacity.

- Metering and protection.
- Energy meter & cubicle.
- LT/HT Power and Control Cables including end terminations and other required accessories for both AC & DC power.
- 415 TPN Distribution Board for catering to lighting of the power station including power plug etc. Lighting fixtures, switches, receptacles and necessary wiring for control room building & area lighting (yard LED lighting).
- Earthing system for PV Array, DC power system, lightning protection system, AC power system for both LT & HT, equipment etc. for control room building, yard area, PCU, transformers and HT switch gear.
- Bidder has to construct a required capacity of switchyard inside the solar land parcel. The Power transformer inside the switchyard should be of adequate capacity and protection system.
- The Bidder has to do the power evacuation and integration it to 220 kV Paras MSETCL Thermal Plant substation via overhead line with the double pole structure / underground cable at 220 kV grid voltage with all necessary infrastructure such as protection switchgears and metering systems as per the requirement of the MSEDCL and MSETCL requirement.
- Monitoring at dual string level shall be provided as per standard practice, along with necessary details.
- Data acquisition system with remote monitoring facilities (SCADA).
- The items of civil erection work shall be performed with respect to the following but not limited to:
  a. Solar PV array.
  b. Power Cables.
  c. Outside area of substation overhead transmission line and underground cable laid.
- Civil foundation work of transformers, switchgears, PV module mounting work, etc.
  a. Entire cable tray inside control room building.
  b. Fabrication, supply & erection of cable trays, support, brackets and accessories in case of site fabrication cable tray.
  c. Galvanized steel rigid / flexible conduits and accessories, hume pipes, ferrules, lugs, glands, terminal blocks, galvanized sheet steel junction boxes, cable fixing clamps, nuts and bolts etc. as required.
  d. Supply of necessary steel materials for field fabrication of cable trays, supports, brackets, grounding system etc.
  e. Construction of pathways inside array and main approach road, entry gate, as required.
  f. Outdoor cables installation shall be trenched or underground as per the site requirement & site conditions method for trenching and undergrounding cable shall comply applicable IS.

g. EPC Contractor shall arrange the water required for module cleaning, sufficient Bore wells along with pumps and piping system provision for project shall be made by Contractor to cater water requirement for module cleaning and other purpose.
h. All relevant drawing, data sheets, technical catalogues on each piece of equipment / devices and type test certificates.
i. Materials and accessories, which is necessary or usual for satisfactory and trouble-free operation and maintenance of the above equipment
j. Furniture for office use as per requirement.
k. Contractor has to make the required power supply arrangement for the construction purpose and auxiliary power supply for O&M of solar power project from MSEDCL & should bear the power charges for utilization of power for his construction work and 5 years of O&M of the solar plant.
l. Adequate air Conditioner system along with required accessories shall be provided for each main control room.
m. Air cooling system by employing ducting for each inverter and blower/suction fan along with required ventilation shall be provided as per requirement.
n. Construction supply arrangement by Contractor from MSEDCL/MSETCL as per current industrials Supply Norm at Own Risk & cost.
o. All statutory approval should be done by Contractor at their own cost like electrical, fire safety and CEIG etc.

1.3. SCOPE OF SERVICE

The item of work to be performed on all equipment and accessories shall include but not limited to the following:

a. Transportation, unloading, receiving and properly storage at site.
b. Arranging to repair and/or re-order all damaged or short-supply items
c. Final check-up of equipment and commissioning and putting the system into successful function operation feeding power to the MSETCL grid from the output of the 33/220 kV Power transformer
d. All statutory clearance (like Electrical, Fire, safety , environment, etc. as applicable)

B :- TECHNICAL SPECIFICATION

1.0. TECHNICAL REQUIREMENTS OF ARRAY YARD

1.0.1 Scope of Civil Work for 62 MW_{AC} SPV Plant Array Yard

1.0.1.1 Topographical Survey

Topographical survey shall have to be done of the proposed site at 5 m interval by Plain Table or any other suitable standard method of survey & according to the applicable standards. All necessary levels as entered in the Field Book have to be submitted along with pre contour layout of the total site. The formation level of the proposed power plant has tobe fixed with reference to High Flood Level of the proposed site. The formation level shallbe at least 1.5m above the highest flood level for efficient drainage of the plot area during rainy season. Based on the above survey work a general layout drawing with clear demarcation showing boundary pillars, grids of corners of the plot boundary, nalla locations, underground and over ground structures, if any in plot area, location and levels of reference benchmark fixed with reference to permanent benchmark available nearby proposed site, location of Array Yard, Main Control Room, sewage & drainage system and approach roads and general drainage etc. has to be prepared.

Six sets of drawings and survey reports along with all relevant documents in one soft copy (CAD and PDF formats) shall be submitted to MAHAGENCO for approval. Drawings of

complete plant capacity must be submitted for approval. Topographical survey drawings for complete 62 MW_{AC} for Paras, Dist. Akola in Maharashtra, along with drawing shall be submitted as per designed layout.

1.0.1.2 Soil Test

i. The Contractor has to perform the soil test to ascertain soil parameters of the proposed site for construction of Main Control Room, Transformer foundation, Inverter room foundation, Watch tower foundation & Array Yard (minimum 6 bore holes). The EPC CONTRACTOR shall carry out sub soil investigation through certified soil consultant. These reports shall be furnished to MAHAGENCO. Based on sub-soil data collected during detailed soil investigation, Contractor shall prepare design parameters for foundation type to be provided suitable for the sub-soil conditions of the Site.

ii. The scope of sub soil investigation covers: execution of complete soil exploration including boring, drilling, collection of undisturbed soil sample where possible, otherwise disturbed soil samples, conducting laboratory test of samples to find out the various parameters mainly related to load bearing capacity, ground water level, settlement, and sub soil condition. The soil resistivity tests and CBR tests are also included in the scope of soil investigation work.

iii. Based on field soil investigation, bore log details and laboratory test reports, a detailed soil investigation report has to be prepared by the NABL accredited geo-technical agency. The report shall recommend foundation type, depth of foundation, safe bearing capacity of various founding strata based on shear and settlement criteria, cutting / filling, use of excavated soil for back filling, use of type of cement, type of concrete, admixtures, etc. The Contractor shall submit the reports in six hard copies and a soft copy.

iv. The soil test shall also include analysis of water sample.

v. Any variation in data furnished to the Contractor at the time of bid invitation and that during execution of work at Site or in detailed soil investigation carried out by the Contractor, shall not constitute any valid reason in affecting the terms and conditions of this Bid. Contractor shall not be entitled for any extension of time and nothing extra shall be payable on this account.

1.0.1.3 Planning and Designing

(i) The Bidder shall carry out Shadow Analysis at the site and accordingly design strings & arrays layout considering optimal usage of space, material and labour. The Bidder shall submit the array layout drawings along with Shadow Analysis Report to Chief Engineer (RE-P&P), MAHAGENCO for approval.

(ii) The Bidder has to plan and design the Array Yard in a proper manner considering the shadow analysis. Bidder has to develop general layout drawing of Array Yard, Internal Road & path ways, drainage system (ensuring no water logging in the Array Yard area). The work also includes landscaping of the entire array yard. All design &drawings have to be developed based on specification given in the tender, soil report, and relevant BIS unless otherwise specified. All details water supply for module cleaning and sewerage system shall be clearly shown in the drawings.

(iii) The Bidder shall submit preliminary Design Basis Report (DBR) for planning, land development along with calculation of land cutting & filling areas, quantity as per design and drawing for approval. The Bidder shall submit six sets of final drawing and DBR to MAHAGENCO for approval to proceed with construction work.

(iv) The buildings shall be with concrete construction in compliance with National Building Code and relevant BIS/International standards.

1.0.1.4 Land Development as per Design

Land development work of the entire area of the Project premises shall have to be done as per Design Basis Report & drawings developed by the Bidder and as approved by MAHAGENCO. The formation level of the land development shall be kept at least 1.5m above the high flood level of the nearby nalla/ pond, etc., where storm water is to be disposed off. Further, the formation level of the plot shall be decided matching the quantities of cutting and filling of the plot area. Any material required for filling for land development work shall be arranged by the bidder at his cost. Any excess material available from cutting of land development work shall be disposed off outside the plot boundary with a lead of 5 kms as directed by Project-In-Charge of MAHAGENCO.

1.0.1.5 Power Supply for Construction

Bidder has to make the required power HT/LT supply arrangement for the construction purpose from MSEDCL. Bidder shall make the required HT/LT arrangement for auxiliary power supply arrangement & shall bear the power charges for utilization of power for his construction work and 5 years of O&M of the solar plant.

1.0.1.6 Module Structure Foundations

(i) Modules structures foundations shall either be RCC foundations made of cement concrete as per applicable IS/ IEC or any other technically suitable design based on site soil condition after prior approval from MAHAGENCO. The minimum clearance between lower edge of the PV and Ground Level shall be 400 mm. A tolerance of +/- 50mm shall be allowed as per site conditions. While making foundations designs due consideration will be given to weight of module assembly and Minimum Wind speed shall be as per IS875, p3 & Seismic as per IS1893 with appropriate safety factor shallbe considered. Minimum value of wind speed to be obtained from historical data with Meteorological department. Seismic factors for the site must be considered while making the design of the foundation. The design of array structure shall be based on soil test report of the site and shall be approved by MAHAGENCO.

(ii) 5 Nos. of Pullout tests on prototype sample foundations at site shall be carried out by third party institution in presence of MAHAGENCO site authority and pullout test reports shall be submitted to MAHAGENCO for approval.

(iii) Foundation drawings & designs shall be submitted to MAHAGENCO for approval before starting the work. Foundation excavation of Module Mounting Structure shall commence only after the proper leveling of the site.

(iv) Aluminum Module mounting structures from Indian / internationally well-known company with hydraulic ramming installation procedure of structure according to the soil analysis can be acceptable after approval of MAHAGENCO.

1.0.1.7 Approach Road & Pathways

(i) Approach road:

- The approach road to the Solar Power Plant shall originate from the main approach road and connect to all Inverter rooms, main control room building and gates. Approach road

shall be asphalt road with top coat of bitumen 80/100 confirming to Grade S 90 of IS 73-1992. 3-meter- wide with 1-meter wide shoulder on both side.

(ii) Peripherals road:

- Peripheral road around the whole plot shall also be provided for easy access. The peripheral road shall be made WBM of minimum 250mm thick well compacted murrum, suitable for road construction. These roads shall be minimum 150mm above NGL. Peripheral road shall be min 3 meter wide. Suitable culverts with RCC slab at top shall be provided at crossing of water bodies. Peripheral road shall also be interconnected with all bituminous approach roads terminating at Invertor rooms and CMCS and all the gates.

(iii) Pathways:

- Pathways with the required width shall be provided between each row of MMS. The pathways shall be levelled and compacted for carrying panels, carrying materials, MMS washing, easy movement of O&M etc. Pathways shall be compacted manually/ mechanically. Wherever the grass/roots are found in the pathways, same shall beremoved upto depth of 200 mm & the ground shall be levelled and compacted. The finished pathways shall ensure easy movement of maintenance vehicle and avoid any growth of vegetation. Pathways surface shall be levelled by minimum 100mm thick PCC(1:3:6), wherever change in topography/ground slope is steeper than 1:6. The PCC/Concrete/brickwork masonry layer shall match the ground topography.

(iv) Concrete/Brick masonry drains shall be provided on either side of roads for proper drainage of rain water.

(v) The asphalt and WBM roads shall be designed as flexible pavements as per provision under IRC-37. The construction of roads shall be in accordance with MoRTH specifications and other relevant IRC/IS codes of practice. The minimum thickness of sub-base, base and wearing courses of asphalt and WBM roads shall be considered as below:

(vi) **Sub-grade**: the sub-grade shall be prepared with well compacted selected soil/ earth to achieve 95% of the standard density at optimum moisture content.

(vii) **Sub-base**: if sub-grade of road is of filled up soil or with natural soft soil, then sub-base shall be prepared with 300mm thick layer of murrum/ selected soil/ crushed stone(grading-1) on this layer 300mm rubble soling with 100mm thick cushion of murrum/ selected soil shall be provided with well compaction.

- If sub-grade is of hard natural soil/ rocky strata, then sub-base shall be of 150mm thick rubble soling with 100mm thick cushion of murrum/ selected soil with well compaction.
- **Base**: 150mm thick (consolidated thickness) water bound macadam course in two equal layers as per MORT&H specifications shall be provided.
- **Wearing course**: the wearing course shall be 75mm thick bituminous macadam binder course with 10 - 12 mm seal coat.
- Security Cabin at main gate shall be constructed by contractor in line with Industrial Safety & Security norms, standards & applicable IS. A hydraulic boom barrier of suitable size and design shall be provided for additional security.
- The drawings of approach road/pathways, gate, cabin and hydraulic boom shall be approved by MAHAGENCO.

1.0.1.8 Module Cleaning:

A. Water Arrangement for Modules Washing:

Contractor shall provide a permanent arrangement along with vehicle mounted mobile unit for module cleaning & washing in the Solar Power Plant.

- The permanent arrangement shall include installing tube wells or open wells or artificial water ponds along with rainwater harvesting arrangements for 62 MW_{AC} Project, with pump and motor and laying network of CPVC/HDPE pipe, confirming to applicable IS, in each row of SPV panels. Opening from the CPVC/HDPE pipe with manual isolating valves shall be provided at regular interval with at least one at each alternate row of SPV panels.
- The vehicle mounted module washing unit shall include minimum Two (2) nos. of suitable units purchased and permanently stationed at the site.
- The washing shall be with pressurized clean water and provision shall be made for water purification, softening and cleaning as the need be depending on the available water quality & requirements by the module suppliers for cleaning of module.
- A provision shall be made for overhead storage tank (confirming to IS 3370 (Parts 1 to4) for storage and IS 11682-1985 (reaffirmed 1998) for staging) or underground RCC water tank with applicable IS or ground level water tank, confirming to IS 3370 (Parts 1 to 4) of adequate capacity at the site for use in module cleaning for entire year.

Contractor shall provide the water test report, water requirement calculations, cleaning schedule and single line diagram of water washing arrangement to MAHAGENCO for approval.

1.0.1.9 Storm Water Drainage System and rain water harvesting scheme

- As per State Pollution Control Board's Regulation, rain water harvesting shall be provided. The rain water harvesting scheme shall be executed as per the recommendations of the central ground water authority/ board obtaining the necessary statutory approvals for the rain water harvesting scheme to be implemented shall be in the scope of Contractor. Rain water harvesting scheme shall be designed for collection of rain water from storm water drains, for reuse of rain water and/ or for recharge of ground water by rain water collector. Further, the suitable outfall locations shall be provided for discharge of excess rain water to the nearby natural nalla/ drains during rainy season.
- The storm water drains shall be designed as network covering the plant area as per specifications and the drains shall be connected to rain water harvesting system to be implemented. The plant area storm water drainage shall be designed to cater to storm water runoff resulting from a three (3) hour storm or one hour rainfall intensity with a return period of 50 years, whichever is higher. The three (3) hour storm value and/ or one hour rainfall intensity value shall be based on the recommendations of Indian Meteorological Department (IMD).
- The drain shall be walled canal type & open brick masonry/ concrete/ Precast rectangular section shall be provided for all drains with minimum width as 450mm and minimum depth as 300mm. bed slope of the drains shall be milder than 1 in 1000.
- Care shall be taken to maintain slopes and to prevent water logging at the site. Proper water drainage shall be designed. The plan, design and drawing shall be submitted to MAHAGENCO for approval.

1.0.1.10 Fencing of 62 MW_{AC} Project

MAHAGENCO will provide fenced Land to the EPC contractor.

1.0.1.11 Watch Towers

Minimum Two Number of watch towers for 62 MW_{AC} Project, made of hot dip galvanized steel confirming IS 2062 and IS 4759:1996 with 85micron galvanization, shall be designed and constructed as per relevant IS/ IEC standards in view of the safety and security of the power plant. The height shall be decided with a view to cover the complete plant area and all its equipment for security purpose. Each Watch Tower shall be equipped with one (1) searchlight and one (1) floodlight along with two (2) PTZ night vision cameras and one (1) siren, which shall be operated locally and remotely from the control room. The design of the Watch Towers shall be submitted to MAHAGENCO for approval.

1.0.1.12 Others

Any civil work which is not mentioned or included here but necessary for the plant shall be borne by the Contractor.

1.0.1.13 Scope of Electrical Work for 62 MW_{AC} SPV Plant Array Yard

The manufacturers for all electrical and electronic components such as Meters, Protection Relays, AC Cables, Lightning Arrestors, Control Panels, Isolators, etc., and wherever no specific experience requirement is mentioned, must have manufacturing track record of at least ten (10) years.

1.1. SOLAR PV MODULES

1.1.1 PV modules should be from latest Approved List of Models and Manufacturers (ALMM) of Solar Photovoltaic Modules published by MNRE.

1.1.2 The Mono-Crystalline/Bifacial Silicon Solar Cell PV modules used must qualify to the latest edition of IEC-61215 or IS 14286: 2019 (Part -1 & 2) equivalent BIS standards.

1.1.3 In addition, Flat PV modules must qualify to IEC 61730 (Edition I and II) for safety qualification testing and all materials used shall have a proven history of reliability and stable operation in external applications.

1.1.4 It shall perform satisfactorily in relative humidity up to 85% with temperatures between -40° C to +80° C and shall have lowest temperature coefficient and shall withstand gust up to 200 km/h on the surface of the panel. Also, the PV modules to be used in a highly corrosive atmosphere throughout their lifetime, they must qualify to IEC 61701: 2011-12 (Edition 2). Each and every SPV module shall be checked for conformity with relevant standard and no negative tolerance shall be accepted for crystalline modules.

1.1.5 Modules shall be PID-free. Contractor shall submit the test certificate by recognized global laboratory to this effect for the model selected to be offered in this project. The Contractor shall also submit an IEC-62804:2015 certificate for the modules offered to this effect.

1.1.6 Experience and Performance:

1.1.6.1 Solar PV modules must have proven history of reliability and stable operation. Contractor shall provide the performance certificate from the owner or developer of any grid connected single solar power project of minimum capacity of 10 MW_{AC}, where these modules are working satisfactorily since last one year and where only the proposed manufacturer's modules are used.

1.1.6.2 Solar module manufacturer must have supplied modules at least cumulative installed capacity of 500 MW or above per year consecutively during the last five years. The Contractor shall provide documentary evidence for the same in the form of certificate from the same manufacturer as well as the invoice copies of supply for the year based

on which eligibility is sought.

1.1.7 Positive Power Tolerance:

1.1.7.1 All modules shall be with positive power tolerance only; i.e. all PV modules shall have 'higher than rated' power output report of flash test at the manufacturing factory, including all measuring and machine tolerance. Zero or Negative power tolerance shall not be accepted.

1.1.7.2 The Contractor shall provide the copy of publicly available/ published datasheet of technical specifications for modules for each of the vendors in addition to the information in the format prescribed in (Annexure 17). Contractor shall also provide GTP for modules from the manufacturer.

1.1.7.3 PV Peak power rating shall not be less than 500 Wp for Mono-crystalline/Bifacial module The module efficiency should not be less than 20%.

1.1.7.4 The front surface of the module shall consist of impact resistant, low iron and high transmission toughened glass.

1.1.7.5 The Interconnected cells shall be laminated in vacuum to withstand adverse environmental conditions.

1.1.7.6 The module frame shall be made of corrosion resistant materials, preferably having aluminum anodized finish the anodizing thickness shall be 15 micron or better.

1.1.7.7 **Module(s) shall be provided with minimum three (03) bypass diode.**

1.1.7.8 The Contractor shall carefully design & accommodate requisite numbers of the modules to achieve the rated power in his bid. MAHAGENCO shall allow only minor changes at the time of execution.

1.1.7.9 The minimum design clearance (at the highest tilt angle) between the lower edge of the modules and the developed ground level shall be 400 mm. A tolerance of +/-50mm shall be allowed as per site conditions.

1.1.7.10 A maximum of two makes of modules shall be accepted. Contractor shall submit separate Table 1 in Annexure 17 for each make of modules proposed to be used in the Project.

1.1.7.11 **Manufacturing date of all modules used in the project shall not be more than 12 months prior to the date of transfer of ownership to MAHAGENCO. The representative of the Contractor must be present at the time of module manufacturing of entire capacity and / or flash testing of modules supplied for the Project. MAHAGENCO may also depute its Authorized Representative to be present at the time.** Contractor should coordinate with MAHAGENCO authorized representative for scheduling of inspection.

1.1.8 Warranties

1.1.8.1 Material Warranty:

i. Material Warranty is defined as: The manufacturer shall warrant the Solar Module(s) to be free from the defects and/or failures specified below for a period not less than twelve (12) years from the date of sale to the Solar Power Company:

ii. Defects and/or failures due to manufacturing defects and/or failures due to materials, including PID defect.

iii. Non-conformity to specifications due to faulty manufacturing and/or inspection processes.

Warranty to be in the name of MAHAGENCO.

If the solar Modules fails to conform to this warranty, the Contractor & module manufacture will repair or replace the solar module(s), at MAHAGENCO's sole option.

1.1.8.2 Performance Warranty:

i. The manufacturer shall warrant the output of Solar Module(s) for at least 90% of its rated power at the end of 12 years and 80% of its rated power at the end of 27 years from the date of receipt of modules on Site. The manufacturer shall warrant for the linear output of Solar Module(s) and degradation of the PV modules willbe linear over 27 years from the date of receipt of modules at site.

ii. If, Module(s) fail(s) to exhibit such power output in prescribed time span, the Contractor will either deliver additional PV Module(s) to replace the missing power output with no change in area of land used or repair or replace the PV Module(s) with no change in area of land used at MAHAGENCO's sole option. Total land available from MAHAGENCO is fixed and the Contractor shall design the plant so that in this case he has enough space within this land toaccommodate additional capacity.

1.1.9 Insurance:

1.1.9.1 The Contractor shall bear the responsibility to arrange PV module insurance for entire contract period encompassing all the probable risks associated with the PV Modules. The insurance should also cover the product warranty & performance warranty. All the expenses in relation to such insurance of the project will have to be borne by the Contractor.

1.1.9.2 The insurance shall be in the name of MAHAGENCO and the policy shall be submitted to MAHAGENCO. The performance warranty shall be specifically a warrant and indemnity insurance against excessive loss of output of PV module. Draft of the insurance should be submitted to MAHAGENCO.

1.1.9.3 The Contractor shall provide the electrical characteristics, of typical solar PV module that is representative sample of proposed modules, including current-voltage (I-V) performance curves and temperature coefficients of power, voltage and current.

1.1.9.4 Modules shall be provided with a junction box, determined make and length of cable and connectors, as prescribed in the IEC certification for the selected module. These shall be approved by MAHAGENCO.

1.1.10 Module Testing:

PV modules must be tested and approved by one of the IEC authorized test centers. Factory test as well as third party testing of the random sample by the Solar Energy Centre is also mandatory. The cost of these testing shall be borne by Contractor.

The acceptance criteria for all these tests shall be as per the applicable IEC/IS. Standard Industry practice will be adopted with mutual understanding in case if no such guidelines are available in IEC for any of the test.

1.1.11 Factory Tests & Inspections:

1. Manufacturing date of all modules used in the project shall not be more than 12 months prior to the date of transfer of ownership to MAHAGENCO.
2. Contractor shall depute its representatives in the module manufacturer's factory for witnessing of QAP (Quality Assurance Plan) and flash tests of complete production of the modules. And daily production/inspection report shall be communicated to MAHAGENCO by email, same day. MAHAGENCO may also depute its Authorized Representative to be present at the time. Contractor should coordinate with MAHAGENCO authorized representative for scheduling of inspection & testing.
3. The Contractor shall provide the electrical characteristics, of each solar PV module that is to be supplied these electrical characteristics includes current-voltage (I-V)

performance curves and temperature coefficients of power, voltage and current etc.

4. Modules deployed must use a RF identification tag. The RFID tag must be fixed only by the module manufacturer in the factory at the time of testing and before dispatch of modules. The following information must be mentioned in the RFID used on each module (This can be inside or outside the laminate, but must be able to withstand harsh environmental conditions).

    i. Name of the manufacturer of the PV module
    ii. Name of the manufacturer of Solar Cells.
    iii. Month & year of the manufacture (separate for solar cells and modules
    iv. Country of origin (separately for solar cells and module)
    v. I-V curve for the module
    vi. Wattage, Im, Vm and FF for the module
    vii. Unique Serial No and Model No of the module
    viii. Date and year of obtaining IEC PV module qualification certificate.
    ix. Name of the test lab issuing IEC certificate.
    x. Other relevant information on traceability of solar cells and module as per ISO 9001 and ISO 14001.

1.1.12 Laboratory Tests:

Following inspections and testing shall be carried out by an independent internationally accredited testing laboratory as per the applicable IEC standards. The sampling will be carried out at factory in presence of MAHAGENCO representative. The IEC standards and norms of sample testing and acceptance shall be followed to compare the test results. In case where the tests show non conformity to tender document and / or has impact on plant performance and guaranteed generation of the plant, the Contractor shallcompensate by replacing or adding the module capacity at the sole discretion of MAHAGENCO. Cost towards these tests shall be borne by the Contractor. Contractor should coordinate with MAHAGENCO Authorized Representative for scheduling of inspection & testing.

1. Determination of module efficiency under standard test conditions - A sample of 200 modules for 62 MW_{AC} shall be tested. The test shall be repeated on the same modules after the light soaking of modules i.e. to test LID.
2. Determination of modules peak power rating on STC condition under PID test- sample of 25 modules for 62 MW_{AC} shall be tested.
3. Low insolation tests with 200, 300, 400, 500 and 800 w/sqm. - A sample of 20 modules for 62 MW_{AC} shall be tested.
4. Determination of cell cracks snail trail and connection errors through electroluminescence testing and normative- actual value comparison of characteristic parameters. - A sample of 100 modules for 62 MW_{AC} shall be tested.
5. Determination of EVA cross-linking degree. - A sample of 25 modules for 62 MW_{AC} shall be tested.
6. Wet leakage test - A sample of 25 modules for 62 MW_{AC} shall be tested
7. Mechanical load test - A sample of 20 modules for 62 MW_{AC} shall be tested (half of the modules from previous tests and half new).
8. Dynamic load test - A sample of 25 modules for 62 MW_{AC} shall be tested (half of the modules from previous tests and half new).
9. Peel test. - A sample of 10 modules for 62 MW_{AC} shall be tested (one of the modules from previous tests and one new).

10. The Contractor shall provide the necessary testing reports to the MAHAGENCO as and when required.
11. Neither the waiving of inspection nor acceptance after inspection by MAHAGENCO shall, in any way, absolve the Contractor of the responsibility of supplying the plant and equipment strictly in accordance with specification and drawings etc.

1.1.13 On-Site Tests:

These tests shall be carried out as per the applicable IEC /IS standards before Final Acceptance Test at site by the third-party testing agency. Cost towards the on-site testing shall be borne by the Contractor.

1. Establishment of module capacity (shall be carried out in Third Party Lab) randomly selected 10 modules from project capacity of 10MW shall be sent to test lab.
2. A sample of 1/1000 modules shall be tested. The results of the measurements shall be compared to flasher protocols.
3. Establishment of string capacity (Shall be carried out at site by third party)
4. A sample of 5 strings /MW shall be tested.
5. Measurement temperature of the PV modules with thermal image camera with respect to the neighboring cells shall be carried out at site by third party A sample of 1/500 shall be tested. In case of failure rate > 10%, the sample shall be increased to 1/100.
6. Inspection of the MMS corrosion protection as per applicable IS/ASTM (Shall be carried out at site by third party). A sample of 6 stands per 5 MW shall be tested. In case of a failure rate > 10%, the sample shall be increased to 60 stands.

1.2. MODULES MOUNTING STRUCTURES

1.2.1 General

The PV modules shall be mounted on metallic structures called Module Mounting Structures (MMS) having adequate strength and appropriate design, which can withstand the load ofthe modules and design wind pressure.

1.2.2 Codes and Standards

The applicable codes and standards are as mentioned below.

Sr. No.	Standards and Codes	Remark
1	IS 875: Part 1 & 2	Code of practice for the design loads for buildings and structures-
2	IS 875: Part 3	Code of practice for the design loads for buildings and structures-Wind Loads
3	IS 800: 2007	Code of practice for use of structural steel in general building construction
4	IS 4759	Hot-dip zinc coatings on structural steel and other allied products
5	IS 1868	Anodic Coatings on Aluminum and its Alloys

1.2.3 Design and Material Requirement

1.2.3.1 The structure design shall be appropriate with the factor of safety of not less than 1.5. Design of MMS shall be as per the design criteria specified under IS 800 and IS 801. Design calculation shall be submitted to MAHAGENCO.

1.2.3.2 The Contractor shall provide Fixed type or Seasonal Tilt or Tracking type structure to hold modules in place at desired tilt and angle.

1.2.3.3 Design drawings with material selected shall be submitted for approval of MAHAGENCO. Modules shall be mounted on a non-corrosive support structures.

1.2.3.4 The foundations of module mounting structures shall be based on site related data, design calculations& drawings shall be submitted to MAHAGENCO for approval.

1.2.3.5 The frames assemblies (i.e. I channel, C channels, rafter, purlins, rails & bracings etc.) of the array structures shall be made of hot dip Galvanized steel per ASTM A123/ IS2062 (grade E350 or higher) and IS 4759:1996. Minimum thickness of galvanization shall be at least 80 microns.

1.2.3.6 Bidder can go for Hot-dip Aluminum-Zinc alloy metallic coated sheet steel strip and sheet sections for rafter, purlin only subject to following conditions.

a. The coating class shall be as per AZM150 (ASTM A792M) / (IS 15961)

b. The structure design shall be as per IS standard & shall comply with all basic terms & conditions mentioned above.

c. The concept of wind tunnel studies shall be considered in the design philosophy for fixed and seasonal module mounting structure. & it must be done from the reputed institutes(IIT in India).

d. If the study is done by any reputed international facility the study results must be vetted by any of the IITs in India.

OR

Aluminum Module mounting structures with hydraulic ramming installation from internationally reputed company can be acceptable after approval of MAHAGENCO.

1.2.3.7 All fasteners shall be of Stainless steel - SS 304 or higher grade. Nut & bolts, supporting structures including module Mounting Structures shall have to be adequately protected against all climatic condition. Hot dip Galvanized steel Nut & bolts can be used only for the structure foundation as per ASTM A123/ IS2062 and IS 4759:1996. Minimum thickness of galvanization shall be at least 80 microns.

1.2.3.8 The vendor credentials, base material test report, GTP & QAP shall be submitted to MAHAGENCO. Before dispatch of material MAHAGENCO will carry out required tests on random samples as per IS from the accredited testing lab the cost of this test shall be borne by Contractor.

1.2.3.9 The Module Mounting Structures shall be warranted up to 05 years by the manufacturer.

1.2.3.10 The structure shall be designed to allow easy replacement of any module and easy access to the O&M staff and P&P (Personnel and Protection).

1.2.3.11 The structure shall be designed for simple mechanical and electrical installation. It shall support Solar PV modules at a given orientation, absorb and transfer the mechanical loads to the ground properly. There shall be no requirement of welding or complex machinery at site.

1.2.3.12 The drawings along with detailed design shall be submitted in six sets to MAHAGENCO for approval before starting the erection work. The work will be carried out as per designs approved by MAHAGENCO

1.2.3.13 The Contractor/manufacturer shall specify installation details of the Solar PV modules and the support structures with appropriate diagrams and drawings

1.2.3.14 The legs of the structures shall be MS Hot Dip galvanized I beams or C channels as per IS 2062 (grade E350 or higher) and IS 4759:1996. Minimum thickness of galvanization shall be at least 80 microns. Design and dimensions of the structure must confirm to withstand minimum wind speed of 150 km/h with appropriate safety factor of 1.5. The design calculations shall be submitted to MAHAGENCO and same shall be get approved from MAHAGENCO.

1.3. MODULE MOUNTING STRUCTURE (MMS) APPROVALS AND TESTS

1.3.1 The drawings along with detailed design & STAAD analysis with latest version shall be submitted in six sets to MAHAGENCO for approval before starting the erection work. The work will be carried out as per designs approved by MAHAGENCO.

1.3.2 Before finalization of MMS design, accredited third party Prototype load test of MMS structures (5 Nos. of load test) shall be carried out at site in presence of the MAHAGENCO representative & test report shall be submitted to MAHAGENCO for approval.

1.3.3 Vendor's credentials, base material test certificates, GTP (Guaranteed Technical Parameters) & QAP of MMS shall be submitted to MAHAGENCO for approval.

1.3.4 Vendor shall submit the certificate from the laboratory on testing the galvanized steel structure member for adherence of coat and for thickness of coating.

1.3.5 Vendor shall submit the report, from NABL accredited laboratory, Test to determine corrosion performance of module mounting structure as per the applicable IS/ASTM.

1.4. CABLE, WIRES & CABLE TRENCHES

1.4.1 AC LT cables:

All 1100 V AC cables shall be PVC insulated (heavy duty) confirming IEC 60189/ IS 1554-I & IEC 60502-1 with Aluminum conductor according to IEC 60228. All AC cables of size 4 sq mm and below shall be electrolyte tinned copper conductor type confirmingthe relevant IS/IEC. All AC cable should be rodent resistive/repellent.

The EPC CONTRACTOR shall submit the GTP (Guaranteed Technical Parameters) and QAP for the approval of MAHAGENCO.

1.4.2 PV wires and DC cables:

1.4.2.1 DC cables (Interconnecting SPV Modules and from SPV Modules to SMU)

Cables used for inter-connecting SPV modules as well as Modules to SCB's shall conform to the requirements of EN 50618:2014 applicable for DC cable for photovoltaic system. The connectors used for interconnecting the modules and connectors used for connecting the strings and/or to the String combiner Box, i.e. field connectors to be mated shall be of same make and model otherwise they shall be tested for Inter-compatibility.

a. These cables shall meet the fire resistance requirement as per above standard and shall be electron beam cured at manufacturing facility.

b. In case 1500 V modules are used, the module inter-connecting wires shall be as per TUV specification 2Pfg 1990/05.12. Conductor shall be Electrolytic tinned copper Class 5, according to EN60228 or IEC 60228. Core insulation & outer sheath of the cable shall be as per XLPO (Electron beam cross linked polyolefinco - polymer). All DC cable should be rodent resistive/repellent.

c. In addition to manufacturer's identification on cables as per TUV, following marking shall also be provided over outer sheath

i. Cable size and voltage grade
ii. Word 'FRNC' at every 5 meter
iii. Sequential marking of length of the cable in meters at every one meter.
iv. The Printing shall be progressive, automatic, in line and marking shall be legible and indelible.
v. Type test, routine, acceptance tests requirements for these cables shall be as per TUV specification 2pfg 1169/08.2007 or 2pfg 1190/05.12 as per requirement Charges of routine and acceptance tests shall be deemed to be included in the cable price. Sampling for acceptance tests will be as per IS 7098.

d. A maximum of 8 Cables (4 Circuits) shall be laid in one HDPE Pipe for DC Cable from Module to string monitoring box (if applicable). The fill factor of the pipe should not be more than 40%.

e. However, in case of necessity to lay more than 8 cables (4 circuits) in one pipe, the same shall be allowed during detailed engineering and as per the derating factors recommended by the cable manufacturer. Fill factor criterion is still to be maintained.

f. Bidder to ensure that there is no gap and proper packing at the junction of two pipes, in which DC cable is laid, using proper method and accessories, like bell mouth.

1.4.2.2 DC cables (SMU to Inverters)

a. Cables used between SMU's and Inverters shall be of min. 1.5 kV (DC) grade. In case Contractor offers 1500V DC system 3.3 kV (E) grade cables shall be provided. These Power cables shall have compacted Aluminum/copper conductor, XLPE insulated, PVC inner-sheathed (as applicable), Armoured/Unarmoured, FRLS PVC outer sheathed conforming to IS: 7098 (Part-I). All DC cable should be rodent resistive/repellent.

b. The DC cables shall be TUV/UL/equivalent certified.

c. Manufacturer shall have in house electron beam cross link facility and shall have successfully supplied cable for Solar Power Plants for at least 25 MW_{AC} single capacity solar project.

d. The DC cable manufacturer shall have proven experience of having supplied successfully to Solar PV grid connected projects of at least 200MW cumulative capacity.

e. Vendor credentials, manufacturing facilities, Guaranteed Technical Parameters, Type test reports, IEC certificates & reports, Cable & wiring design, calculations, QAP and detailed explanations along with drawing shall be provided to MAHAGENCO for approval.

1.5. CABLE LAYING, TRENCHES & SEALING

1.5.1 Contractor shall design the array yard such that Module mismatch loss shall be less than 1.5% loss in system power.

1.5.2 Only terminal cable joints shall be accepted. No cable joint of two cable ends shall be accepted. All cable plugs provided shall be as per IEC/IS standards.

1.5.3 The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All opening in floor/roof/wall/cable tunnel/cable tranches

made for conduit installation shall be sealed and made water proof by the Contractor with modular multi-dimensional cable system consisting of frames, blocks, compression wedge and its accessories. The cable sealing system shall have been tested for fire insulation for minimum 2 hrs. as per BS 476/UL 1479/EN 1364 and shall provide water sealing for continuous pressure of 0.3 bars the system shall be rodent proof and shall have valid enclosure protection as per IEC 60529.

1.5.4 All cable/wires shall be marked with good quality letter and number ferrules of proper sizes so that the cables can be identified easily. The IS 5578:1984 (First revision-2011)/ IEC 60391-1972 shall be adhered to for guidelines for marking.

1.5.5 AC and DC cables shall be laid underground according to the applicable IS / IEC.

1.5.6 Wherever cables are carried underground through trenches, these trenches shall be excavated to a suitable depth and of suitable width as per the applicable IEC/ IS standard depending on runs of cables passing through. These trenches shall be refilled with sand, bricks and backfilled excavated soil, wherein cables are bedded in clean sand. There shall be cable pulling pits at inspection and maintenance points at intervals. The bare cables, wherever necessary, shall pass through these trenches in PVC conduits.

1.5.7 Cables used in the project, whether underground or above, shall be marked clearly with identification useful for repairs and maintenance.

1.6. STRING COMBINER BOX & STRING MONITORING SYSTEM

1.6.1 String Combiner Box:

1.6.1.1 **The string combiner boxes shall be dust, vermin, waterproof and sunlight/ UV resistive as well as fire retardant** & must have minimum protection to IP 65 and Protection Class II. The terminals will be connected to copper bus-bar arrangement of proper sizes to be provided. The junction boxes will have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables. Suitable markings shall be provided on the bus bars for easy identification and cable ferrules will be fitted at the cable termination points for identification.

1.6.1.2 String Combiner Boxes Specification shall be as per EN 61439-2, class-II.

1.6.1.3 SCB shall be designed for ambient temperature in summer up to 60 deg C and humidity up to 90% non-condensing before monsoon. DC System Voltage 1500 V DC (VOC), On Load DC Voltage: 1000 to 1500 V DC (based on Inverter MPPT settings), IP protection: IP65

1.6.1.4 Enclosure of SCB shall be FRP cabinet with hinged door(s)

1.6.1.5 SCB shall be have designed Inputs of 8 /14/16 /24, with suitable current rating (Isc) & fuses holder as per applicable IS standard for each input. This rating (Isc) shall be finalized during engineering & design review phase.

1.6.1.6 In each SCB 5% spare terminals along with cable glands and fuse rounded off to next higher integer shall be provided to connect the PV strings.

1.6.1.7 In order to provide protection to all cables and modules, string fuses shall be provided with strings. String fuses shall be of PV category and dedicated to solar applications and conform to IEC 60269-6 or UL-2579 standards and fuse base shall comply with IEC 60269-1. String fuses should be so designed that it should protect the modules from reverse current overload. Fuses or Isolation Link shall be mounted in pull out type fuse holders. Fuse holders shall be suitable for DIN rail mounting. PCB mounted fuses are not acceptable. Fuse rating for single and combined input (limited to two) shall be 15 A and 30 A respectively suitable for 1000/1500 Volt for crystalline module. The fuse rating shall be decided during detail engineering. In case of negative grounded system, requirement of string fuses as well as inverter input fuses on negative side shall be

decided based on the recommendation of Inverter (PCU) manufacturer.

1.6.1.8 Surge arrestors: Minimum 2 Nos. per box needed as per the requirements of class II and III according to the IEC 61643-1:2008 standard, whereas type (1+2) and type 3 are according to EN 61643-111 class C and D as well as DIN VDE 0675, T.6, class C and D, T6, A2 10/96. Surge Protection Device (SPD) shall be provided for data / communication circuit.

1.6.1.9 DC-DC control power supply unit confirming the relevant IEC standard shall be provided in SCB.

1.6.1.10 Output: 1500V DC, Solar Connectors: Push in Type no need to crimp the connections, Output Cable compatibility: copper DC Rated cable up to 300 sq. mm x 1 run and need out Stud Type Terminals with protective cover as per Rated impulse withstand voltage / Pollution severity Gauge to IEC 60947-1 / Flammability class UL94.

1.6.1.11 DC Disconnector switch needed: ONLOAD Disconnector type switch for required DC voltage & design current as per IEC 60947-1, braking capacity DC21B or better.

1.6.1.12 Earthing: floating DC system, compatible with negative earthing.

1.6.1.13 SCB shall be finger touch proof & adequate safety labels of instructions.

1.6.1.14 In addition to suitable surge protection, the string combiner box will have over-voltage and over current and lightning protection. Adequate capacity solar DC fuses & isolating Miniature Circuit Breakers or manual isolator shall be provided if required.

1.6.1.15 Codes and Standards

Codes	**Description**
UL 94 V	Fire Resistant/ flammability for Enclosure
UL 746C	UV Resistant for Enclosure
IEC 62262/EN 50102	Mechanical Impact Resistance for Enclosure
IS 2147/IEC 60529	Degrees of protection provided by enclosures (IP Code)
IEC 61643-12	Surge Protection
IEC 62208	Enclosure for low voltage Switchgearand control gear assemblies

Vendor shall submit the suitable Test Certificate/Report from accredited lab(s) indicating compliance of mentioned codes and standard if asked for the offered component or assembly.

1.6.2 String Monitoring System:

1.6.2.1 Monitoring of various parameters at dual string level with Y type of connector shall be made possible in the Main Control Room at site by installing the suitable string monitoring system any fault at string level could be recognizable by that system.

a. Each of these input strings to be monitored for string current.
b. Monitoring Device: Shunt type as per IEC61010-1 and IEC 61326-1 certified
c. Output Total voltage and current to be monitored
d. Communication: RS485 / MODBUS RTU/ Wireless or any other compatible.
e. Maximum Error: ± 1%
f. Power Supply: the power supply or data acquisition and monitoring systems Input (V)85...264 V AC (De-rating @ 100 V AC: 2.5 % / V) as per EN61000- 4-2 (ESD), EN61000-4-3 und EN61000-4-8 (Fields), EN61000-4-4 (Burst), EN61000-4-5 (Surge), EN610004-6 (conducted), EN61000-4-1 (Dips) standards
g. System shall be able to operate on error free and trouble free mode, atthe ambient 60 deg temperature (and internal combiner box temp of 70°C).

h. String Combiner Box & String Monitoring System (SCB& SM) shall be able to withstand the harsh climatic conditions without active cooling or heating.
i. A string monitoring system shall be able to monitor inside and outside temperature string combiner box
j. Memory mapping of the communication devices shall be submitted for SCADA integration.
k. Makes and specifications, Certifications of all components (especially the data acquisition devices and communication devices, Monitoring Device, fuses, terminal blocks, surge arrestors, DC isolator switches) shall be provide to MAHAGENCO for approval.
l. Mounting arrangements, installation manual and operation and maintenance manual shall be shared.
m. SCB & SM system shall be warranted for minimum 5 years.
n. String Combiner Box & String Monitoring System shall be IEC certified system andshall have proven track record. The system shall use precision accuracy sensors for current. The system shall use precision accuracy sensors for current. Accordingly, the Contractor has to submit the hard copy in physical support document for authentication of experience by past PO of supply for String Combiner Box & String Monitoring System while submitting the Bid, failure of which may be lead to rejection of the bid.
o. Accordingly, the Contractor has to submit the hard copy in physical support document for authentication of experience by past PO of supply for String Combiner Box & String Monitoring System while submitting the Bid, failure of which may be lead to rejection of the bid.
p. Contractor shall submit the GTP, QAP, TUV/UL/equivalent certifications, performance/experience certificate, detailed datasheet, heat load calculations of String Combiner Box and string monitoring system to MAHAGENCO for approval.

1.6.3 Type Test

Vendor shall submit the following Type Test/ Product Certification from any National /International accredited lab for approval.

i. Temperature rise test on complete assembled box as per acceptable limit mentioned in relevant clause.
ii. Type test for enclosure as per code and standard mentioned inrelevant clause.
iii. Thermal ageing at 70 °C for 96 hours as per IEC 60068-2
iv. HV Test

1.7. DC Plug-in Connectors for Field Cabling

1.7.1 General Requirement

1. Field connectors are electrical connectors/coupler used for connecting solar panels and also strings of panels to String combiners box. Cable connector to be used for connecting SPV modules and String monitoring boxes shall be in accordance with IEC 62852: 2014.

2. Connector shall be of plug and socket design to be plugged together by hand but can be separated again using a tool only. Contractor shall ensure that field connectors to be mated shall always be of same make and model or shall be tested Inter-compatible as per clause no.6.3.11 of IEC 62852: 2014 for offered make(s).

3. Mating of connectors of different makes/model shall not be acceptable if not tested for inter-compatibility by any accredited lab.

1.7.2 Technical Requirements for DC connectors

Particular	Description
Rated Current, IEC (85°C)	30 A (4 mm^2, 6 mm^2), 40 A (10 mm^2)
Rated Voltage	Min1000/1500 Volts as per system requirement
Connector Design	Snap-In locking Type
Protection Degree	IP68 (Mated)
Ambient Temperature	(-) 40^0 C to (+) 85^0 C
Protection/Safety Class	Class II
Contact material	Cu
Contact surface material	Silver/Tin
Contact resistance for plug connecter	$\leq$ 0.5 milli-ohms
Stripping length	10 mm
Inflammability class	UL 94-V0
Insulating Material	PPE / PPO/Polyamide
Pollution degree	3
Certification	UL/TUV/CSA/EAC or Equivalent

1.7.3 Type Test for DC Plug-In Connectors

1. Protection Degree (IP)
2. Operating Temperature
3. Inflammability
4. Pollution Degree
5. Voltage Withstand (Rated Voltage/Test Voltage)
6. Product Certification

1.8. ARRAY YARD LIGHTING

Adequate Array Yard LED based energy efficient lighting including erection of poles, fixtures & cables as per IS standards, keeping the general security in the mind using auxiliary power supply at location. Array yard LED based energy efficient lighting theoretical design, calculations and detailed explanations along with drawing shall be provided and approved by MAHAGENCO.

1.9. LIGHTNING PROTECTION

1.9.1 The Complete Solar PV Power plant shall be provided with Lightning and over voltage protection. The "Lightning Protection System" must be completed prior to start-up of commissioning activities of the project. The 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. The source of over voltage can be lightning or other atmospheric disturbance.

1.9.2 The Lightning Conductors shall be made to protect the entire Array Yard from Lightning stroke. Necessary concrete foundation for holding the lightning conductor in position to be made after giving due consideration to maximum wind speed and maintenance requirement at site in future.

1.9.3 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 having locking arrangement, watering pipe using charcoal or coke and salt as required as per provisions of IS.

1.9.4 Direct Stroke lightning protection shall be used. The system shall have following features:

1.9.4.1 Active Lightning Rod OLP-214 shall based on Early Streamer Emission principle, complying NFC 17-102 and UNE 21186 Standards. The Device shall create an upward propagating streamer into the air 60 microseconds earlier than conventional air terminals or other objects on the earth, The device selected shall gives 107 meter radius of protection in level IV when mounted on 5 meter effective height mast. Along with Mast (G.I. pipe of suitable height) for mounting The device & adaptor along with supporting stray wires, etc. The device shall be in compliance to CE. The device shall be tested & cer1ified by CPRI (Central Power Research Institute- Bangalore) Govt. of India. The device shall be tested from International lab I University in compliance with NFC17-102 standard for Lightning catching head (ESE) impulse voltage streamer time Lag. Gain measurement. The ESE device shall have Warranty of 30 years.

1.9.4.2 High voltage insulated (HVI) cable shall be used as a down conductor to overcome the separation distance which is essential to avoid creep age flashovers. The HVI shall have high voltage resistant of the inner Cu conductor. Safe injection of lightning voltage at the entry thus preventing creeping flashovers (voltage flashovers) along the surface between the first Earthing point and the entry. The diameter of cable shall be 27mm, inner conductor size 25sqmm. And Separation distance: S 90 cm in air or S l.8 meter in solid

1.9.4.3 Tripod C- Bar Maintenance Free Chemical Earthing for Lightning Protection consistsof 3 Nos. of Copper bonded rod of 5/8"dia 10' length (The electrode shall be a solid steel rod made of high tensile low carbon steel and coated with molecularly bonded copper on the outside as per UL 467. The thickness of the copper coating shall be at least 250 microns. The electrode shall carry UL marking.) With two clamps (Clamp shall be suitable to terminate the earth rod and strip. The clamp shall be of Brass/Gunmetal), supported with 3 bags of 22.6 Kg Ground Enhancement Material (GEM) {The GEM shall have a low resistivity for faster transient/fault current dissipation. The GEM shall be Performed in all soil conditions even during dry periods. The GEM shall maintain constant resistance for the life of the system, temperature variation effects less than 1.0%. The GEM shall be non-toxic, environment friendly and does not adversely affect soil or ground water. The GEM shall lower the contactresistance to earth by up to 63%. The GEM shall have a resistivity of less than 0.2 ohmmeter. The GEM shall be CE & ROHS certified.} Joined by using 25x3mm copper flexible strip of 3 mtr length each (total 9 mtr.) and one number of poly plastic pit cover no meson work needed.

1.9.4.4 The Contractor shall ensure adequate lightning protection to provide an acceptable degree of protection as per IS for the array yard. If necessary, more numbers of Lightning conductors may be provided. Theoretical design calculations and detailed explanations along with drawings shall be provided and approved by MAHAGENCO.

1.10. EARTHING SYSTEM FOR ARRAY YARD

1.10.1 General requirements

This specification is intended to outline the requirement of earthing (grounding) for Solar array (DC) side and AC Power block side of Solar PV Project. It is not the intent of the specification to specify all details of design and construction since the bidder has fullresponsibility for engineering and implementation of earthling system meeting the intent of the specification and functional requirement. Any additional equipment, material, services

which are not specifically mentioned herein but are required for successful installation, testing and commissioning of earthling system for safe and satisfactory operation of the plant shall be included under scope of the bidder.

1.10.2 Earthing design requirements

The object of protective earthing system is to provide as nearly as possible a surface under and around a station which shall be at a uniform potential and as nearly zero or absoluteearth potential as possible. The purpose of this is to ensure that, in general, all parts of apparatus other than live parts, shall be at earth potential, as well as to ensure that operators and attendants shall always be at earth potential. Also, by providing such an earth surface of uniform potential under and surrounding the station, there can exist no difference of potential in a short distance big enough to shock or injure an attendant when short-circuitsor other abnormal occurrences take place. Care must be taken for equipment with functional earthing that its service is not disrupted due to undesired disturbances in protective earthing system.

1.10.3 Codes and standard

IEEE: 80	IEEE guide grounding for safety in AC Substation
IEEE: 837	Standard for qualifying permanent connections used in substation grounding
IS: 2309	Code of Practice for the protection of building and allied structures against lightning.
IS: 802	Code of practice for the use of Structural Steel in Overhead Transmission Line Towers.
IS: 2629	Recommended practice for hot dip galvanizing of iron & steel
IS: 2633	Method for testing uniformity of coating on zinc coated articles
IS: 513	Cold rolled low carbon steel sheets and strips
IS: 6745	Methods for determination of mass of zinc coating on zinc coated iron & steel articles.
IS 2062	hot rolled medium and high tensile structural steel — specification
IS: 4736	Hot-dip Zinc coating for MS Tubes.
IS: 458	Precast Concrete Pipes (With and Without Reinforcement)
UL-467	Grounding and Bonding Equipment
IEC62561 -7	Requirements for earthing enhancing Compounds
	CEA regulations for electrical safety-2010
	Indian Electricity Rules/ Indian Electricity Act.

All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as on date of opening of bid. In case of conflict between this specification and those (codes and standards, etc.) referred to herein, the former shall prevail. All work shall be carried out as per the above standards/ codes as applicable.

The earthing system includes earth electrode, installation of earth electrode in suitable pit size, construction of earth pit with cover for the installation, connection of earth electrode with equipotential earth bus and connection of equipment to equipotential earth bus.

1.10.4 Earth electrode

The earth electrode is in direct contact with the ground provides means for conducting earth current with ground. Earth Electrode material should have good electrical conductivity and mechanical strength and should not corrode in wide variety of soil conditions. For an effective earthing system, following type of vertical earth electrodes can be used.

a) MS Rods: Hot rolled, Medium or High Tensile Steel Rod as per IS 2062 of length not less than 3000 mm.
b) Copper Bonded Rods: High tensile-low carbon steel rod having diameter not less than 14/17 mm of Length 3000 mm to be selected based on earth fault current. The Rod shall comply with requirements of BS 4360 Grade 43A or EN10025:2-004 S275JR, molecularly bonded by 99.99% pure high conductivity copper on outer surface with copper coating thickness 250 micron or more in conformity to UL-467. Its surface shall be clean, freefrom mechanical defect and any visible oxide layer or foreign material.

1.10.5 Earthing Enhancement Compound

A low resistance earth electrode system is important to provide a low impedance path for the better dissipation of lightning/fault currents, and to protect personnel and equipment by minimizing and equalizing voltage potential differences. Earthing (ground) enhancement materials shall be used to improve the ground electrode resistance. Earth enhancement material shall be a superior conductive material which improves earthing effectiveness, especially in areas of poor conductivity (rocky ground, areas of moisture variation, sandy soils etc.). It shall be tested and should conform to the requirements of IEC 62561-7. It shall have the following characteristics: -

a) High conductivity improves earth's absorbing power and humidity retention capability, non-corrosive in nature having low water solubility but highly hygroscopic.

b) Carbon based with min 95% of fixed carbon content premixed with corrosion resistant cement to have set properties. Cement shall not mix separately & shall not have Bentonite.

c) Resistivity of less than 0.2 ohms -meter.

d) It shall not depend on the continuous presence of water to maintain its conductivity and shall be permanent & maintenance free and in its "set form", maintains constant earth resistance with time.

e) It shall not dissolve, decompose, or leach out with time and shall be environmentally friendly, suitable for soils of different resistivity and any kind of earth electrode.

f) The Earth enhancement material shall be supplied in sealed, moisture proof bags, marked with Manufacturer's name or trade name, quantity etc. The minimum quantity of earth enhancement compound to be used with each earth-pit shall be 25 Kg.

1.10.6 Earthing conductor

Earthing conductor is the conductor for buried below the ground at the depth of 600 mm connecting earth pits to make interconnection of earth pit. To interconnect earth pits, following

type of conductor can be used. Application of specific conductor and its size has been mentioned in relevant clause

a) Galvanized Steel Flat (GS) Flat GS/GI Flat (Strip) conductor shall comply to IS 2026 with Galvanization of 85 Micron as per IS. Material shall be clean and free form mechanical defects.

b) Copper Clad Steel (CCS) Earthing Conductor. The Copper Bonded Steel Grounding Conductor shall be made of steel with the coating of 99.99% pure copper complying to ASTM B 869-96 and ASTM B 452-93 standards.

c) Each strand of CCS shall have continuous, uniform coating and the conductor surface shall be smooth and free from mechanical defects.

d) MS Rod Hot rolled, Medium or High Tensile Steel Rod as per IS 2062 of length not less than 3000 mm and diameter of 40 mm.

1.10.7 Earthing Technical and Installation Requirement

Careful consideration should be given to installing an earthing system that meet or exceed statutory requirements. Contractor shall select certified product and ensure good workmanship for installation for satisfactory performance to fulfill the designed parameters all the times. Following care shall be taken while installation of earthing.

- Metallic frame/ structure of all electrical equipment shall be earthed by two separate and distinct connections to earthing system, each of 100% capacity, Crane rails, tracks, metal pipes and conduits shall also be effectively earthed at two points. Steel RCC columns, metallic stairs, and rails etc. of the building housing electrical equipment shall be connected to the nearby earthing grid conductor by one earthing ensured by bonding the different sections of handrails and metallic stairs. Metallic sheaths/screens, and amour of multi-core cables shall be earthed at both ends. Metallic heaths and armour of single core cables shall be earthed as per requirement mentioned elsewhere in the specification. Every alternate post of the switchyard fence shall be connected to earthing grid by oneGS flat and gates by flexible lead to the earthed post. Portable tools, appliances and welding equipment shall be earthed by flexible insulated cable. Metallic column for Inverter/Switchgear shelter/E-house shall be earthed with two distinct connections at minimum two column. All the wall cladding section shall be earthed at minimum two location with flexible copper cable of not less than 50 sq. mm.
- Each continuous laid lengths of cable tray shall be earthed at minimum two places by G.S. flats to earthing system, the distance between earthing points shall not exceed 30 meters. Wherever earth mat is not available, necessary connections shall be done by driving an earth electrode in the ground.
- Neutral connections and metallic conduits/pipes shall not be used for the equipment earthing. Lightning protection system down conductors shall not be connected to other earthing conductors above the ground level.
- The earth conductors shall be free from pitting, laminations, rust, scale and other electrical, mechanical defects.
- Connections between earth leads and equipment shall normally be of bolted type. Contact surfaces shall be thoroughly cleaned before connections. Equipment bolted connections after being tested and checked shall be painted with anti-corrosive paint/compound.
- Connections between equipment earthing leads and between main earthing conductors

shall be of welded type. For rust protection the welds should be treated with red lead compound and afterwards thickly coated with bitumen compound. All welded connections shall be made by electric arc welding. Resistance of the joint shall not be more than the resistance of the equivalent length of conductors.

- Earthing conductors buried in ground shall be laid minimum 600 mm below grade level unless otherwise indicated in the drawing. Back filling material to be placed over buried conductors shall be free from stones and harmful mixtures. Back filling shall be placed in layers of 150 mm.
- Earthing conductors embedded in the concrete floor of the building shall have approximately 50 mm concrete cover
- Earth pit shall be constructed as per IS:3043. Electrodes shall be embedded preferably below permanent moisture level. Minimum spacing between electrodes shall be 600mm.
- Contractor shall obtain all necessary statutory approvals for the earthing system before charging of the plant and electrical equipment's

1.10.8 Technical detail solar array for DC earthing

1. This section outlines the earthing requirement for discharging DC fault current to earth of Solar PV plant and provide equipotential bonding for Module Mounting Structure (MMS), SCB Mounting structure, Module Frames etc.

   System Requirement for the solar array DC earthing: System fault level--5 KA for 1 Sec

   Min. Steel corrosion --As per IS 3043 Life Expectancy - 25 years

2. Each Module mounting structure (MMS), SPV Module frames, mounting arrangement for String Monitoring Boxes, Metallic Junction Boxes, Metal frames/Panel, Metallic Pipes of the solar array shall be effectively earthed by two separate and distinct connections to earthing system.

3. Earthing conductor for connection to structure and equipment may be kept on the ground below MMS. However, these conductors shall be laid 300 mm below the ground along the pathway and/or crossing the pathway.

4. Contractor shall seek MSPGCL's approval for connecting solar array earth mesh with any other earth mat/earth grid of the solar PV plant.

5. Inverter functional earthing (Negative earthing, Anti PID Earthing) shall be carried out as per guideline of OEM. Contractor shall submit complete detail of such earthing from OEM and implement the earthing accordingly.

1.10.9 Technical details for AC earthing system

1. This section outlines the requirements of protective and functional earthing system to discharge AC fault current to earth and provide equipotential bonding for Transformer, HT and LT Switchgear Panel and other similar electrical equipment, Transformer neutraland shield.

2. The Contractor shall furnish the detailed design and calculations as per IEEE 80/IS 3043 for Employer's approval for equipment earthing.

1.10.10 Earthing System requirement for AC Earthing

Conductors above ground level and in built up trenches -Galvanized steel

- Conductors buried in earth -Mild steel rod of 40 mm diameter
- Earth electrodes - Mild steel rod of diameter 40mm or Copper bonded steel rod of diameter not less than 17 mm
- Life Expectancy - 25 years
- Min. Steel corrosion - As per IS 3043
- Soil Resistivity -Actual as per site condition

- For functional earthing of electronic component such as SCADA, contractor shall provide 1 no. (Min) isolated earth electrode near to the equipment connected with 2 run of copper cable of size not less than 25 sq. mm. Contractor shall comply to the recommendation of OEM (Original Equipment Manufacturer) for electronic earthing and electrode can be connected with other earth electrode as per recommendation of OEM.
- Each inverter duty transformer having shield between HV and LV winding shall be provided with 2 nos. Isolated earth electrode connected with each other for functional earthing of transformer shield. Each electrode shall be connected with transformer shield with separate 25x6 Cu flat.
- Contractor shall ensure there at least two earth pits each dedicated for earthing of each Transformer, HT/LT Switchgear panel, transformer neutral,Battery Charger/UPS/Control Panel etc. shall be provided. Earth electrode shall be located near to the equipment and all earth electrodes shall be interconnected with parallel conductor buried in earth surrounding the equipment.
- **Earthing system of different locations such as Inverter room/Pooling Switchgear/Sub pooling switchgear/Inverter shelter etc. shall be interconnected in single network with buried conductor of the size 65x8 GS Flat laid at 600 mm depth**. Contractor shall submit the calculation based on the system of earth conductor and electrode connected in single network. Location and manner of interconnection shall be approved during detail engineering.
- Bidder shall also interconnect the earthing system of Solar PV plant with MSPGCL existing earthing system wherever available.
- For functional earthing of electronic component such as SCADA, contractor shall provide 1 no. (Min) isolated earth electrode near to the equipment connected with 2 run of copper cable of size not less than 25 sq.mm. Contractor shall comply to the recommendation of OEM for electronic earthing and electrode can be connected to other earth electrode as per recommendation of OEM.

1.10.11 Water Arrangement for Earthing

The EPC Contractor shall make water arrangement for continuous requirement of earth pits in switchyard as per applicable IS/IEC.

1.11. OTHERS

Any Electrical work which is not mentioned or included here but necessary for the plant shall be borne by Contractor.

1.12. SCOPE FOR CONTROL ROOM

A. SCOPE OF CIVIL WORK FOR UNIT CONTROL ROOM(INVERTER ROOM) MAIN CONTROL ROOM

1.12.1 Planning & Design

1.12.1.1 **Main control room**: The Contractor has to plan and design the RCC type building/ container type/ prefabricated building for 62 MWAC Main Control Room in a proper manner. Contractor has to develop general layout drawing of Control Room including landscaping of the entire Control room area should accommodate inverter and all the required equipment & panels, switchgears, SCADA, battery & charger battery & charger, firefighting equipment's etc. All design & drawing/s have to be developed based on specification given in the tender, soil report, and relevant IS unless otherwise specified. All details should be clearly shown in the drawings. MAHAGENCO reserves the right to modify the main control room design as per local site conditions/requirements.

1.12.1.2 **Unit Control Room (Inverter Room)**:
The contractor has to plan & design 1-12.5 MW (AC) Unit Control Room (Inverter Room) as per design layout of 62 MW_{AC} Solar plant. Unit Control Room shall be RCC type/ container type/ prefabricated building. The Unit control room should accommodate inverter and all the required equipment & panels, switchgears, SCADA, battery & charger, firefighting equipment's etc. The Unit control room should be designed as per global industry best practices and local conditions. The design of Main Control Room Buildings shall also incorporate the outlet openings for ventilation ducting from inverter. The Contractor shall submit the detailed design with relevant certifications and approvals for MAHAGENCO approval.

1.12.2 Container type solution for Unit Control Room (Inverter Room):

The manufacturer of container / enclosure for inverter and other equipment shall have experience of supplying minimum of 50 MW_{AC} capacity in similar type. The container solution if used for inverter shall be approved by the inverter manufacturer and the Contractor shall submit the certificate from the inverter manufacturer to such effect, without changes in any performance or product warranties.

1.12.3 Construction of Unit control room using Pre-fabricated material:

The Contractor can use pre-fabricated material designed to meet required functionality of the room. All designs and details shall be according to the latest versions of relevant global / Indian standards. Wind and other loads on structure shall be transmitted to the foundations through moment resistant frames in one direction and vertical X braced or K braced frames in other direction. Structure that resists lateral loads with rigid frame shall be avoided.

The structure shall be designed for all types of loads as given below.

1. Dead load: Self weight of structure including purlins, sheeting, girts, bracings, etc.
2. Live load: Live loads shall be as per IS 875.
3. Collateral loads: All frames shall be designed for additional collateral load of 0.2 kN/m^2 on purlins and runners.
4. Wind loads: Wind loads shall be as per IS 875.
5. Earthquake load: Seismic forces shall be as per IS 1893.

6. All materials for sheet and accessories shall strictly confirm to IS/BS/ASTM/AS specifications as applicable.

1.12.4 Concrete Structure Unit Control Room:

The Contractor also has the option to construct Unit Control Room in concrete structure. In such case all the specifications as mentioned in this document shall be applicable.

1.12.5 Main Control Room:

1.12.5.1 The Main Control Room has to plan & design the RCC type building/ container type/ prefabricated building adhering to relevant standards. It shall have an inverter room. The Contractor has to submit the proposed drawing of control room during construction phase to MAHAGENCO for approval. The building shall be designed to meet National Building Code requirement.

1.12.5.2 Main Control design should be developed considering optimal usage of space, material and labour without compromising the effect of shadow, cooling, ventilation, accessibility, losses during electrical interconnections, etc.

1.12.5.3 Main control room construction should be in compliance with National Building Code and relevant BIS/International standards.

1.12.5.4 The Main control room buildings shall have to be designed based on topological survey report & soil testing report, relevant BIS code, National Building Code of India, unless otherwise mentioned in the general scope of work & technical specification in consultation with Project Manager/Site-in-Charge.

1.12.5.5 The Main Control Room building shall be equipped with Toilets, Washbasin, and Overhead tank for water storage, with proper fresh water and sewage arrangement and septic tank. Relevant standards have to be maintained for construction.

1.12.5.6 Main Control Room shall have, all the required equipment & panels, switchgears, SCADA, battery & charger battery & charger, firefighting equipment's etc.

- Office Room for staff.
- Air conditioned SCADA room
- Store Room
- Lobby
- Pantry

1.12.5.7 Office room for staff:

Office space for MAHAGENCO representative of minimum size of 20 X 15 Feet shall be into the Main control.

1.12.5.8 Toilet and urinal:

The Contractor shall submit the proposed drawing of control room building along with the bid to MAHAGENCO for approval. The following specifications are applicable for control room buildings; the main control room, if proposed to be civil constructed room.

RCC WORK - All RCC works shall be of M25 grade as per IS 456-2000 and the materials used viz. Cement reinforcement, steel etc. shall be as per relevant IS/ IEC standards. In addition IS: 2502 Code of Practice for Bending and Fixing of Bars for concrete Reinforcement must be complied. Reinforcement shall be high strength TMTFe 415 or Fe 500 conforming to "IS: 1786-1985".

MASONRY WORK - All brick works shall be of atleast class II approved quality as per IS 2212 and IS: 3495. The cement mortar for brick masonry shall be in the ratio 1

cement and 5 sand, by weight. The cement mortar shall be machine mixed. Bricks required for masonry work shall be thoroughly soaked in clean water tank for approximately two hours. Brick shall be laid in English bond style. Green masonry workshall be protected from rain. Masonry work shall be kept moist on all the faces for a period of seven days.

1.12.5.9 Doors & windows:

Doors, windows and ventilators of air-conditioned areas, entrance lobby of buildings (wherever provided), and all windows and ventilators of main plant and service shall have, electro colour dyed (anodized with 15-micron coating thickness) aluminum framework with glazing. All doors of toilet areas shall be of steel framed solid core flushshutter.

The doors frames shall be fabricated from 1.6 mm thick MS sheets and shall meet the general requirements of IS: 4351. Steel windows and ventilators shall be as per IS: 1361 and IS:1038. All windows and ventilators on ground floor of main control room shall be provided with suitable grill.

Minimum size of door provided shall be 2.1 m high and 1.2 m wide. However, for toilets minimum width shall be 0.75 m and office areas minimum width shall be 1.20m.

The main entrance shall include Mild Steel single leaf door. The structural steel shall conform to IS:7452 and IS: 2062. The holdfasts shall be made from steel flats (50 mm and 5 mm thick). The fixtures, fastenings and door latch are to be made with same materials. Each window shall have a solid bronze polished, cam locking handle and strike. All steel windows shall be suitably painted after fabrication in accordance with the relevant Indian Standard(s).
Fixing of metal doors and windows shall be done in accordance to IS: 1081 and IS 7452.

Doors and windows on external walls of the buildings (other than areas provided, with insulated metal claddings) shall be provided with RCC sunshade over the openings with 300 mm projection on either side of the openings. Projection of sunshade from the wall shall be minimum 450 mm over window openings and 750 mm over door openings except for main entrance door to the control room where the projection shall be 1500mm.

1.12.5.10 Glazing:

All accessible ventilators and windows of all buildings shall be provided with min. 4mm thick float glass, plain or tinted for preventing solar radiations, unless otherwise specified.

For single glazed aluminum partitions and doors, float glass of 8mm or 10 mm thickness shall be used. All glazing work shall conform to IS:1083 and IS:3548. 6 mm reflective toughened glass, with following minimum technical characteristics: Solar factor 45% or less, U-value less than 5.7 W/SQMK, VLT min 35%: The glass to be used shall be from the manufacturers of glass like Asahi Intecc, Gujrat Guardian, Borosil, La opla, Hindustan nirmal glass, Saint Gobain (France) Or equivalent. The glass shall be free from distortion and thermal stress.

1.12.5.11 Plastering:

All external surfaces shall have 20mm cement plaster in two coats, under layer 12 mm

thick cement plaster 1:4 and finished with a top layer 8mm thick cement plaster 1:4 with water proofing compound. White cement primer shall be used as per manufacturer's recommendation.

At least one coat of plaster shall be applied to interior walls by hand or mechanically, to a total thickness of 12 mm using 1:4, 1 cement and 4 sand. Plastering shall comply to IS: 1542, IS:1661, IS:1630. Oil bound washable distemper on smooth surface of internal walls shall be applied with 2 mm thick Plaster of Paris putty for control room.

Plaster of Paris (Gypsum Anhydrous) conforming to IS:2547 shall be used for plasterof Paris punning.

1.12.5.12 Flooring:

The Cement shall be ordinary Portland cement as per IS:269. Flooring for stores shall be of cement concrete flooring as per IS 2571-1970. Flooring for office building, security cabin & control room shall be vitrified tiles.

1.12.5.13 Roofing:

Roof of the control room building shall consist of Cast-in-situ RCC slab treated with a water proofing system which shall be an integral cement based treatment conforming to CPWD specification (item no. 25.8 of DSR 1997). The roof of the building shall be water proof with tarfelt 5 layer over screeding. The roof shall be designed for minimum superimposed load to 150 kg/m2.

For efficient disposal of rainwater, the runoff gradient for the roof shall not be less than 1:100 and the roof shall be provided with RCC water gutter, wherever required. Gutter shall be made watertight using suitable watertight treatment. This gradient can be provided either in structure or subsequently by screed concrete 1:2:4 (using 12.5 mm coarse aggregate) and/or cement mortar (1:4). However, minimum 25 mm thick cement mortar (1:4) shall be provided on top to achieve smooth surface.

1.12.5.14 Painting of walls & ceilings:

The paint shall be anti-fungal quality of reputed brand suitable for masonry surfaces for high rainfall zone. All painting on masonry or concrete surface shall preferably be applied by roller. If applied by brush, then same shall be finished off with roller. For painting on concrete, masonry and plastered surface IS:2395 shall be followed. All paints shall be of approved make including chemical resistant paint. Minimum 2 finishing coats of paint shall be applied over a coat of primer.

For painting on steel work and ferrous metals, BS: 5493 and IS:1477 shall be followed. The type of surface preparation, thickness and type of primer, intermediate and finishing paint shall be according to the painting system adopted.

The cement paint as per as per IS: 5410 shall be of approved brand and manufacturer. All external surfaces of walls shall be painted with water-proof cement base paint. Ceiling of all rooms except Battery room shall be whitewashed. The ceiling of Battery room (if provided) shall be acid resistant paint.

1.12.5.15 Plinth protection:

Plinth protection shall be provided around the buildings with Brickbats and PCC 1:2:4 & smoothly finish of top surface.

1.12.5.16 Water supply:

GI pipes of Medium quality conforming to IS 1239 (Part I-1990) and IS 1795-1982 (reaffirmed 1990) for Mild Steel pipes shall be used for all water supply and plumbing

works. The Sintex or equivalent make PVC storage water storage tank conforming to IS:12701 shall be provided over the roof of the Main control room with adequate capacity for 10 No person and 8 hours' requirement completes with all fitting including float valve, stop cock etc. The capacity of the tank shall be minimum 500 liters.

1.12.5.17 Plumbing & Sanitary:

Toilet shall have the following minimum fittings. WC (Western type) 390 mm high with toilet paper roll holder and all fittings or WC (Indian Type) with all fittings (both types of WCs shall be provided at alternate locations).

- Urinal (430 x 260 x 350 mm size) with all fittings.
- Wash basin (550 x 400 mm) with all fittings.
- Bathroom mirror (600 x 450 x 6 mm thick) hard board backing
- CP brass towel rail (600 x 20 mm) with C.P. brass brackets
- Soap holder and liquid soap dispenser.
- All fittings, fastener, grating shall be chromium plated. Necessary plumbing lines shall be provided for office cum control room building and Security cabin

The floor finish for washroom, pantry and toilet shall be vitrified ceramic anti-slip tiles and Dado glaze ceramic tiles up to 2.1m shall be used. The normal size of Ceramic tiles shall be 300 mm X 300 mm X 9 mm and shall comply IS:15622.

The Contractor shall design & provide underground one septic tank and two soak pits and assuming that a total of 10 persons shall be working for O&M in combined three shift.

The pantry shall consist of one number stainless steel pantry sink, as per IS : 13983, of size 610 x 510 mm, bowl depth 200 mm with drain board of at least 450 mm length with trap, with inlet and outlet connections and CPVC concealed water supply pipe of minimum 12 mm dia of medium class, sanitary pipe of minimum 75 mm diameter, floor trap with Stainless Steel grating, inlet and outlet connections for supply and drainage, with all bends, tees, junctions, sockets, etc., as are necessary for the commissioning and efficient functioning of the pantry (all sanitary fittings shall be heavy duty chrome plated brass, unless noted otherwise)

1.12.5.18 Stairs:

Contractor to provide service ladder made up of access the roof for maintenance of communication equipment and water tank.

1.12.5.19 False ceiling:

Main control room shall be provided with false ceiling of 15 mm thick mineral fiber board, in tile form of size 600mm x 600mm, along with galvanized light gauge rolled form supporting system in double web construction pre painted with steel capping, of approved shade and colour, to give grid of maximum size of 1200x600 mm as per manufacturers details including supporting grid system, expansion fasteners for suspension arrangement from RCC, providing openings for AC ducts(if required), return air grills(if required), light fixtures, etc., all complete.

1.12.5.20 Office furniture:

Adequate and appropriate ergonomically designed furniture of approved make for the control room shall be included in the Price bid. The furniture shall be chosen in such a way that it matches with the decor of the control room. Furniture shall be of reputed approved manufacturer.

1.12.5.21 Signboards

The Signboard will contain brief description of the Power Plant. The Signboard will be made of steel plate of not less than 3 mm. Aluminum strip of 2 mm thickness, 18mm width and length equal to the length of sign board shall be provided with the board for clamping the board on to the RC Poles. Letters on the board have to be with proper illumination arrangement. The design & size of the signboard shall have to be befitting the Control Room.

1.12.5.22 Security cabin & boom barrier

Security cabin containing CCTV terminals shall be designed and constructed by the Contractor keeping in view the safety and security of the power plant as a whole and as per requirements in consultation with Project Manager. The design of the Gate shall be submitted to MAHAGENCO for approval.

1.12.5.23 Others

Any Civil work which is not mentioned or included here but necessary for the plant shall be borne by Contractor.

1.13. SCOPE OF ELECTRICAL WORK FOR UNIT CONTROL ROOM (Inverter Room)

1.13.1 General Requirement

There will be necessary numbers of Power Control Units (PCU) which will consist of an electronic Inverter along with associated control, protection and data logging devices. The system shall incorporate a unidirectional inverter and should be designed to supply the AC power to the grid at load end. The power conditioning unit shall adjust the voltage & frequency levels to suit the Grid. All three phases shall be supervised with respect to rise/fall in programmable threshold values of frequency. PCU shall confirm to IEC 60068-2 standards for Environmental Testing.

1.13.2 Power Control Unit (Inverter Room) :

1. Central inverters of minimum capacity of 1000-6847kW shall be used in the project. The central inverters can be with modular built-up design.
2. The Bidder/its Sub-vendor should have designed, manufactured and supplied grid connected solar Inverters of cumulative capacity of 200 MW out of which at least one such supply order for a single plant should be of 10 MW or above capacity.
   The reference plant in which 10 MW or above capacity solar Inverters (consisting of one or more) were supplied must have been in successful operation for at least six (6) months prior to the date of issue of LoA by Mahagenco to bidder.
3. The efficiency of the PCU inverter shall be equal to or more than 98% at 75%load asper IEC 61683.The Contractor shall specify the conversion efficiency at different loads say 25%, 50%, 75% and 100% in his offer. The Contractor should specify the overload capacity in the bid Inverter should be warranted up to 20 years
4. The output power factor of the PCU inverter should be of suitable range to supply or sink reactive power. The PCU shall have internal protection arrangement against any sustained fault in the feeder line and against lightning in the feeder line.
5. The PCU inverter shall have the required protection arrangements against earth-leakage faults. Inverters shall be suitable for floated or negative earthing.
6. Specifically, the PCU inverter should be three phase power conditioning unit using static solid state components. DC lines shall have suitably rated isolators to allow safe start up and shut down of the system. Circuit breakers used in the DC lines must be rated suitably.

7. Each solid state electronic device shall have to be protected to ensure long life of the inverter as well as smooth functioning of the inverter.
8. The PCU inverter shall have anti islanding protection.
9. The system shall tend to balance unequal phase voltage (with 3-phase systems) with reference to the red phase (line-1)
10. The PCU inverter front panel shall be provided with a display (LCD or equivalent) ofall important Parameters such as DC input voltage, DC input current, AC input voltage, AC input Current, AC output power, power factor, frequency etc.
11. If the Contractor is not able to provide PCU with display, the same has to be made available at the SCADA monitoring & controlling desk installed in Main Control Room.
12. Nuts, bolts and the PCU enclosure shall have to be adequately protected taking into consideration the atmosphere and weather prevailing in the area.
13. Dimensions and weight of the PCU shall be indicated by the Contractor in the offer. 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 causethe 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.
14. It should have Local LCD (Liquid crystal display) and keypad for system control, monitoring instantaneous system data, event logs, data logs and changing set points. Control and read-out should be provided on an indicating panel integral to the Inverter. Display should be simple and self-explanatory display to show all the relevant parameter relating to PCU operational data and fault condition in form of front Panel meters / LED'sor two line LCD Display.
15. PCU shall have arrangement for adjusting DC input current and should trip against sustainable fault downstream and shall not start till the fault is rectified.
16. Operation & maintenance manual should be furnished by the Contractor before dispatch of PCU's.
17. The bill of materials associated with PCU's should be clearly indicated while delivering the equipment.
18. Standby Mode
    The control system shall continuously monitor the output of the solar power plant until pre-set value is exceeded & that value to be indicated.
19. Basic System Operation (Full Auto Mode)
    The system shall automatically „wake up‟ in the morning and begin to export power provided there is sufficient solar energy and the grid voltage and frequency is in range.
20. Maximum Power Point Tracker (MPPT)
    MPPT control algorithm shall adjust the voltage of the SPV array to optimize solar energy fed into the grid.
21. Sleep Mode
    Automatic – "sleep" mode shall be provided so that unnecessary losses are minimized at night. The power conditioner must also automatically re-enter standby mode when threshold of standby mode reached.

22. Maximum Power Tracking

Maximum power point tracker shall be integrated in the power conditioner unit to maximize energy drawn from the Solar PV array. The MPPT should be microprocessor based to minimize power losses. The details of working mechanism of MPPT shall be mentioned by the Contractor in his offer. The MPPT must have provision for constant voltage operation. The MPPT unit shall confirm to IEC 62093 for design qualification.

23. Technical specifications –

The inverter output shall always follow the grid in terms of voltage and frequency. This shall be achieved by sensing the grid voltage and phase and feeding this information to the feedback loop of the inverter. Thus control variable then controls the output voltage and frequency of the inverter, so that inverter is always synchronized with the grid. The inverter shall be self-commutated with Pulse width modulation technology.

i. Nominal AC Output Power : Contractor can use inverter of Nominal AC Output Power from 1000KW to 6874KW as per their design.
ii. Nominal Output voltage : 240 – 800 Volts
iii. Minimum Efficiency at : 75% load : ≥ 98%
iv. Output frequency : 50 Hz +/- 0.5% Hz (Inverter to follow grid frequency up to +/- 3Hz of the nominal output frequency during normal operation)
v. Maximum Input voltage : 1200 V DC
vi. THD Less than : 3%
vii. Ambient temperature : 0 to 50 degree C
viii. Humidity : 85% Non-Condensing Enclosure
ix. Minimum IP20 (Indoor Rated)

24. The Inverter shall have following features:

i. No load loss<1% of rated power and maximum loss in sleep mode shall be less than 0.05%
ii. Sinusoidal current modulation with excellent dynamic response.
iii. VAR control with +/-0.9 power factor
iv. Unit wise & integrated Data logging.
v. Dedicated Prefabs / Ethernet for networking
vi. Protection against
vii. Over current
viii. Sync loss
ix. Over temp.
x. DC bus over voltage
xi. Cooling Fan failure(If provided)
xii. Power regulation in the event of thermal overloading
xiii. Set point pre-selection for VAR control
xiv. Bus communication via -interface for integration
xv. Remote control via telephone modem or mini web server
xvi. Integrated protection in the DC and three phase system
xvii. Insulation monitoring of the PV array with sequential fault location
xviii. Ground fault detector - which is essential for large PV generators in view of appreciable discharge current with respect to ground.

xix. In case of any fault in grid the inverter shall protect itself before any damage to inverter or grid.

xx. Vendor's credentials, base material test certificates, GTP (GuaranteedTechnical Parameters) & QAP for Inverter shall be submitted for approval from MAHAGENCO.

The Power Conditioners/Inverters of the SPV power plants must conform to the latest edition of IEC/ equivalent BIS Standards as specified below:

Efficiency Measurements	IEC 61683
Environmental Testing	IEC 60068-2/ IEC 62093
Electromagnetic Compatibility (EMC)	IEC 61000-6-2, IEC 61000-6-4
Electrical Safety	IEC 62103/62109-1 &2
Protection against Islanding of Grid	IEEE1547/IEC 62116/ UL1741 or equivalent EN/BIS Standards
Grid Connectivity	Relevant CERC Regulations and Grid Code as amended and revised from time to time.
Rated capacity	Nominal/Rated output power of the inverter (if different power ratings are mentioned at different temperatures, then power rating at 50° C shall be considered) in kW will be considered as inverter rated capacity.

1.13.2.1 DC Bus & Panel (If necessary)

DC generated by the Solar modules is transmitted through the appropriate cables from Array Yard to Inverters in control room. DC bus & Panel should be provided for the incoming DC supply from Array Yard. The Panel should consist of adequate size DC Bus/Cable which can handle the current and the voltage safely as per the relevant IS/ IEC standards. DC panel should be equipped with an adequate capacity indoor DC circuit breaker along with control circuit, Protection Relays, fuses, annunciations and remote operating and controlling facility from the Main Control Room.

Theoretical design calculations and detailed explanations along with drawings, vendor's credentials, GTP (Guaranteed Technical Parameters) & QAP shall be submitted to and approved by MAHAGENCO.

1.13.2.2 AC Bus & Panel

AC converted by the inverter is transmitted through the appropriate cables from Inverter to Inverter transformers. AC bus & Panel should be provided for the outgoing AC supply from inverter to inverter transformer Switchyard, the Panel should consist of adequate size indoor AC Bus/Cable which can handle the current and the voltage safely as per IS 8623(Part 2):1993 / IEC 60439-2. AC panel should be equipped with an adequate Protection Relays, fuses, annunciations and remote operating and controlling facility from the Main Control Room.

An AC Bus & Panel housed in the control room shall be provided in between PCU and 415V/33 kV (or of suitable primary voltage) transformer. It shall have MCB/MCCB or

Circuit Breaker of Suitable rating for connection and disconnection of PCU from Grid. The connection between ACDB and Transformer shall be busbar. It shall have provision to measure bus voltage, current and power feeding the transformer.

Bus-bars shall be of high conductivity aluminum alloy or copper of adequate size. The bus- bars shall be adequately supported by non-hygroscopic, noncombustible track resistant and high strength type polyester fiber glass moulded insulators. Separate supports shall be provided for each phase and neutral busbar. The bus-bars joints shall be provided with high tensile steel bolts, bellevelle washers and nuts, so as to ensure good contacts at the joints. The bus-bars shall be colour coded as per IS 375.

Theoretical design calculations and detailed explanations along with drawings, vendor's credentials, GTP (Guaranteed Technical Parameters) & QAP shall be submitted to and approved by MAHAGENCO.

1.13.2.3 Circuit Breaker

Appropriate & adequate Capacity 240V / 380V / 415V AC indoor air Circuit Breaker as per IS 60947 (Part 2):2003 / IEC 60947-2 along with control circuit, protection relay circuit, fuses, annunciations and remote operating and controlling facility from the Main Control Room is necessary.

Theoretical design calculations and detailed explanations along with drawings, vendor's credentials, GTP (Guaranteed Technical Parameters) & QAP shall be submitted to and approved by MAHAGENCO.

1.13.2.4 UPS, DC Battery & Charger

An uninterrupted power supply along with adequate capacity maintenance-free type DC battery Bank should be provided for emergency control supply of control / protection system & emergency lighting. The DC voltage shall be as per requirement of and suitable to design of the system (220/110/96/60/48/24VDC).

A appropriate capacity Battery charger with relevant IS/IEC standards & protection and automatic change over system should be provided to charge the battery bank along with relay circuit, fuses, annunciations and remote operating and controlling facility from the Main Control Room.

A DC power supply Distribution panel/board should be supplied along with the Charger as per relevant IS/ IEC standards.

Control room DC Battery Bank & DC supply system theoretical design, calculations, QAP, GTP and detailed explanations along with drawing shall be provided and approved by MAHAGENCO.

1.13.2.5 Protective Relays

The SPP and the associated power evacuation system shall be protected as per Indian Standards. Over current relays, reverse power relays, differential protection relays and earth fault relays have to be essentially provided. All relay should be numerical type & should be remote operating and controlling facility from the Main Control Room.

Detailed design calculations shall be provided on fault power computations and the

philosophy of protective relaying with respect to short circuit kVA calculations. These shall be provided in the software and its version as required by MAHAGENCO. Design & Drawing of protection relay should be approved by MAHAGENCO.

1.13.2.6 Auxiliary Power Supply

A supply point connection for LT supply required to provide essential and peripheral loads on 24x7 basis shall be provided by Mahagenco. However, necessary separate transformer and its accessories, control & protections for auxillary power supply shall be in the scope of contractor.

These shall be designed depending on the plant auxiliary power requirement. Design and drawings shall be submitted to MAHAGENCO for its approval.

1.13.2.7 String Monitoring System

Monitoring of various parameters at string level should be made possible in the Main Control Room at site by installing the suitable string monitoring system so that any fault at string level could be recognizable by that system.

String Monitoring System theoretical design, calculations and detailed explanationsalong with drawing shall be provided and approved by MAHAGENCO.

Additionally necessary facility shall be installed at the Main Control Room to enable remote monitoring of the plant performance from MAHAGENCO's Mumbai office facility.

1.13.2.8 Air Ventilation System

The control room shall be equipped with appropriate air ventilation system suitable for heat dissipation. The calculations for air flow, heat dissipation and other shall be submitted to MAHAGENCO for approval.

1.13.2.9 Lighting Fixtures

All lighting fixtures shall be indoor type & pre-wired comprising of Lamp(s) as indicated with lamp holder(s) and Electronic Ballast(s) with metal reflector(s).The lamp fitting shall be covered by Glass or Perspex material. The Lamp Fixture shall be fitted on wall as per direction of Site -In-charge. Alternatively, LEDs may be used after submitting detailed descriptions of illumination computations and test certificates from reputed test centers.

The number of lighting fixtures should be such that it should give sufficient luminance level for daily operation as per BEE standards.
Load calculations and detailed explanations along with drawing shall be provided and approved by MAHAGENCO.

1.14. MAIN CONTROL ROOM PANELS & MONITORING DESK

1.14.1 The Panel shall have adequate inputs to take in from the centralized Push Button

Switching Unit having Suitable Mimic with Power flow Indicator & Status Indicator of different PCUs.

1.14.2 The Panel shall be floor mounted type. All the measuring instruments such as feeder voltmeter, ammeter, frequency meter, Electronic Energy Meter (for measuring the deliverable units (kWh) for sale), selector switches, Mimic etc. shall be in the front panel.

1.14.3 All the Power cables shall be taken through backside of the Panel.

1.14.4 The Panel shall be fitted with suitable rating & size, HRC fuses/circuit breaker/isolator indicators for all incomer and outgoing terminals, Voltmeter & Ammeter with suitable selector switches to monitor & measure the power to be evacuated.

1.14.5 Nut & bolts including metallic cubicle shall have to be adequately protected against atmosphere and weather prevailing in the area.

1.14.6 The overall dimensions of the panel shall be suitable with other power conditioning units of the power plant. However, dimensions, weight, sheet thickness, painting etc. should be indicated by the Contractor . The bill of material associated with the equipment should be clearly indicated while delivering the equipment.

1.14.7 Drawings, vendor's credentials, GTP (Guaranteed Technical Parameters) & QAP along with makes of components shall be submitted to and approved by MAHAGENCO.

1.15. MAIN CONTROL ROOM CABLES & WIRES FOR LIGHTING FIXTURES

1.15.1 All cables shall be PVC insulated grade conforming to relevant IS/ IEC standards shall also confirm to IEC standards for test and measuring. Methods of testing & make of cable should be approved by MAHAGENCO.

1.15.2 The wiring for modules inter connection shall be with hard PVC conduit of approved make. All Tees, Bends etc. shall be approved make. Before procurement, approval for materials should be obtained from MAHAGENCO.

1.15.3 Only terminal cable joints shall be accepted. If the length of cable increases significantly, straight-through joints can be accepted.

1.15.4 Cables inside the control room shall be laid in suitable Cable Trays of approved type.

1.15.5 All wires used on the LT side shall conform to IS/ IEC and should be of appropriate voltage grade. Copper or Aluminium conductor wires of reputed make shall be used.

1.15.6 Cable terminations shall be made with suitable cable lugs & sockets etc., crimped properly and passed through brass compression type cable glands at the entry & exit point of the cubicles. The panels' bottoms should be properly sealed to prevent entry of snakes/lizard etc. inside the panel.

1.15.7 All cable/wires shall be marked with good quality letter and number ferrules of proper sizes so that the cables can be identified easily.

1.15.8 Control room panel wiring theoretical design, calculations and detailed explanations along with drawing shall be provided and approved by MAHAGENCO.

1.16. MAIN CONTROL ROOM SCADA AND REMOTE MONITORING SYSTEM

1.16.1 The plant shall be automatically operated and shall be controlled by microprocessor based control system SCADA. Computer Aided Data Acquisition Unit shall have features for simultaneous monitoring and recording of various parameters of different sub-systems, power supply of the Power Plant at DC side and AC side. The drawings of

Plant Monitoring Desk should be approved by MAHAGENCO.

1.16.2 Computer Aided Data Acquisition Unit (in the form of personal computer (PC)) shall be a separate and individual system comprising of different transducers to read the different variable parameters, A/D converter, Multiplexer, De-multiplexer, Interfacing Hardware& Software, Industrial Type PC, which will be robust & rugged suitable to operate in the Control Room Environment.

1.16.3 Two sets of reliable sensors (one for horizontal and one for tilted surface) for Solar Radiation, Temperature & other Electrical Parameters are to be supplied with the data logger unit.

1.16.4 **The computer shall be of Server grade, rugged & robust in nature to operate in a hostile environment with latest specifications. The computer shall have 52" LED Color monitor, latest generation Intel Core i7 processor having SSD of at least 1 GB & 1TB HDD with 32 GB RAM & 4 GB dedicated graphic memory card, web camera, speaker, mic, USB drive, scroll mouse and UPS for 4 hours power back up.** The printer shall be of industrial type, rugged & robust in nature and of reputed make.The printer shall be equipped for printing, scanning, copying.

1.16.5 The Data Acquisition System shall perform the following operations: Measurement and continuous recording of:

- Power at 220 kV Terminal
- Power at 33kV terminal.
- Ambient temperature near array field
- Control room temperature.
- Wind speed
- AC and DC side power of each inverter
- Solar irradiation / insolation.
- Voltage of HT side.
- Any other parameters considered necessary by supplier based on current practice.

1.16.6 SCADA shall record data for each 30 seconds and provide every 15 Minutes data averages for daily, monthly and annual average of following parameters

- Radiation
- Temperature
- Exported energy
- Energy of each inverter
- Current and voltage on string at SCB end.

1.16.7 All data shall be recorded chronologically date wise. The data file should be MS Excel compatible. The data logger shall have internal reliable battery backup and data storage capacity to record all sorts of data simultaneously round the clock. All data shall be stored in a common work sheet chronologically. Representation of monitored data shall also be in graphics mode or in tabulation form. All instantaneous data can be shown in the Computer Screen.

1.16.8 SCADA shall have feature to be integrated with the local system as well remotely via the web using either a standard modem or a GSM/WIFI modem. The Contractor shall provide compatible software and hardware so that data can be transmitted via standard modem.

1.16.9 The Bill of Materials associated with the equipment must clearly indicate especially the details about the PC and Printers, etc.

1.16.10 SCADA shall be provided with reliable power supply along with backup supply for at least four hours to cater to outage of grid.

1.16.11 The Data Acquisition System should be housed in a desk made of steel sheet.

1.16.12 If needed SCADA system upgradation shall be done by bidder as per requirement of owner at his own cost.

1.16.13 For the purpose of Remote Monitoring a necessary facility should be installed to enable remote monitoring of plant performance including all parameters. There shall be dedicated communication link from MAHAGENCO's Mumbai office and the SLDC (Maharashtra State Load Dispatch Center) at Kalwa facility in Thane district. All blocks in the Project need to be brought in common network with appropriate protocol conversion so that through the single link of SLDC and MAHAGENCO's Mumbai office the data shall flow.

1.16.14 For MAHAGENCO's Mumbai office facility the data is required on OPC protocol.

1.16.15 The data requirement for SLDC is on IEC-104 protocol. This arrangement shall be as per protocols, specifications and other requirements of the SLDC. The architecture must be approved by SLDC Kalwa.

1.16.16 Cost of equipment, internet facility and all rentals for the facility of remote monitoring shall be borne by the Contractor for the complete project period.

1.16.17 The drawings, designs, protocols and complete Bill of Material relating to SCADA and remote monitoring shall be submitted to MAHAGENCO for approval.

1.17. MAIN CONTROL ROOM ELECTRICAL WIRING

1.17.1 Electrification of building shall be carried out as per IS 732-1989, IS 46481968 and other relevant standards. Suitable AC Distribution Board should be designed to Supply AC power in Control room.

1.17.2 Control room AC distribution Board theoretical design, calculations and detailed explanations along with drawing shall be provided and approved by MAHAGENCO.

1.18. MAIN CONTROL ROOM AUXILIARY POWER SUPPLY

L.T. Power supply as required to provide essential and peripheral loads on a 24 x 7 basis shall be provided by the Contractor initiating necessary action with MSEDCL/MSETCL through MAHAGENCO.

1.19. MAIN CONTROL ROOM DC BATTERY & CHARGER

1.19.1 Adequate capacity DC battery Bank should be provided for emergency control supply of control / protection system & emergency lighting.

1.19.2 A Battery charger of appropriate capacity with relevant IS/IEC standards & protection and automatic change over system should be provided to charge the battery bank along with relay circuit, fuses, annunciations.

1.19.3 A DC power supply Distribution panel/board should be supplied along with the Charger as per relevant IS/ IEC standards.

1.19.4 Control room DC Battery Bank & DC supply system theoretical design, calculations, GTP, QAP and detailed explanations along with drawing shall be provided and approvedby MAHAGENCO.

1.20. ENERGY METERS

1.20.1 Energy meters shall be provided AT 33 kV side of the inverter Transformer and AT 220 kV Side of the Power Transformer i.e. Delivery Point at the 220 kV MSETCL substation adjacent to the project site and shall be as per the applicable Grid Code and recommendations of MSEDCL/ MSETCL.

1.20.2 The Contractor shall be responsible for installation, operation and maintenance of the Main Meters and Back-Up Meters as per the provisions of MSEDCL / MSETCL. The Contractor shall comply with arranging for installation, sealing, inspection, calibration, maintenance and testing of Main Meters and Back-Up Meters as per the applicable Grid Code and recommendations and provisions of MSEDCL / MSETCL and shall also conform to the Central Electricity Authority (Installation and Operation Meters) Regulation, 2006 as amended from time to time.

1.21. SEALING AND MAINTENANCE OF METERS

1.21.1 The Main Meters and the Back-Up Meters shall be sealed in the presence of representatives of MAHAGENCO, Contractor and MSEDCL/MSETCL.

1.21.2 When a Main Meter and/or a Backup Meter and/or any component thereof is found to be outside the acceptable limits of accuracy or otherwise not functioning properly, itshall be repaired, re-calibrated or replaced by the Contractor and/or the MSEDCL/MSETCL at the Contractor's cost, as soon as possible.

1.21.3 Any seal(s) of Main Meter or Backup Meter shall be broken only by MSEDCL/MSETCL's representative in the presence of the Contractor's representative whenever such Main Meter or the Backup Meter is to be inspected, tested, adjusted, repaired or replaced.

1.21.4 The Main Meters and Back-Up Meters shall be calibrated once in a period of one (1) year.

1.21.5 In case, both the Main Meter and the Back Up Meter are found to be beyond permissible limit of error, both shall be calibrated immediately and the correction applicable to such Main Meter shall be applied to the electricity registered by the Main Meter at the correct energy for the purpose of energy accounting/ billing for the actual period during which inaccurate measurements were made, if such period can be determined. If this period is not readily determinable, it shall be the shorter of:

- The period since the immediately preceding test of such Main Meter, or
- Forty five (45) days immediately preceding the test at which such Main Meter was determined to be defective or inaccurate.

1.21.6 Further, if the quantum of error in the meters is not determinable or where both the Main Meter and the Back Up Meter have failed to function as per specifications, then in such event, the assessment of the electricity supplied shall be equivalent to the electricity registered at the Main Meter during an equivalent generation period of 45 days in the previous calendar year.

1.22. MAIN CONTROL ROOM LIGHTING FIXTURES

All LED Lighting fixtures shall be indoor type & pre-wired comprising of Lamp(s) as indicated with lamp holder(s) and Electronic Ballast(s) with metal reflector(s). The lamp fitting shall be covered by Glass or Perspex material. The Lamp Fixture shall be fitted on wall as per direction of Site - In-charge. Alternatively,

LEDs may be used after submitting detailed descriptions of illumination computations and Test certificates from reputed test centers. The number of lighting fixtures shall be such that it shall give sufficient luminance level for daily operation as per BEE standards.

1.23. MAIN CONTROL ROOM AIR CONDITIONERS

The control room shall be equipped with appropriate energy efficient (as per BEE standards 5 star) spilt Inverter type air conditioning system suitable for heat dissipation.

1.24. SURVEILLANCE CAMERA MONITORING DESK

Surveillance CCTV system is required to ensure effective surveillance of solar power plant area (array yard, Main control room, switchyard etc.) as well as create a tamperproof record for post event analysis. The System shall provide an online display of video images on Large LCD/LED monitors located in Main Control Room as well as at Security cabin in the site. System should facilitate viewing of live and recorded images and controlling of all cameras by the authorized users present in the LAN. System should provide interoperability of hardware, OS, software, networking, printing, database connectivity, reporting, and communication protocols. System expansion should be possible through off-the-shelf available hardware.

There shall be cameras installed inside and outside the control rooms, main gate, security cabin, switch yard, all weather stations and all watch tower, providing round the clock surveillance. The location and type of cameras are mentioned as here:

1.24.1 **Location of Surveillance Cameras**:

Following table states location wise types of cameras to be used in CCTV system.

Sr. No	**Location**	**Type of Cameras**
1	Inside - Main Control Room	Dome Type
2	Outside - Main Control Room	Bullet Type
3	Main Gate	Bullet Type
4	Inside – Security Cabin	Dome Type
5	Outside – Security Cabin	Bullet Type
6	Main Switchyard & Pooling Substation	Bullet Type
7	Weather Station	Bullet Type
8	Each Watch Tower	PTZ

Cameras shall cover the entire inside & outside area of all units & main control rooms, main gates, security cabin, switch yards, all weather stations and all watch towers, providing round the clock surveillance considering the safety point of view. No. of cameras will depend on the design of Surveillance & vigilance CCTV system.

Design & drawing for the Surveillance & vigilance CCTV system shall be submitted for approval to MAHAGENCO.

1.24.1 **Equipment with better specifications shall be accepted.**

a. CCTV Cameras should have low lux so that the same can operate in minimum illumination also. Cameras should have both auto/manual focus mode and control should also be both manual/auto.
b. The system should be based on Stand Alone Integrated DVR (Digital Video Recording). Specifications of Stand Alone Integrated DVR:
    i. Ability to connect Cameras as per requirement,
    ii. Facility to store 90 days of Video,
    iii. Capability to set the frame rate, contrast, brightness of each individual camera,
    iv. Shall have facility to view live video (with audio) images in a monitor, in a PC and web browser.
    v. Remote Administration: Should be fully administrable/ programmable remotely through client software and web browser.
    vi. Recording rate per channel - NTSC/30 fps per channel, PAL/25 per channel.
    vii. Configurable/adjustable recording rate.
    viii. Full recording and playback facilities on remote machine.
    ix. Smart monitoring (Motion Detection).
    x. Adjustable motion detection (motion detection sensitivity should be adjustable).
    xi. Ability to convert H.264 video into AVI files.
    xii. Date and time stamping of video files.
    xiii. Viewing for all cameras.
    xiv. Shall support backup devices like USB drive, DVD writer DVR Software must be able to take backup in DVD writer, USB drive etc.
    xv. Shall have live display, playback, record facilities.
    xvi. Shall have minimum 1 USB port.
c. System should have the capability of increasing the storage capacity as and when required.
d. It shall have low maintenance cost and should be upgradeable to inputsfor more cameras, as and when required, with minimum cost.
e. It shall be compatible with alarm system.
f. Cameras should be C-mount type.
g. The firm installing the system should have adequate infrastructure for providing aftersales/installation service.
h. Cameras of CCTV system must at least cover the following areas:

1.24.2 PTZ Cameras (IP base)

- 36x optical zoom and 16x digital zoom, up to 432x total zoom
- High resolution of 540TVL (color) and 570TVL (B/W)
- Wide Dynamic Range (WDR)
- True Day/Night (IR-cut filter)
- IP66 rate and surge protector
- Pan speed up to 300°/sec and tilt speed up to 120°/sec
- High-performance memory with 128 preset positions, 24 privacy mask zones

and 3 self-learning auto tracks
- Advanced security functions and network administration, such as encryption.
- HTTPS preserved performance, IPv4 and IPv6 and Quality of Service.

1.24.3 Integrated IR Bullet camera (IP base)

- Ultra-high resolution: 700TVL
- Min. illumination: 0 Lux (IR ON)
- 2 IR LED array lights; 30 – 40m IR range
- 5 - 50mm lens
- True Day/Night (with IR-cut filter)
- AES, BLC, White Balance, digital spot compensation, lens shaded control, horizontal mirror
- Motion detection, privacy masking
- Lens shaded control, horizontal mirror, OSD
- Defog function
- IP66, aluminum casing – vandal-proof, lightening-proof
- UTC (Up-the-Coax) function optional
- HTTPS preserved performance, IPv4 and IPv6 and Quality of Service.

Operating Temperature	-20°C to 50°C
Storage Temperature	-30°C to 70°C
Operating Humidity	90%RH (non-condensing)
Casing Material	Aluminum Alloy
Rating	IP66, vandal proof, lightening proof

1.24.4 Dome camera (IP base)

- Ultra-high resolution: 700TVL
- 5 - 50mm lens
- True Day/Night (with IR-cut filter)
- White Balance, electronic Shutter adjustable, BLC
- Lens shaded control, horizontal mirror
- Defog function
- Motion detection, privacy masking, OSD
- Up-the-Coax (UTC) function (optional) for controlling OSD remotely
- 24V AC / 12V DC
- HTTPS preserved performance, IPv4 and IPv6 and Quality of Service.
- Video Cable: RG59U video cable (with heavy gauge PVC conduit)
- Power Cable with heavy Gauge
- Other technical requirements:
- The DVR system shall have CE certification with certificates
- All Cameras must be provided with suitable mounts/housings Wall, Dome etc.
- All cameras must be connected with DVR system with RG59 (with heavy gauge PVC conduits) cables and vendor must perform the necessary cablingto connect DVR with cameras.
- The DVR system offered must be an integrated DVR system and shall not be a DVR system assembled using third party Personal Computers and DVR cards.

- 16 channel DVR shall be able to support D1 resolution for all camera's with 16 TB HDD facility & they shall have a central management software & joystick keyboard shall be there for PTZ Controlling.
- Training Aspect: At the time of installation of equipment, the vendor shall offer free training specific to CCTV system.
- CCTV vendor shall be reputed and have relevant experience of similar solutions in any of Private/ PSU/ State Govt . Supporting documents in formof customer completion letter shall be submitted at vendor approval stage to Mahagenco.
- The CCTV system shall be warranted for 5 years from the date of commissioning. Circuit diagram for the Surveillance & vigilance CCTV system shall be submitted for approval to MAHAGENCO

1.24.5 Fire Protection System

The SPP shall be equipped with suitable fire protection &firefighting systems for protection of entire equipment including SPV, Inverter room, Main Control Room, main switchyard & Pooling Substation and Security Cabins as per CEIG requirements. Contractor shall comply with **recommendation** of Tariff Advisory Committee to incurring minimal premium for insurance. The installation shall meet all applicable statutory requirements, safety regulations in terms of fire protection.

1.24.6 Fire Extinguishers

Liquefied CO_2 fire extinguisher shall be Upright type of capacity 10 kg having IS: 2171. 7 IS: 10658 marked. The fire extinguisher shall be suitable for fighting fire of Oils, Solvents, Gases, Paints, Varnishes, Electrical Wiring, Live Machinery Fires, and All Flammable Liquid & Gas.

Contractor to provide following number of portable fire extinguisher

Particular	DCP Type (ABC type) (10 Kg. Cap)	CO2 Type Hand held (9 kg)	Foam Type Hand held (9 kg)
Main Control Rooms	3 each	3 each	3 each

1.24.7 Fire Detection & Alarm

Contractor to provide intelligent microprocessor based main fire alarm panel of modular construction complete with central processing unit, input and output modules, power supply module, supervision control and isolator modules with 10% spare provisions.

Fire detection alarm system shall include alarm initiating devices e.g. multisensor type smoke detectors and alarm notification Appliances (Audio device). Multisensor type smoke detectors shall be provided for below false ceiling areas of Main Control Room. One (01) sensor shall be provided for each 25 sqm. of area in Main Control Room.

1.24.8 Fire Alarm Control Panel:

- Alarm conditions shall be immediately displayed on the control panel of Main Control Room. Alarm LED shall flash on the control panel until the alarm has been acknowledged. Once acknowledged the LED shall remain lit. A subsequent alarm received from another zone after acknowledgement shall illuminate the alarm LED and the panel display shall show the new alarm information.
- During an alarm condition, an alarm tone shall sound within the control panel until the

alarm is acknowledged.

- If the audible alarm signals are silenced for any reason, they shall automatically resound if another zone is activated.
- All alarm signals shall be automatically "locked in" at the control panel until the operated device is returned to its normal condition and the control panel is manually reset.

1.25. OTHERS

Any Electrical work which is not mentioned or included here but necessary for the plant shall be borne by Contractor.

1.26. TECHNICAL REQUIREMENTS OF POWER EVACUATION SYSTEM:

1.26.1 Scope of Civil Work for 33/220 kV Main Switchyard (Pooling Substation)

Indoor/outdoor Inverter Room switchyards of capacity 1-12.5MW of 240-800V/33kV for each Unit Control Room (Inverter Room) as per design of suitable primary side voltage and current in accordance with inverter AC output. Solar power from these Inverter Room Switchyard will be pooled in main switchyard of 62 MW_{AC} project through underground 33kv XLPE cables from Inverter Room Switchyard. Main Switch yard will consist one numbers of Power Transformer of 33/220 kV and other required equipment's as per MSETCL requirement. Solar power at 220kV will be transmitted through transmission line/underground cable to interconnection point which is situated in adjacent MSETCL 220kV substation of Paras.

Contractor shall be responsible to construct 220kV bay/s and interconnection points at MSETCL 220 kV at Paras substation.

a) Main Switchyard (Pooling Substation):

For 62 MWAC Capacity separate Switchyard will be situated at the pre-decided suitable area. Itshall consist a 33 kV and 220 kV Circuit Breaker, Metering, Protection CTs, PTs, LAs, Isolators & any other associated equipments etc. All these equipments shall be outdoor type.

Construction of the 220kV bay at the plant end and MSETCL substation end (If required) is in scope of the Contractor. Total evacuation arrangement and testing commissioning cost of the same shall borne by the EPC.

O&M of the evacuation lines (i.e. underground/ overhead line) is in scope of EPC. Construction of the Meter room is in scope of the contractor.

Supply and installation of the ABT meter/ summation meter by approval of MSETCL/MSEDCL requirement with Automated meter reading (AMR) is in scope of the EPC Contractor.

b) The underground cables of 33 kV between Inverter room till switchyard is in the scope of the Contractor. This line shall be XLPE Aluminum cable confirming to IEC60502 and IS7098-II.

c) The Contractor has to do the power evacuation up to interconnection point i.e. 220 kV bus level of nearest MSETCL Paras substation via 220 kV overhead transmission line/ underground cable with the all necessary infrastructure such as protection switchgears and metering systems as per the requirement of the MSEDCL and MSETCL.

d) This 220 kV line shall be constructed as per state grid code and MSETCL norms.

Site wise nearest substation details are as follow-

a. Construction of 220 kV switchyard with associated electrical works required for interfacing with grid (i.e. transformer, breakers, isolators panels, protection system, earthing and metering).
b. The Contractor has to do the power evacuation and integration to at 33/220KV substation via overhead line with the double pole structure / underground cable at 220 kV grid voltage with all necessary infrastructuresuch as protection switchgears and metering systems as per the requirement of the MSEDCL and MSETCL requirement. Contractor shall be liable for approvals, permissions and NOC from MSEDCL & MSETCL at its own cost.
c. Construction of the 220kV bay at the plant end side is in scope of the Contractor.
d. Total evacuation arrangement and testing commissioning cost of the same shall borne by the EPC Contractor.
e. O&M of the evacuation lines (i.e. underground/overhead line) is in scope of EPC Contractor.
f. Construction of the Bays should have done by the EPC Contractor at the plant end side.
g. Construction of the Meter room is in scope of the Contractor.
h. Supply and installation of the ABT meter with Automated meter reading (AMR) is in scope of the EPC Contractor.

1.26.2 Land Developing & Leveling

Land developing work of the entire switchyard area of the plant premises shall have to be done as per drawing developed by Contractor and as approved by MAHAGENCO. Leveling must be carried out as per requirement.

1.26.3 Water Arrangement for Earthing:

Contractor shall make water arrangement for continuous requirement of earth pits in switchyard.

1.26.4 Earthing System

The 415–600V, 33kV, 220kV (or with suitable primary side voltage and current in accordance with inverter AC output) equipment and parts shall be earthed as required as per provisions of IS.

The intent of this specification is to define the requirements for the supply wherever applicable, installation, testing and commissioning of the Earthing System Standards

The work shall be carried out in the best workmanship in conformity with this specification, the relevant specifications/codes of practice of Indian Standard Institution, approved drawings and instructions of the Engineer-in-charge or his authorized representative issued from time to time. For earthing installation work details' along with all Drawings/Data Sheets have to be approved by MAHAGENCO. In case of any conflict between the standards, the instructions of Engineer-in- Charge of MAHAGENCO shall be final and binding.

In addition to the standards all works shall also conform to the requirements of the

following Rules & Regulations.

- Indian Electricity act and rules framed there under.
- Fire insurance regulations.
- Regulation laid down by Chief Electrical Inspector of State, State Electricity Board.
- Regulations laid down by the Chief Inspector of Explosives.
- Regulations laid down by the Factory Inspector of state.
- Any other regulations as may be laid down by the Central/Local authorities.

1.26.5 Grounding and lightning protection system

1.26.5.1 The station earthing system shall be as designed that actual step and touch voltage are well within the maximum safe values at the site. The design shall be done in compliance of IEEE guide and shall be subject to approval.

1.26.5.2 Grounding system shall consist of a ground grid formed by a number of M.S. Rods placed in a mesh foundation by all welded joints, riser connections from ground gridand ground G.S. flat for grounding of equipment. Ground electrodes shall also beprovided at intervals and driven into solid earth.

1.26.5.3 Size of below ground conductor shall be selected based on unrestricted ground fault current and maximum duration of fault closing time shall be 1 second. Connection to individual equipment shall be sized based on fault clearing time.

1.26.5.4 Metal body of all electrical items of motors, transformers, switchgears shall have duplicate ground connection. All exposed conductive parts of plant and equipment; control cubicles, valves actuators, cable glands and armors etc. shall be effectively earthed.

1.26.5.5 All extraneous conductive parts such as structural steel work, cable support steel work, steel tanks and pipe works compound and station perimeter, fences gates etc. shall be effectively bonded to the earthing system.

1.26.5.6 A separate instrument earth network shall be provided, single point connected to the main earth system, to which all alarm, control computer, instrument etc. earth connection shall be made Instrumentation cable screens shall be single point bonded to the instrument earth network to minimize the effects of electrical interference.

1.26.5.7 The Lightning protection of Power station, other buildings, chimney etc. shall be designed and executed as per code of practice for lightning protection and connected directly to main ground grid. The main earthing grid conductor shall be of M.S. Rod. Sizes for main conductors shall be selected by the Contractor to suit the system requirement. Earth electrodes shall be as per IS 3043.

1.26.6 Earthing network

1.26.6.1 The earthing installation shall be done in accordance with the earthing drawings, specifications and the standard drawings of reference. The entire earthing system shall fully comply with the Indian Electricity Act and Rules framed there under. The Contractor shall carryout any changes desired by the Electrical Inspector or MAHAGENCO, in order to make the installation conform to the Indian Electricity Rules at no extra cost. The exact location of earth conductors, earth electrodes and earthing points on the equipment shall be determined in field, in consultation with the Engineer-in-charge or his authorized representative. Any changes in the methods, routing, size etc. MAHAGENCO/Engineer-in- charge approval shall be obtained before execution.

1.26.6.2 Excavation and refilling of earth, necessary for laying underground earth loops shall be the responsibility of the Contractor.

1.26.6.3 The earth loop impedance to any point in the electrical system shall have a value which will ensure satisfactory operation of protective devices.

1.26.6.4 The main earth loop shall be laid at a depth of 1000 mm below grade level. Wherever cable trenches are available, the earth lead shall be laid in the trenches. The earthing strip shall be protected against mechanical damage.

1.26.6.5 In process unit areas, the earthing cable/strip shall be run along cable trays wherever specified in the layout drawings. The earthing strip/cable shall be suitably cleaved and electrically bonded to the cable tray at regular intervals.

1.26.6.6 Joints and tapping in the main earth loop shall be made in such a way that reliable and good electrical connections are permanently ensured. All joints below grade shall be welded and suitably protected by giving two coats of bitumen and covering with Hessian tape. All joints above ground shall be made by means of connectors/lugs as far as practicable. Tee connectors shall be used for tapping earth leads from the main earth loop wherever it is installed above ground. Earthing plates shall be provided for earthings of two or more equipment at a place from earth grid.

1.26.6.7 Where aluminum cable risers are to be connected to the underground MS earth bus, the aluminum cable riser shall be taken to the nearest earth pit and terminated through a bolted joint. If this is not practicable, then a MS riser shall be brought above grade anda bolted joint shall be made between this MS riser and the aluminum cable riser just above grade. Aluminum lugs shall be used for cable termination. This MS Riser shall be protected by applying two coats of bituminous paint/bitumen on the exposed portion.

1.26.6.8 Conduits in which cables have been installed shall be effectively bonded and earthed. Cable armours shall be earthed at both ends.

1.26.6.9 HV and LV earthing system shall not be mixed and to be kept separately.

1.26.6.10 Contractor shall submit Theoretical design calculations and detailed explanations along with drawings shall be provided and approved by MAHAGENCO.

1.26.6.11 Earth electrodes : Earth pipe electrodes shall be installed as shown in the earthing layout drawings and in accordance with the standard drawings of reference and IS: 3043. Their location shall be marked to enable accurate location by permanent markers.

1.26.7 Foundations for Various Structures

Foundation of all Switchyard equipment transformers, L.A. C.T., P.T. Isolators, Gang operated isolators etc. should be RCC works of M25 grade as per IS 456-2000 and the materials used viz. Cement reinforcement, steel etc. shall be as per relevant IS/ IEC standards. In addition IS: 2502 Code of Practice for Bending and Fixing of Bars for concrete Reinforcement must be complied. Reinforcement shall be high strength TMT Fe 415 or Fe 500 conforming to “IS: 1786-1985”.

1.26.8 Stone Metal Spread

Suitable size stone metal as per IS/ IEC standards should be spread in switchyard area as per requirement.

1.26.9 Cable Trench

Suitable size cable trenches as per IS/ IEC standards should be constructed in switchyard as per requirement.

1.26.10 Sand Buckets

Sand bucket should be wall mounted made from at least 24 SWG sheet with bracket fixing on wall conforming to IS 2546

1.26.11 Fencing & Gates

The fencing work required for electrical switchyard shall be of barbed wire / twisted

G.I. fencing wire in accordance to IS: 278 and CEIG requirement. It shall be of commercial type and conforming to "IS: 226- 1969". M.S. angle posts shall confirm to "IS: 226-1969 and IS 800- 1984". Suitable Gates should be provided

Fencing & gate drawing shall be provided by the Contractor and the same shall be got approved from MAHAGENCO.

1.26.12 Others

Any Civil work for Main Switchyard which is not mentioned or included here but necessary for the plant shall be borne by Contractor.

1.27. SCOPE OF ELECTRICAL WORK FOR 33kV SWITCHYARD (Outdoor)

The manufacturers for all electrical and electronic components such as Meters, Protection Relays, AC Cables, Lightning Arrestors, Control Panels, Isolators, etc., and wherever no specific experience requirement is mentioned, must have manufacturing track record of at least ten (10) years.

1.27.1 Transformers 240-800V/33kV (or suitable voltage)

Each step up transformer shall be 3 phase, 240-800V/33kV (or with suitable primary side voltage and current in accordance with inverter AC output), 1250 / 6874 kVA, 50 Hz. "Two primary and One secondary" type three windings transformers can be used in case required as per design. The noise level shall be in accordance to NEMA TR-1. Transformer shall have Off Circuit Tap Changer with tapings of at least +/- 15% with individual steps of 2.5%. The vector group, impedance, bushing rating, HV/LV termination & neutral earthing shall also meet the system requirement & shall also be in line with standards as mentioned in this specification. Air clearance shall be in line with CBIP norms. Suitable Bushing CTs shall be provided to meet the system protection requirement. Transformer shall be in accordance to IS:2026 or equivalent to any other international standard. The designs and specifications must be submitted to MAHAGENCO for approval.

The Bidder/its Sub-vendor should have designed, manufactured and supplied transformers of 33 kV or higher voltage class of cumulative capacity of 40 MVA or above, out of which at least one such supply order for a single plant should be of 10 MVA or above capacity.

The reference plant in which transformers of 10 MVA or above capacity (consisting of one or more) were supplied, must have been in successful operation for at least six (6) months prior to the date of award of contract by MSPGCL to the bidder

1.27.1.1 General Construction

- Transformer shall be constructed in accordance to IS:2026 and IS:3639 or equivalent to any other international standard. Transformer shall be complete & functional in all respect and shall be in scope of supplier. The other important construction particulars shall be as below.
- The Transformer tank and cover shall be fabricated from high grade low carbon plate

steel of tested quality. The tank and the cover shall be of welded construction and there should be provision for lifting by crane.

- A double float type Buchholz relay conforming to IS: 3637 shall be provided. The relay shall be provided with a test cock suitable for a flexible pipe connection for checking its operation.
- Suitable Inspection hole(s) with welded flange(s) and bolted cover(s) shall be provided on the tank cover. The inspection hole(s) shall be of sufficient size to afford easy access to the lower ends of the bushings, terminals etc.
- All bolted connections to the tank shall be fitted with suitable oil tight gaskets which shall give satisfactory service under the operating conditions for complete life of the transformer if not opened for maintenance at site.
- The transformer shall be provided with conventional single compartment conservator. The top of the conservator shall be connected to the atmosphere through a transparent type silica gel breather. Silica gel is isolated from atmosphere by an oil seal.
- Transformer shall have adequate capacity Conservator tank to accommodate oil preservation system and volumetric expansion of total transformer oil. The conservator shall be bolted into position so that it can be removed for cleaning purposes.
- Transformer shall have Oil Temperature Indicator and Winding temperature Indicator with accuracy class of +/-2 deg.
- The radiators shall be detachable type, mounted on the tank with shut off valve at each point of connection to the tank, along with drain valve at the bottom and relief valve at the top.
- The new insulating oil before pouring into the transformer shall conform to the requirement of IS: 335. No inhibitors shall be used in the oil. The oil samples taken from the transformer at site shall conform to the requirements of IS: 1866.
- A sheet steel, weather, vermin and dust proof marshaling box shall be furnished with each transformer to accommodate temperature indicators & terminal boards for incoming and outgoing cables.

1.27.1.2 Windings

- The Contractor shall ensure that windings of all transformers are made in dust proof & conditioned atmosphere.
- The Contractor shall furnish details of the facilities available at works along with the bid.
- The conductors shall be of electrolytic grade copper free from scales & burrs.
- All windings of the transformers shall be fully insulated.

1.27.1.3 Core

- The core shall be constructed from high-grade non-aging, cold rolled, super grain oriented silicon steel laminations.
- Core isolation level shall be 2 kV (rms.) for 1 minute in air.
- Adequate lifting lugs will be provided to enable the core & windings to be lifted.

1.27.1.4 Fittings

The following fittings shall be provided with transformer:

- Breather for conservators shall be mounted not more than 1400 mm above rail top.

- Minimum two Nos. of spring operated pressure relief devices with alarm/trip contacts. Discharge of PRD shall be properly taken through pipes & directed away from the transformer /other equipment.
- Air release plug.
- Inspection openings and covers.
- Bushing with metal parts and gaskets to suit the termination arrangement.
- Cover lifting eyes, transformer lifting lugs, jacking pads, towing holes and core and winding lifting lugs.
- Protected type Mercury or alcohol in glass thermometer.
- Bottom and top filter valves with threaded male adapters, bottom Sampling valve & drain valve.
- Rating and diagram plates on transformers and auxiliary apparatus.
- Prismatic/toughened glass oil gauge for transformers and Tap Changer chamber
- 150 mm dial type oil temp indicator with alarm and trip contacts, maximum reading pointer & resetting device.
- 150-mm dial type Winding temp indicator with alarm and trip contacts, maximum reading pointer & resetting device.
- Flanged bi-directional wheels. (as applicable)
- Marshaling Box.
- Bushing current transformers.
- Drain valves/plugs shall be provided in order that each section of pipe work can be drained independently. Sludge valve at bottom most point of tank to be provided for easy flush out/removal of sludge during maintenance.
- Terminal marking plates.
- Valves schedule plates.
- Equipment earthing.
- The fittings listed above are only indicative and other fittings, which generally are required for satisfactory operation of the transformer, are deemed to be included.

1.27.1.5 Performance

- The maximum flux density in any part of the core & yoke at the rated MVA, voltage & frequency shall be such that under 110% continuous voltage condition it does not exceed 1.9 Tesla.
- The transformer & all its accessories including CTs etc., shall be designed to withstand without injury the thermal & mechanical effects of any external short circuit to earth & of short circuits at the terminal of any winding for a period of 2 sec. Contractor shall submit the short circuit withstand calculations.
- Transformers shall withstand, without injurious heating, combined voltage & frequency fluctuations, which produce the following over fluxing condition:

110%	Continuous
125%	For One Second
140%	For Five Seconds

- Contractor s to provide 150% voltage withstand capacity in time/cycle.
- The transformers shall be capable of being operated continuously without danger at

the rated MVA with voltage variation of ±10%.

- The transformers shall be capable of being loaded in accordance with IS: 6600 / IEC: 60354 up to load of 150%. There shall be no limitation imposed by bushings etc. or any other associated equipment.

1.27.1.6 Tests and Inspection

The Type Test & Routine test of the transformer shall be carried out in accordance with IS: 2026 or as specified elsewhere in the specification In addition to this tank Vacuum test and tank pressure test shall also be carried out as a type test in line with CBIP norms.Oil leakage test shall also be performed as routine test as per the clause no. 1.27.1.9 below.

In case the Contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit the type test reports to MAHAGENCO for waiver of conductance of such type test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.

In case the Contractor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in case the type test report(s) are not foundto be meeting the specification requirements, the Contractor shall conduct all such tests under this contract free of cost to the Employer and submit the reports for approval.

1.27.1.7 Vacuum Test –

Each type of transformer tank shall be subjected to the specified vacuum. The tank designed for full vacuum shall be tested at an internal pressure of 3.33 KN/sq. m absolute (25 torr) for one hour. The permanent deflection of the plate after the vacuum has been released shall not exceed the values specified below:

Horizontal length of flat plate (mm)	**Permanent deflection (mm)**
Up to and including 750	5.0
751 to 1250	6.5
1251 to 1750	8.0
1751 to 2000	9.5
2001 to 2250	11.0
2251 to 2500	12.5
2501 to 3000	16.0
Above 3000	19.0

1.27.1.8 Tank pressure Test –

Transformer tank of each type shall be subjected to a pressure corresponding to twice the normal head of oil or to the normal pressure plus 35 KN / sq. m whichever is lower, measured at the base of the tank & maintained for one hour. The permanent deflection of the plates after the excess pressure has been released shall not exceed the figure specified above for vacuum test.

1.27.1.9 Oil leakage test on assembled transformer –

All tank & oil filled compartment shall be tested for oil tightness by being completely filled with oil of viscosity not greater than that of specified oil at the ambient temperature& applying pressure equal to the normal pressure plus 35 KN/sq. m measured at the base of the tank. The pressure shall be maintained for a period of not less than 24 hours during which time no sweating shall occur.

1.27.2 Lightning Arrestor

- The surge arrestors (SAs) shall conform in general to IEC 60099-4 or IS: 3070 except to the extent modified in the specification. Arresters shall be of hermetically sealed units,self-supporting construction, suitable for mounting on lattice type support structures. Contractor shall furnish the technical particulars of Surge arrester.

- The SAS shall be of heavy duty station class and gapless Metal Oxide type without any series or shunt gaps. The SAs shall be capable of discharging over-voltages occurring during switching of unloaded transformers, and long lines.

- Arrestors shall be complete with insulating base for mounting on structure. Self- contained discharge counters, suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit with necessary connection. Suitable leakage current meters should also be supplied within the same enclosure. The reading of millimeter and counters shall be visible through an inspection glass panel
- The surge arrestors shall conform to type tests and shall be subjected to routine and acceptance tests in accordance with IEC-60099-4

Rate System Voltage	36kV
Rate Arrester Voltage	30kV
Nominal Discharge Current	10 kA of 8/20 micro sec wave
Minimum Discharge Capability	5 kJ/kV (referred to rated arrester voltage corresponding to minimum discharge characteristics
Maximum Continuous Operating	24 kV rms
Maximum Residual Voltage (1kA)	70 kVp
Maximum Residual Voltage at 10kAnominal discharge current(8/20 micro sec wave)	85 kVp
Maximum Switching Impulse ResidualVoltage at 500A Peak(	70 kVp
Maximum Steep Current Residual Voltage	93 kVp at 10 kA
High Current short duration test value (4/10 micro sec wave)	100 kAp
Current for Pressure Relief Test	25 kA rms

One Minute Power Frequency Withstand voltage of Arrester Housing (dry and wet)	70 kV (rms)
Impulse Withstand Voltage of Arrester Housing with 1.2/50 microsec wave	170 kV (Peak)
Radio Interference Voltage at 156 kV	< 1000 micro volt
Partial Discharge at 1.05 MCOV (continuous operating voltage)	< 50%

1.27.3 Isolators

The isolators and accessories shall confirm in general to IEC 62271-102 (or equivalent Indian standard) except to the extent explicitly modified in specifications. Earth switches shall be provided on isolators wherever mentioned.

Operating Mechanism of Isolator and Earth	Motor operated
Nominal System Voltage	36kV
Highest System Voltage	30kV
Type	
Rated short time current of isolator and earth switch	25 kA (rms) for 1 sec
Rated dynamic short time withstand current of isolator and earth switch	62.5kA (peak)
Impulse withstand voltage with 1.2/50 micro sec wave	170kVp to earth 195 kVp across isolating distance
One minute power frequency withstand voltage	70 kV (rms) to earth & 80 kV (rms) across isolating distance
Temperature Rise	As per Table-IV of IS: 9921
Rated mechanical terminal load	As per 62271-102
Creepage Distance (Total)	900 mm
Line charging breaking capacity	6.3 A
Transformer off-load breaking	6.3 A

- Isolator shall be gang operated for main blades and earth switches. The operation of the three poles shall be well synchronized and interlocked.
- The design of linkages and gears shall be such so as to allow one man to operate the handle with ease for isolator and earth switch.
- They shall be constructed such that they do not open under influence of short circuit current and wind pressure together. The earth switches wherever provided shall be constructional interlocked so that the earth switches can be operated only when the isolator is open and vice-versa.
- In addition to the constructional interlock, isolator and earth switches shall have provision to prevent their electrical and manual operation unless the associated and other

interlocking conditions are met. All these interlocks shall be of failsafe type. Suitable individual interlocking coil arrangements shall be provided. The interlocking coil shall be suitable for continuous operation from DC supply and within a variation range as stipulated in relevant section. The interlock coil shall be provided with adequate contacts for facilitating permissive logic for "DC" control scheme of the isolator as well as for AC circuit of the motor to prevent opening or closing of isolators when the interlocking coil is not energized.

1.27.4 Circuit Breaker for Inverter Transformer

1.27.4.1 **Circuit Breakers shall be outdoor/indoor type, comprising three identical single pole units, complete in all respects with all fittings and wiring. The circuit breakers and accessories shall conform to IEC- 62271-100 or equivalent Indian Standard.**

Duty Requirements

- Circuit breaker shall be C2/M1class under all duty conditions and shall be capable of performing their duties without opening resistor. The circuit breaker shall meet the duty requirement of any type of fault or fault location and shall be suitable for line charging and dropping when used on 33 kV effectively grounded or ungrounded systems and perform make and break operations as per the stipulated duty cycles satisfactorily.
- The circuit breaker shall be capable for breaking the steady & transient magnetizing current corresponding to 33 kV transformers. It shall also be capable of breaking line charging currents as per IEC- 62271-100 with a voltage factor of 1.4.
- The rated transient recovery voltage for terminal fault and short line faults shall be as per IEC: 62271-100.
- Contractor shall indicate the noise level of breaker at distance of 50 to 150 m from base of the breaker.
- The Contractor may note that total break time of the breaker shall not be exceeded under any duty conditions specified such as with the combined variation of the tripcoil voltage, pneumatic pressure etc. While furnishing the proof of the total break time of complete circuit breaker, the Contractor may specifically bring out the effect of non-simultaneity between same pole and poles and show how it is covered in the guaranteed total break time.
- While furnishing particulars regarding the D.C. component of the circuit breaker, the Contractor shall note that IEC-62271-100 requires that this value should correspond to the guaranteed minimum opening time under any condition of operation.
- The critical current which gives the longest arc duration at lock out pressure of extinguishing medium and the duration shall be indicated.
- All the duty requirements specified above shall be provided with the support of adequate test reports to be furnished along with the bid.

1.27.4.2 Operating Mechanism

- Circuit Breaker shall be vacuum or SF6 type with electrically spring charged mechanism
- The operating mechanism shall be anti-pumping and trip free (as per IEC definition) electrically and either mechanically or pneumatically under every method of closing. The mechanism of the breaker shall be such that the position of the breaker is maintained even after the leakage of operating media and/or gas. The circuit breaker

shall be able to perform the duty cycle without any interruption.

- Electrical tripping shall be performed by shunt trip coil. Provision shall also be made for local electrical control. „Local / remote" selector switch and close & trip push buttons shall be provided in the breaker central control cabinet. Remote located push buttons and indicating lamps shall also be provided.
- Operating mechanism and all accessories shall be in local control cabinet. A central control cabinet for the three poles of the breaker shall be provided along with supplyof necessary tubing, cables, etc.

1.27.4.3 General Parameters

Type of circuit breaker	Vacuum type or SF6 type
Highest system Voltage	36 kV
Rated frequency	50 Hz (+3% to -5%)
Number of poles	Three (3)
Rated/minim po frequency 70 kV voltage Withstand	
Rated lightning impulse voltage	170 kV
Minimum Creepage distance	25 of system voltage
Rated operating duty cycle	0 - 0.3 sec. - CO - 3min. - CO
Rated line charging breaking	As per IEC Current (voltage factor of 1.4)
Reclosing	Single and three phase high speed auto reclosing
Maximum fault level	25 kA (rms) for 1 sec
Total closing time	Not more than 150 ms
Auxiliary contacts	As required plus 4NO and 4NC contacts per pole as spare.
Noise level	Maximum 140dB at 50m distance from base of circuit breaker
Seismic acceleration	0.3 g horizontal

1.27.5 Conductors & Insulators

- All switchyard overhead conductors should be designed as per IS/ IEC standards & should have adequate size and current carrying capacity.
- Bushings shall be manufactured and tested in accordance with IS: 2099 & IEC: 137. Hollow column insulators shall be manufactured and tested in accordance with IEC: 60233/IS: 5261. The support insulators shall be manufactured and tested as per IS: 2544 / IEC: 600168/IEC: 600273. The insulators shall also conform to IEC 815 as applicable. Contractor shall furnish the technical particulars of all type of insulators used.
- Porcelain insulator shall comply IS: 731-1976 or equivalent international standard and shall be homogenous, free from laminations, cavities and other flaws or imperfections

that might affect the mechanical or dielectric quality and shall be thoroughly vitrified, tough and impervious to moisture. Hollow porcelain should be in one integral piecein green & fired stage

- Contractor may offer silicone rubber housed composite type insulator as an alternative to the above porcelain insulator with equivalent creepage distance.

1.27.6 Instrument Transformers

1.27.6.1 General Requirement:

1. The instrument transformers i.e. current and voltage transformers shall be single phase transformer units and shall be supplied with a common marshaling box for a set of three single phase units. The tank as well as top metallic shall be hot dip galvanized or painted Grey color as per RAL 9002.
2. The instrument transformers shall be oil filled hermetically sealed units. The instrument transformers shall be provided with filling and drain plugs.
3. Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block. The insulators shall have cantilever strength of more than 500 kg.
4. Manufacturers of Current Transformers and Voltage Transformers shall haveexperience of having supplied similar CTs and VTs in power plants having a cumulative capacity of at least 1000 MW.

1.27.6.2 Current Transformers (CTs)

1. The CTs shall have single primary of either ring type or hair pin type or bar type. In case of "Bar Primary" inverted type CTs, the following requirements shall be met:
2. The secondaries shall be totally encased in metallic shielding providing a uniform equi-potential surface for even electric field distribution.
3. The lowest part of insulation assembly shall be properly secured to avoid any risk of damage due to transportation stresses.
4. The upper part of insulation assembly sealing on primary bar shall be properly secured to avoid any damage during transportation due to relative movement between insulation assembly and top dome.
5. The CT shall be provided with oil sight glass.
6. Different ratios shall be achieved by secondary taps only, and primary reconnections shall not be accepted.
7. The guaranteed burdens and accuracy class are to be intended as simultaneous for all cores.
8. The instrument security factor at all ratios shall be less than five (5) for metering core. If any auxiliary CT/reactor is used, then all parameters specified shall be met treating auxiliary CTs/reactors as integral part of CT. The auxiliary CT/reactor shall preferably be in-built construction of the CT. In case it is separate, it shall be mounted in secondary terminal box.
9. The secondary terminals shall be terminated on stud type suitable no's of non-disconnecting and disconnecting terminal blocks inside the terminal box of degree of protection IP: 55 at the bottom of CT.
10. The CTs shall be suitable for horizontal transportation.
11. The CTs shall have provision for taking oil samples from bottom of CT without

exposure to atmosphere to carry out dissolved gas analysis periodically. Contractor shall give his recommendations for such analysis, i.e. frequency of test, norms of acceptance, quantity of oil to be withdrawn, and treatment of CT.

12. The CT shall have provision for measurement of capacitance and tan delta as erected at site.

General Parameters for Current Transformers

Highest system Voltage(Um)	36 kV
Rated frequency	50 Hz
System neutral earthing	effective earthed
Installation	Outdoor
Rated short time thermal current	25 kA for 1 sec
Rated dynamic current	63 kA (Peak)
Rated min power frequency withstand voltage (rms value)	70kV
Rated lightning impulse withstand	170kV
Partial discharge level	10 pico Coulombs max
Minimum Creepage distance	25 mm/kV of highest system Voltage
Temperature rise	As per IEC 60044
Type of insulation	Class A
Number of cores	Three (3) with 2 protection cores and one metering core of accuracy 0.2s class.
Number of terminals in marshalling box	All terminals of control circuits wired up to marshalling box plus 20 terminals spare

1.27.6.3 Voltage Transformers (VTs)

1. Voltage transformers shall be electro-magnetic(EMU) type and shall comprise of compensating reactor, intermediate transformer, and protective and damping devices. The oil level indicator of EMU with danger level marking shall be clearly visible to maintenance personnel standing on ground.
2. The secondaries shall be protected by 3A HRC cartridge type fuses for all windings. In addition fuses shall also be provided for protection and metering windings for connection to fuse monitoring scheme. The secondary terminals shall be terminated on stud type non-disconnecting terminal blocks via the fuse inside the terminal box of degree of protection IP: 55. The access to secondary terminals shall be without the danger of access to high voltage circuit.
3. The accuracy of metering core shall be maintained through the entire burden range up to 75VA on all three windings without any adjustments during operations.

System neutral earthing	Effectively earthed
Installation	Outdoor
System fault level	25 kA
Rated min power frequency withstand voltage(rms value)	70 kV
Rated lightning impulse withstand voltage (peakvalue)	170 kV
Standard reference range of frequencies forwhich accuracy is valid	96% to 102% for protection and 99% to 101% for measurement
Rated voltage factor	1.2 continuous & 1.5 for 30 sec
Class of accuracy	0.2/3P
Stray capacitance and stray conductance of LVterminal over entire carrier frequency range	As per IEC 358
One Minute Power frequency withstand voltage – for secondary winding	2 kV rms
Temperature rise over ambient temp of 50degrees C	As per IEC 60044
Number of Terminals in control spare	All terminals of control circuits wired Cabinet up to marshaling box plus 10 terminals
Rated total Thermal burden	350 VA
Partial Discharge level	10 Pico Coulombs max
Number of Cores	Two (2); one for protection and one for metering with 0.2 class accuracy

1.27.7 Marshaling Box / Connector Box

1. The connector box shall be made of stainless steel, Dust & Vermin Proof, which is to be recessed at the base of each Yard LED Lighting system. The connector box shall have suitable brass or copper made connector terminal.
2. The wiring diagram for the interconnection of three phase instrument transformer shall be pasted inside the box in such a manner so that it is visible and it does not deteriorate with time. Terminal blocks in the marshaling box shall have facility for star/delta formation, short circuiting and grounding of secondary terminals. The box shall have enough terminals to wire all control circuits plus 20 spare terminals.
3. Detail Drawing for Marshaling box should be submitted for approval of MAHAGENCO.

1.28. SCOPE OF ELECTRICAL WORK FOR SWITCHYARD (INDOOR)

Instead of 33kV out door switchyard mentioned in above clause no. 1.27, contractor can also offer the indoor composite type VCB panel of 33 KV, 1250 A, 25 KA, Multi panel, shunt trip, Indoor Type, motor operated, spring closing Vacuum Circuit Breaker having SCADA compatible facilities and complete with all required accessories under a shed.

Vendor details, design & drawing for 33kV composite VCB panel & installation shed should be submitted for approval of MAHAGENCO.

33kV composite VCB panel should be as per following specifications & standards

Unit Of Measurement And Language :

In all correspondence, in all technical schedules and on all drawings prepared by the manufacturer, the metric units of measurement shall be used. On drawings or printed pamphlets where other units have been used, the equivalent metric measurements shall be added. All documents, correspondence, drawings, reports, operating and maintenance instructions/manuals and nameplate details of the equipment shall be in English language.

Service Conditions:-

In choosing materials and their finishes, due regard shall be given to the environmental and climatic conditions under which the switchgear panels shall be called upon to work.
The switchgear panels shall be installed in a room or under sheds without air conditioning but with ventilation to allow natural cooling. Therefore all the protection and control devices employed shall be capable of operating in this environment without failure for their designed life time. Design & drawing of Room/shed should be submitted to Mahagenco for approval. Following climaticparameters as per site location and applicable IS should be considered while design of materials.

a) Max. Ambient temperature
b) Reference Ambient Temperature for design
c) Min. Ambient temperature
d) Relative humidity
e) Average number of rainy days
f) Max. Annual rainfall
g) Max. Wind pressure
h) max. Wind velocity
i) Max. Altitude
j) Seismic level
k) average thunder storm
l) Climatic condition

All equipment must be designed for operations in the severe climate conditions and fully comply with climatic aging tests as per IEC 60932-class 2.

System Parameters :

a) System voltage : 33 KV
b) Highest system voltage : 36 KV c) Number of phase : Three
d) Power frequency : 50 Hz.
e) System earthing : Impedance earth. f) Fault level : 25 KA
g) BIL : 33 KV / 36 KV / 170 KV (P)

Technical specifications:

Metals**:**

Iron and Steel are generally to be painted or galvanized as appropriate. Indoor parts may alternatively have chromium or copper-nickel plates or other approved protective finish. Small iron and steel parts (other than rustless steel) of all instruments and electrical equipment, the cores of electromagnets and the metal parts of relays and mechanisms shall be treated in an appropriate manner to prevent rusting.

Screws, Nuts, Springs, etc.:

The use of iron and steels shall be avoided in instruments and electrical relays wherever possible. Steel screws shall be zinc, cadmium or chromium plated or where plating is not possible owing to tolerance limitations, shall be of corrosion resisting steel. Instrument screws (except those forming part of a magnetic circuit) shall be of brass or bronze. Springs shall be of non-rusting material, e.g., phosphor-bronze or nickel silver, as far as possible.

Rubbers:

Neoprene and similar synthetic compounds, not subject to deterioration due to the climatic conditions, shall be used for gaskets, sealing rings, diaphragms, etc.

Working Stress and Equipment/Apparatus Design

1.28.3.1 General

a) The design, dimensions and materials of all parts shall be such that they will not suffer damage under the most adverse conditions nor result in deflections and vibrations, which might adversely affect the operation of the equipment. Mechanisms shall be constructed to avoid sticking due to rust or corrosion.

b) The equipment and apparatus shall be designed and manufactured in the best and most substantial and workmanlike manner with materials best suited to their respective purpose and generally in accordance with up-to-date recognized standards of good practice.

c) Whenever possible, all similar parts, including spare parts, shall be made interchangeable. Such parts shall be of the same materials and workmanship and shall be constructed to such tolerances as to enable substitution or replacement by spare parts easily and quickly.

d) All equipment shall be designed to minimize the risk of fire and consequential damage, to prevent ingress of vermin and dust and accidental contact with electrically energized or moving parts. The switchgear panels shall be capable of continuous operation with minimum attention and maintenance in the exceptionally severe conditions likely to be obtained in a tropical climate and where the switchgear is called upon to frequently interrupt fault currents on the system and also where the duty of operation is high.

e) Suitable lifting hooks needs to be provided for lifting of the equipment.

1.28.3.2 Strength and quality

a) All steel castings and welding shall be stress-relieved by heat treatment before machining, and castings shall be stress-relieved again after repair by welding.

b) Liberal factors of safety shall be used throughout, especially in the design of all parts

subject to alternating stresses or shocks.

1.28.3.3 Designed data for low voltage equipment

Low voltage equipment and installation shall be designed in accordance with EMC (Electromagnetic Compatibility, IEC 61000) directives. The rating and design criteria for low voltage equipment shall be as follows:

1.28.3.4 AC Supply Rating system

i. Rated voltage between phase 415 V AC
ii. Connection type 3ph 4wire
iii. Rated voltage between phase to earth 240 V AC
iv. Grounding system PME
v. Frequency 50 HZ
vi. Voltage variation ± 10 %
vii. Frequency variation ± 5 %
viii. Power frequency 1 min, Test Voltage 3 kV
ix. Thermal rating of conductors 120 % of load

The AC supply shall be used for power circuit and for lighting, indication, motor controls and similar small power circuits. Unless otherwise specified, the equipment provided under this tender is to be capable of reliable operation at voltages as low as 85% of the rated voltage, and to withstand continuously up to 110% supply voltage above the rated value of 240V or 415V AC.

1.28.3.5 DC Auxiliary Supply Rating

Equipment/Device Rated voltage 30V DC

Connection type 2 wire.
Voltage variation 24 to 40 V DC

The auxiliary dc supply shall be used for controls, indication, alarm and circuit breaker tripping and closing circuit, etc. All equipment and apparatus including the circuit breakers, control devices and accessories, measuring and indicating instruments and electronic equipment shall be capable of satisfactory operation at 80% to 130% of the rated dc supply voltage. However, in case of VCB, for tripping the range should be 70% to 110% and for closing that should be 85% to 110%.

1.28.3.6 Electrical controls, auxiliaries and power supplies

a) Responsibility for electrical control and auxiliaries.
The manufacturer shall provide all control, indication and alarm and all auxiliary equipment with wiring and interconnecting cable which are integral parts of or are directly associated with or mounted on the switchgear panels to be supplied under this tender. The design of protection and control schemes for the switchgear panels shall be subject to approval of MAHAGENCO.

b) Operation and control.
Interlocking devices shall be incorporated in the control circuit to ensure safety, and proper sequence and correct operation of the equipment. The scheme will be finalised during detailed engineering and drawing approval.

1.28.3.7 Corona and radio interference

i. Switchgear shall electrically be designed to avoid local corona formation and discharge likely to cause radio interference.

ii. The design of jointing of adjacent metal parts and surfaces shall be such as to prevent corrosion of the contact surfaces and to maintain good electrical contact under service conditions.

iii. Particular care shall be taken during manufacture of bus bar and fittings and during subsequent handling to ensure smooth surface free from abrasion. All joints on the bus bar and the circuit within the switchgear board shall be silver or tin-plated to ensure good electrical connection.

Panel construction

Enclosure type	Dead front, floor- standing, rigid welded/bolted/rebated steel frames fully compartmentalized, Metal clad, Vermin Proof, suitable for indoor installation and provision for bolting to the floor.
Degree of protection of enclosure	IP55
Material of enclosure	CRCA Steel/Alu-Zinc
Metal sheet thickness	Load bearing member : 2.5 mm Doors & covers : 2.0 mm Gland plate : 3.0 mm
Compartment	Bus-bar, VCB, Power cable, PT, LV Instrument
VCB Compartment door	Separate with lockable handle.
Breaker to bas compartment	Through seal off bushing
Breaker to cable compartment	Through seal off bushing
Pressure relief device	To be provided for each HV Compartment. Each compartment shall be separated from adjacent one by sheet steel barrier.
Bus support insulator	Non hygroscopic, track-resistant, high strength, epoxy insulators (calculation for validating dynamic force withstand capability to be submitted during detailed engineering)

Power cable termination	Cable entry from rear bottom side for Incomer and Outgoing feeders, suitable for 3 Core XLPE, 33 KV grade , Aluminum, 300mm^2.The cable termination height shall be at least 750 mm in the cable compartment. Double cable termination arrangement to be provided with two sets of nut and bolts. Copper terminator strip of adequate size shall be provided for termination of cables and shall have adequate height inside to accommodate the heat shrinkable type indoor cable termination.
Isolator panel	Draw out type Isolator trolley will be required for tapping 33 KV Power cable for 100 KVA, 33/0.4 KV Station Service Transformer. Necessary phase to phase & phase to earth clearance will have to be maintained as per VCB particulars. The isolating contact should have inductive current breaking capacity of the Station Service Transformer. The said Trolley will have link instead of Vacuum Bottle and will be without tripping and closing mechanism. Only draw out facility will be required.
Bus Section Panel	Bus Section Panel to be provided beside the Bus Coupler Panel for front bus connection purpose.
Prevention of internal arc	Shall be type tested against internal arc as per provision in IEC 62271-200. The Circuit Breaker, bus bars and cable compartments shall be provided with arc venting outlet. The doors for the compartment shall be capable of withstanding the effects of maximum internal arcing fault without being blown off and causing danger to personnel and other equipment. This should be proven by successful testing for 25 KA with duration 0.1second as per relevant IEC standard.
Multi way terminal block and low voltage wiring	Delinking type, Rail/Channel mounted, Terminal Connector to be used in CT Circuit & Screw type for other Circuit. The Terminal Blocks should be suitable for 2.5 sq.mm wire and covered with insulated transparent cover. Pitch should be minimum 8mm & 10mm for Screw type & Delinkingtype connectors respectively. The low voltage cable shall be enclosed in grounded metal conduit when routed through a high voltage compartment. Control wiring shall be neatly bundled and tie wrapped where applicable. Wiring shall be protected from rubbing against door flanges or other parts of the enclosure. Minimum 100 mm clearance to be maintained between two rows of TB. 20% spare terminal block to be provided in each row.
Cable tray	Netted Metal cable Tray of suitable size at the rear side of Switchgear, preferably running at the top along the panel for carrying the signal cables for SCADA interface to be provided.

Space heater	Thermostat control space heater with switch for isolation to be provided in Breaker, HT Cable & Instrument compartments.
Illuminating lamp	15 Watt, CFL type.
Power Switch & Socket	5Amp rated Power Socket & Switch to be provided in Instrument compartment.
Surface cleaning	Seven tank process or Sand blasting
Painting	Powder coating with texture finish
Paint shed	RAL 7032

Circuit Breaker

Mounting	On withdrawable truck or trolley, horizontally draw out & horizontal isolation with locking facility in service position. Switchgear truck/trolley should be floor mounted. Racking-in and Racking-out should be such that one person can do it easily.
Arc quenching medium	Vacuum
Switching duty	Oil filled transformer and UG Cable up to 20 Km.
Breaker operation	Three separate identical single pole units operated through the common shaft and shall be fully interchangeable both electrically and mechanically. Circuit breaker poles between the interrupters and primary plug-in contacts shall be fully insulated with durable material. Each breaker shall be provided with Mechanical 'ON' and 'OFF' facility by operating suitable closing and opening devices. Each breaker shall be provided with Mechanical 'ON' and 'OFF' indicators. Each breaker shall have three positions - service, test and isolated/withdrawal marked. Mechanical safety interlocks shall be provided so that it is not possible for a circuit breaker a. To be put into the cubicle unless the truck is secured in position. b. To be either draw out or draw in from and to the service position unless its contacts are safely open. c. To be withdrawn or inserted in the fixed housing unless it is at the withdrawable position. d. To be operated in service position unless its primary and secondary isolating contacts are fully engaged. e. The circuit breaker racking equipment can be padlocked in closed position. f. Electrical close/trip operation should be dependent on Local/Remote switch. However, protection trip and emergency trip circuit should be independent of

	Local/Remote Switch.
Inter changeability	The Circuit Breakers of Incomer, Bus Coupler & Feeder Panels should be interchangeable both for electrically & mechanically.
Operating mechanism	a) Re-strike free, trip free both electrically and mechanically, with electrical anti-pumping feature. b) One O-C-O operation possible after failure of power supply to the spring charging motor. c) Motor wound, spring, charged, stored energy type with manual charging facility. One no. Breaker Truck operating handle for every three panels needs to supply.
Tripping & Closing coil	To be rated for substation DC voltage. Suitable for operation at minimum operating voltage of 70% for tripping and 85% for closing operation. Burden shall be about 200 watt for each coil.
L/R Switch	To be provided for breaker operation from Local & Remote
Provision of Push Button on breaker panel front	a) Manual close & Open operation b) Emergency electrical Trip operation
Mechanical indication	CB ON, CB OFF, Spring Charged / Discharged.
Electrical indication	CB ON, CB OFF, Spring Charged, CB in Test / Service Position, Flush mounted type high intensity, clustered LED lamps to be used. Colour of the lamps will be as follows : a) Breaker ON : Red b) Breaker OFF : Green c) Spring charged : Blue d) Auto trip : Amber e) Test / Service position : White.
TNC Switch with pistol grip	To be provided for electrical ON / OFF operation and other purpose. It should be lockable and spring return to normal position.
Operating handle	Breaker shall be provided with handles for easy handling, rack in-out operation and manual spring charging as applicable.
Safety shutter	Automatic safety shutter to be provided cover contacts fully when breaker is withdrawn to test. Independent operating mechanism for bus bar & cable side shutters, separately padlock able in closed position.

Interlocking arrangements	a) Breaker compartment door cannot be opened unless breaker is OFF and racked out to TEST / ISOLATED position. b) Breaker compartment door cannot be closed unless breaker is in ISOLATED position. c) Racking in or out of breaker inhibited when the breaker is CLOSED. d) Racking in the circuit breaker inhibited unless the control plug is gully engaged. f) Disconnection of control plug inhibited as long as the breaker is in service position. g) Other interlocks as per Standard.
Breaker operation	a) Local closing : Only when L/R switch in Local position and CB in either Service or Test position. b) Local tripping : Only when L/R switch in Local position and CB in either Service or Test position. c) Remote closing : Only when L/R switch in Remote position and CB in Service position. d) Remote tripping : Only when L/R switch in Remote position and CB in either Service or Test position. e) Protection tripping : Irrespective of L/R switch position and CB in Service condition.
Trip coil supervision	To be given for CB close & open condition.
Anti pumping	Anti Pumping Relay (94) to be provided in the Breaker panel. PLA type relay / Contactor is not acceptable.
Aux. AC & DC control supply in all panels	Fed by single AC & DC incoming source in Bus Coupler Panel as well as Incomer Panels for entire Switch Board.
Spring charge limit switch	The circuit breaker shall be provided with motor operated spring charged closing. Spring charging by motor should be smooth and hassle free and there should be nominal sound during spring charging. Motor should be 230 Volt AC operated, Tripping of the circuit breakers shall be through "Shunt trip" coils rated for 30V DC auxiliary supply. It shall be possible to trip the breaker manually in case of necessity. 2 NC : For Motor circuit 1 NO : For Breaker Closing Circuit 1 NO : For Breaker Closing permissive to be used in IED/Relay. 1 NO : For panel spring charged indication AC operated contactor may be used for contact multiplication of Limit Switch, if required, for indication and spare contacts.
Local Remote Switch	Switch should be 4 Pole 2 Ways lockable and stay put type.

Operation counter	Suitable mechanical operation counter to be provided in the breaker trolley with count range 0 to 9999.
Current Transformer	Shall be cast resin type with insulation class of E or better. Contact tips on primary side shall be silver plated. Correct polarity shall be invariably marked on each primary and secondary terminal. Primary shall be wound or bar type, rigid, high conductivity grade copper conductor. Unavoidable joints on the primary conductor shall be welded type, preferably lap type. Current density at any point shall not exceed 1.6 A/sq.mm. Suitable insulated copper wire of electrolytic grade shall be used for CT secondary winding. Multi ratio in CT shall be achieved by reconnection of secondary winding tapping. The secondary terminals shall have screw type terminals. The screw should have sufficient length for connection of at least two nos wires with plain and spring washers and minimum 10 mm clearance between the adjacent screws.
C T Mounting	To facilitate easy replacement of 33 KV CT afterwards, fixing of CT in hanging condition/CT baseplate fixed at the upper covering of the CT Chamber may not be acceptable. Fixing in horizontal upright condition over a base channel is preferable. CT Secondary connection terminals should be clearly visible and accessible from the back side of the breaker assembly just after opening the rear cover plate. P1 side of CT will be at Bus side for both Line & Transformer panel.

Potential Transformer	Potential Transformer should be three no Single Phase PT housed in a withdrawable carriage, Shall be cast resin type with insulation class of E or better. Service position locking mechanism shall be provided and indicated by bidder in relevant drawing. Rigidity of primary stud point with earth bus in service position shall be confirmed. Contact tips of primary/secondary contacts shall be silver plated. Correct polarity shall be distinctly marked on primary and secondary terminal. Secondary terminal studs shall be provided with at least three nuts, two plain and two spring washers for fixing leads. The stud, nuts and washers shall be of brass, duly nickel plated. The minimum outside diameter of the studs shall be 6 mm. the length of at least 15 mm shall be available on the studs for inserting the leads. The space clearance between nuts on adjacent studs when fitted shall be at least 10 mm. Trolley mounted and connected on bus side. It can be plugged into and withdraw from service by pullingor pushing the PT by the handle provided on the PT. This action traverses the PT shall automatically operate the spout shutters. The shutter drive also forms a latch which holds the PT in the service position and this latch shall be required to be releasedbefore PT can be isolated.
Earth bus	A ground bus rated to carry maximum fault current shall be furnished along the full length of the panel board. Each stationary unit shall be grounded directly to ground bus. All bolted joints in the bus will be effected by connection of two bolts.
	The earth bus shall be of copper and shall have adequate cross sectional area. Earthing conductors shall be of annealed high conductivity stranded Copper

Internal wiring	a) 750 V grade PVC insulated stranded flexible copper wire to be used. b) Size of wire will be as follows : CT & PT circuit : 2.5 sq. mm Main AC & DC circuit : 4.0 sq. mm Other circuit : 1.5 sq. mm. c) A suitable wiring duct system firmly fixed on the panel and having covers shall be installed for front to rear and inter panel wiring to provide easy access for inspection and replacement of the wires. d) Wiring between terminals of the various devices shall be point to point. Splices or tee connection will not be acceptable. e) Wires shall be suitably bunched adequately supported to prevent sagging and it shall have sufficient clearance from High voltage system. f) Colour of wires will be as follows : For CT & PT circuit: R Phase : Red, Y Phase : Yellow, B Phase : Blue, Neutral : Black For DC circuit : Grey For AC circuit : Black For Earth circuit : Green.
Ferrules	a) Plastic ferrules conforming to IS to be used. Same marking to be used at both ends of wires. b) Ferrule markings will be as follows : AC Circuit : H1,H2,H3 - - - - - Metering circuit : D11, D31, D51 - - Protn. Circuit : C11, C31, C51 - -REF Circuit : A11, A31, A51 - - MainDC Ckt : J1, J2, J3 - - - - - - DC Control ckt : K1, K2, K3 - - - - Indication ckt : L1, L2,L3 - - - - - Motor ckt : M1,M2,M3 - - - - PT Circuit : E11,E31,E51 - - - Spare circuit : U1,U2,U3 - - - - - c) Plastic channels, inter panel wiring through PVC sleeves or suitable grommets
Guarantee of the complete equipment	5 (five) years from the date of last dispatch of any integral part of the equipment.

Mandatory particulars of Panel

Type	Metal clad, air insulated with VCB type indoor circuit breaker
Reference Standard	IEC : 62271-100 & 200, IS 13118, IS 3427
Rated voltage	33 KV
Rated current	1600 Amps
Highest system voltage	36 KV
Insulation level	36 KV/70 KV/170 KV(P)
Frequency	50 Hz.
Enclosure degree of protection	IP55
Thickness of metal sheet (min)	Load bearing : 2.5 mm Doors & covers : 2 mm
Bus bar & Earth bus material	Electrolytic Copper with Tin / Silver plated
Shape of Bus bar	Rectangular/Tubular
Bus identification	Colour coded (R-Y-B)
Bus clearance	Phase to phase : As per type test report Phase to ground : As per type test report
Position of Mechanical & Electrical Emergency Trip Arrangement	Front side of the Panel
Separate Bus Section Panel at the side of Bus Coupler	To be provided
Paint type	Powder coated
Paint shade	RAL 7032 (both external & internal)
Paint thickness	50 microns (min)

Mandatory particulars of Current Transformer

Type	Cast resin, Bar primary, Indoor type . Marking on primary and secondary terminal as per requirement of IEC 60044-1, IS 2705 and shall be indelibly marked. The secondary terminals shall have screw type terminals.
Reference Standard	IEC : 60044-1, IS : 2705
Make	To be approved from Mahagenco
Rated voltage	33 KV
Highest system voltage	36 KV
Insulation level	36 KV/70 KV/170 KV(P)
STC	25 KA for 1 Sec
Class of insulation	A
Continuous over load capacity	120 % of rated primary current
Core identification	Core 1 : Metering, Core 2 : Protection Core 3 : Protection Special
Accuracy class	0.2s class.

Mandatory particulars of Potential Transformer

Type	Resin cast, draw out, single phase unit
Reference Standard	IEC : 60044-2, IS : 3156
Make	To be approved from Mahagenco.
Rated voltage	33 KV
Highest system voltage	36 KV
Frequency	50 Hz.
Class of insulation	A
Core identification	Core 1 : Metering, Core 2 : Protection
Accuracy class	0.2 / 3P
Rated voltage factor	1.2 Continuous, 1.9 for 30 sec.

Mandatory particulars of Vacuum Circuit Breaker

Type	Metal clad, air insulated with VCB type indoor circuit breaker
Reference Standard	IEC : 62271-100, IS : 13118
Make	To be approved from Mahagenco
Rated voltage	33 KV
Highest system voltage	36 KV
Insulation level	36 KV/70 KV/170 KV(P)
Frequency	50 Hz.
STC	25 KA for 3 sec.
Duty cycle	O -0.3 Sec-CO-3 Min-CO
Sym. Breaking current	25 KA
Short circuit making current	62.5 KA (P)
Closing time	< 100 ms
Opening time	< 60 ms

Mandatory particulars of Vacuum Bottle

Make	OEM
Rated voltage	33 KV
Highest system voltage	36 KV
Rated current	1600 Amps
Insulation level	36 KV/ 70 KV / 170 KV(P)
Frequency	50 Hz
STC	25 KA for 3 Sec
Short circuit breaking capacity	25 KA
Making capacity	62.5 KA (P)
Mechanical Endurance capacity	30000 operation
Electrical Endurance capacity	20000 operation
Minimum electrical life	100 no at rated short circuit current

Type Test : - Following Type Test reports are should be submitted to Mahagenco for approval.

Switchgear panel (with circuit breaker installed)	a) Lightning Impulse Voltage withstand test b) H.V. dry power frequency voltage withstand test c) Short time and peak withstand current test d) Short circuit test with basic duties e) Single phase breaking capacity test. f) Cable charging breaking current test g) Temperature Rise test h) IP Test i) Internal Arc Test as per IEC 62271-200 j) Horizontal Acceleration due to seismic force (if available)
Circuit Breaker	a) Mechanical Endurance Test as per M2 Class of IEC
Current Transformer	a) Short Time Current Test b) H.V. dry power frequency voltage withstand test c) Impulse Voltage Withstand Test d) Temperature Rise Test
Potential Transformer	a) Impulse Voltage Withstand Test b) H.V. dry power frequency voltage withstand test c) Temperature Rise Test

Copies of test certificates in respect of following bought out items:-

a. Vacuum Interrupter.
b. Insulators
c. Bus Bar Material
d. Terminal connectors

Note: All the type test report on Switchgear Panel & Circuit Breaker to be conducted with offered Vacuum Interrupter.

Submission of drawings & documents:

Contractor should submit vendor credentials of HT panel, Circuit Breaker, CT, PT, LA and other equipments to Mahagenco for approval the qualifying requirements for vendors shall be as per RFP terms and conditions.

Contractor should submit following drawing/documents along with all calculations and Design Basis Report, GTP and QAP to Mahagenco for approval.

a) GA of indoor composite panel Switchgear showing constructional features and space required in the front for withdrawal of breaker truck and in back, other accessories, power and control cable entry with plan elevation andviews.
b) Sectional view of incomer, bus coupler & transformer panels with parts list.
c) GA of Circuit Breaker truck.
d) GA of Current Transformer
e) GA of Potential Transformer.
f) Technical particulars of Switchgears and brochures for technical data sheet of vacuum interrupter.
g) Details, design, drawing and calculations of shed.

Six copies of drawing, data and manuals containing above shall be submitted for approval and afterwards for final distribution.

Contractor shall submit all above drawings and following additional drawings along with design basis calculations to Mahagenco for approval before commencement of supply:-

i. Drawing of the shed.
ii. Foundation details for Panel Switchgear.
iii. Equipment door layout for incomer, bus coupler & transformer panels.
iv. Schematic Diagram for incomer bus coupler & transformer section of Switchgear
v. CT Circuit, PT circuit & DC control circuit for incomer bus coupler & transformer section of Switchgear
vi. Name Plate CT & PT.
vii. Rating Plate details of the Panel
viii. Manual for installation, operation and maintenance procedure.

Routine & Acceptance test :

a) All the switchgear panels shall be tested in accordance with the requirement of IEC 62271-200. Tests shall be carried out on the circuit breakers as per the requirement ofIEC 62271-100.

b) Current transformers and Voltage transformers shall be tested in accordance with the requirement of IEC 60044-1, IS 2705 and IEC 60044-2, IS 3156 respectively.

All routine tests at manufacturer's works shall be carried out as per the RFP terms and conditions.

All Acceptance tests shall be carried out at manufacturer's works on every lot offered for inspection as per relevant IS & IEC in presence of the Mahagenco representatives. The entire cost of acceptance and routine test that to be carried out shall be borne by Contractor.

Six copies of test reports duly signed by the inspecting officers, shall be submitted to the Chief Engineer, RE-P&P, Mahagenco

1.29. 33/220KV MAIN SWITCHYARD (POOLING SUBSTATION).

1.29.1 Scope of work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, training of Owner's personnel, handing over to employer and guarantee for two years of outdoor Switchyard for Solar Photovoltaic (SPV) Power Plant and as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services for completeness of the system including but not be limited to following.

1.29.2 Outdoor Switchyard Equipment

1. The switchyard shall be 33/ 220 kV of the outdoor type power transformer. The power transformers are however covered elsewhere in the specification.
2. Supply, installation and commissioning of switchyard equipment and necessary protection arrangement at Plant end shall be as per the CEA & CEIG Regulation/ requirement and norms and to the satisfaction of employer including statutory inspection.
3. The 220 kV side equipments rating, bus bar arrangement, conductor sizing, control,

protection, telemetry etc. shall also be as per the requirement and norms of CEA and the drawings/documents of the same shall be got approved through MSETCL by contractorbefore submitting to MSPGCL.

4. Bidder's scope shall be termination at 220 kV line take-off gantry. All equipment/hardware including take-off gantry required for termination of 220 kV lines as well as equipment support structure and civil works shall be under scope of bidder. The Contractor shall identify all interface issues with MSPGCL and shall be responsible for such interfacing, coordination and exchange of all necessary information for completeness of the system.

1.29.3 Power Transformer

Technical Requirement

Sr. No.	Description	Unit	Technical Parameters
1	Voltage ratio (Line-to-Line)	kV	220/33
2	Rated Capacity (HV & LV)	MVA	100
3	No of phases		3 (Three)
4	No of secondary windings		One winding
5	Vector Group		YNyn0
6	Type of transformer		Power transformer
7	Applicable Standard		IEC 60076 / IS 2026
8	Cooling type		ONAN / ONAF
9	Rating at different cooling	%	70 / 100
10	Frequency	Hz	50
11	Cooler Bank Arrangement		2 X 50%
12	Tap Changer		
i)	Type		On-load tap changer /OCTC
ii)	Tap range and steps		-5% to +5% in steps of 1.25% for HV variation
iii)	Location of tap changer		On HV neutral end
13	Impedance at 75°C, at highest MVA base		
i)	Max. Voltage tap	%	16.2
ii)	Principal tap	%	15
iii)	Min. Voltage tap	%	14
iv)	Tolerance on Impedance		As per IEC
14	Service		Outdoor
15	Duty		Cyclic
16	Overload Capacity		IEC-60076-7
17	Temperature rise over 50°C ambient Temp		
i)	Top oil measured by thermometer	°C	45
ii)	Average winding measured by resistance method	°C	50

18	Winding hot spot rise over yearly weighted temperature of 32°C	°C	61
19	Tank Hotspot Temperature	°C	110
20	Maximum design ambient temperature	°C	50
21	Windings		
i)	Lightning Impulse withstand Voltage		
	HV	kVp	950
	LV	kVp	170
	HV Neutral	kVp	95
	LV neutral	kV_p	170
ii)	Chopped Wave Lightning Impulse Withstand Voltage		
	HV	kV_p	1045
	LV	kV_p	187
iii)	Switching Impulse withstand Voltage		
	HV	kVp	750
iv)	One Minute Power Frequency withstand Voltage		
	HV	kVrms	395
	LV	kVrms	70
	HV Neutral	kVrms	38
	LV neutral	kVrms	70
v)	Neutral Grounding (HV & LV)		Solidly grounded
vi)	Insulation		
	HV		Graded
	LV		Uniform
vii)	Tan delta of winding	%	≤ 0.5
22	Bushing		
i)	Rated voltage		
	HV	kV	245
	LV	kV	36
	HV Neutral	kV	36
	LV Neutral	kV	36
ii)	Rated current		
	HV	A	1250
	LV	A	3150
	HV Neutral	A	3150
	LV neutral	A	3150
iii)	Lightning Impulse withstand Voltage		
	HV	kVp	1050

iv)	Switching Impulse withstand Voltage		
	HV	kVp	850
v)	One Minute Power Frequency withstand Voltage		
	HV	kVrms	505
	LV	kVrms	77
	HV Neutral	kVrms	77
	LV Neutral	kVrms	77
vi)	Tan delta of bushing at ambient Temperature	%	<0.5
vii)	Minimum total creepage distances		(Specific creepage distance: 31mm/kV corresponding to the line to line highest system voltage)
	HV bushing	mm	7595
	LV bushing	mm	1116
	HV neutral / LV neutral	mm	1116
viii)	Maximum Partial discharge level at Um		
	HV	pC	10
23	Maximum Partial discharge level at 1.58 * Ur / √3	pC	100
24	Maximum Noise level at rated voltage, at principal tap & no load and all cooling active	dB	80
25	Termination details		To be provided by the purchaser as per its requirement
26	Maximum Permissible Losses of Transformers		100
i)	Max. No Load Loss at rated voltage and frequency	kW	Losses based on maximum flux density of 1.7 T at rated MVA, voltage & frequency and maximum current density of 3.5 A/mm2 at all taps may be provided by the Manufacturers.
ii)	Max. Load Loss at rated current and at 75°C for HV and LV windings at principal tap position	kW	
iii)	Max. Auxiliary Loss at rated voltage and frequency	kW	

1.29.4 Structure Accessories and Auxiliaries

1. One (1) lot of conductor as required to complete the system with bus bar arrangement (as per norms & requirement) in the switchyard,
2. One (1) lot of galvanized gantry structures and supporting structures required to complete the switchyard system,

3. One (1) lot of insulators, hardware fittings, fasteners, lightning masts, earthing risers for equipment and gantry structures, earth wire including arrangement for screening of switchyard for protection against lightning,
4. Necessary quantity of Marshalling Kiosks for ease of construction and operation,
5. One name plate and two danger plates of more than 300 X 300mm size for each bay,
6. Continuous on-line monitoring for operating parameters such as current, voltage, temperature etc. complete with sensors, control/processor units, wiring/cabling in all respect and coordination & provision of necessary contacts and/or ports for integration with plant SCADA system,
7. All necessary auxiliaries for control &supervisory circuits, local control switches and other relays as required,
8. All secondary wiring, terminal blocks, labelling, nameplates, sockets etc.
9. Transformer and Line Control & Relay Panel
10. Complete Fire Fighting System
11. PLCC/OPGW and/or any other means as per system requirement, STU norms / requirements for speech transmission, line protection, data channels etc.
12. Spare parts,
13. Tools & instruments
14. Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

1.29.5 Rating and Functional Characteristics

Outdoor Switchyard Equipment

System Parameters	HV system
Installation	Outdoor
Type of Busbar Arrangement	As per requirement
Total No. of Bays	As above
Nominal Voltage , kV, RMS	220
Highest System Voltage, kV	245
Rated Frequency, Hz	50 + 5%
Rated Continuous Current, A, RMS	As per the system requirement
Rated Short Time Withstand Current (RMS) for 1 sec.	As per relevant IS/IEC standard
Rated Peak Withstand Current, k A	
Rated Duration of Short Circuit (SC)	
Rated Insulation Level	
One Minute Power Frequency Withstand Voltage	
Dry (kVrms)	As per relevant IS/IEC standard
Wet (kVrms)	
Rated Lightning Impulse Withstand Voltage ((1.2/50 micro sec.) (kVpeak)	
Line To Earth (kVp)	
Across Isolating Distance (kVp)	

Minimum Creepage Distance , mm	
Rated Control Voltage DC, V	
Auxiliary AC supply, 3 Phase, V	
Partial discharge at 1.05 MCOV (Continuous operating voltage)	
Maximum Radio Interference Voltage for any frequency between 0.5 MHz to 2.0 MHz in all positions (micro volts)	
Degree of Protection	IP 55
Circuit Breaker	
Type	SF6
Description	Three Phase
Rated SC Symmetrical Breaking Current kA (r.m.s)	As per relevant IS/IEC standard
Rated SC Making Current, kA (peak)	
Rated Line Charging Breaking Current Capacity, A	
Rated Cable Charging Breaking Current Capacity, A	
First-Pole-to Clear Factor	1.3
Closing Time	Maximum 150 ms.
Total Break Time for any current up tothe Rated Breaking Current	Not more than 60 ms.
Rated Operating Duty Cycle	O-0.3Sec-CO-3 Min– CO
No of Trip Coils	2
Isolators	
Type	3 Phase Double Break
Operation	Motorised as well as Manual
Total Operating Time of isolator along with its operating mechanism	<12 s
Current Transformers	
Current Ratio Line Bay	As per system requirement
Current Ratio Power Tr. Bay (incoming)	As per system requirement
Accuracy Class For Protection	PS
Accuracy Class For Metering	0.2
Surge Arrestors	
Rated Arrestor Voltage	As per system requirement
Rated Nominal Discharge Current (8/20$_{\mu}$s wave)	10 kA
Continuous Operating Voltage (COV) at 50 Deg C	As per system requirement
Energy Dissipation Capability	Not less than 5 KJ/kV
Partial discharge at 1.05 MCOV (Continuous operating voltage)	<10 pC
Capacitive Voltage Transformers for HV Bus	

Purpose	Metering & Protection,
Voltage Ratio	As per system requirement
Accuracy Class for Metering & Protection	0.2 (1-core) & 3P (2core) respectively
Number of Cores in Secondary side	3
Rated Voltage Factor	1.5 for 30 s & 1.2 Continuos
Partial Discharge at Highest Voltage	<10 pC
Insulation Class	A

1.29.6 Current Transformers (CT)

1. The CTs shall have single primary of either ring type or hair pin type or bar type. In case of "Bar Primary" inverted type CTs, the following requirementsshall be met:

2. The secondaries shall be totally encased in metallic shielding providing auniform equi-potential surface for even electric field distribution.

3. The lowest part of insulation assembly shall be properly secured to avoid any risk of damage due to transportation stresses. The upper part of insulation assembly sealing on primary bar shall be properly secured to avoid any damage during transportation due to relative movement between insulation assembly and top dome.

4. The insulator shall be one piece without any metallic flange joint. The CT shall be provided with oil sight glass/oil level indicator.

5. The core lamination shall be of cold rolled grain oriented silicon steel or other equivalent alloys. The cores shall produce undistorted secondary current under transient conditions atall ratios with specified parameters.

6. Different ratios shall be achieved by secondary taps only, and primaryreconnections shall not be accepted.

7. The guaranteed burdens and accuracy class are to be intended assimultaneous for all cores.

8. The instrument security factor at all ratios shall be less than five (5) for metering core. If any auxiliary CT/reactor is used, then all parameters specified shall be met treating auxiliary CTs/reactors as integral part of CT

9. The auxiliary CT/reactor shall preferably be in-built construction of the CT. In case it is separate, it shall be mounted in secondary terminal box.

10. The secondary terminals shall be terminated on stud type suitable no's of non-disconnecting and disconnecting terminal blocks inside the terminal box of degree of protection IP:55 at the bottom of CT.

11. The CTs shall be suitable for horizontal transportation.

12. The CTs shall have provision for taking oil samples from bottom of CT without exposure to atmosphere to carry out dissolved gas analysis periodically. Contractor shall give his recommendations for such analysis, i.e. frequency of test, norms of acceptance, quantity of oil to be withdrawn, and treatment of CT.

13. The CT shall have provision for measurement of capacitance and tan delta as erected at site

1.29.7 Parameters for Current Transformers

Highest system Voltage(Um)	245 kV
Rated frequency	50 Hz
System neutral earthing	effective earthed
Installation	Outdoor
Rated min power frequency withstand voltage (rms value)	70 kV
Rated lightning impulse withstandvoltage (peak value)	170 kV
Partial discharge level	10 pico Coulombs max.
Minimum Creepage distance	As per Clause 1.05
Temperature rise	As per IEC 60044
Type of insulation	Class A
Number of cores	Tariff CTs shall be single metering core with 0.2S accuracy class.
Number of terminals in marshallingbox	All terminals of control circuitswired upto marshalling box plus 20 terminals spare

1.29.8 Voltage Transformers (VTs)

1. Voltage transformers shall be of Outdoor type, Oil filled, bottom and dead Tank type electromagnetic, with sealing arrangement as per IS-316-1992. Itis also to be equipped with protective and damping devices Oil level indicator with danger level marking is also to be provided.

2. They shall be of the oil immersed, self-cooled type and providedalternatively with an inert gas cushion or with metallic bellows above the- insulating oil level. A pressure relief device valve type may also be providedif permitted to design.

3. The VTs may be built up of high-grade non ageing cold rolled grain orientedsilicon steel lamination, conforming to IS: 3024, of low hysteresis losses andhigh permeability to ensure high accuracy at both normal rated and above rated voltages.

4. The limits of temperatures rise shall not exceed the values specified in Table 3 of IS: 3156 (Part-1) 1998. However, if the voltage transformers has an inert gas cushion above the oil at the top of the tank or housing shall not exceed 50º C. The oil shall be mineral insulating oil conforming to IS: 335- 1983.

5. The HV neutral end terminal shall not be earthed directly to the metal body of the VT but shall be brought out through a porcelain 2 kV class bushing. Atinned copper link of the bolted type shall be provided to connect the HV neutral end terminal and the earth bushing. Both the HV neutral end bushing and the earth bushing shall be housed in a. dust tight, vermin proof box with a front access bolted type gasketted cover.

6. The secondaries shall be protected by HRC cartridge type fuses for all windings. In addition fuses shall also be provided for protection and metering windings for connection to fuse monitoring scheme. The secondary terminals shall be terminated on stud type non-

disconnecting terminal blocks via the fuse inside the terminal box of degree of protection IP55. The access to secondary terminals shall be without the danger of access to high voltage circuit.

7. The accuracy of metering core shall be maintained through the entire burden range upto 50VA on all three windings without any adjustments during operations.

1.29.9 Parameters for Voltage Transformers

Highest System Voltage(Um)	245 kV
System neutral earthing	effective earthed
Installation	Outdoor
Rated min power frequency withstand voltage (rms value)	70 kV
Rated lightning impulse withstand voltage (peak value)	170 kV
Standard reference range of frequencies for which the accuracy are valid	96% to 102% for protection and 99% to 101% for measurement
Rated voltage factor	1.2 continuous & 1.5 for 30 sec
Class of Accuracy	For tariff metering VT - 0.2Other VTs – 0.2
Stray capacitance and stray conductance of LV terminal over entire carrier frequency range	As per IEC:358
One Minute Power frequency Withstand voltage for secondary winding	2 kV rms
Temp. rise over an ambient temp.of 50 deg. C	As per IEC 60044
Number of terminals in controlspare.	All terminals of control circuits wired Cabinet upto marshalling box plus10 terminals
Rated total thermal burden	350 VA
Partial discharge level	10 pC max.

1.29.10 Surge Arrestor

1. The surge arrestors (SAs) shall conform in general to IEC 60099-4 or IS: 3070 except to the extent modified in the specification. Arresters shall be of hermetically sealed units, self-supporting construction, suitable for mounting on lattice type support structures. Bidder shall furnish the technical particulars of Surge arrester.

2. The SAs shall be of heavy-duty station class and gapless Metal Oxide type without any series or shunt gaps. The SAs shall be capable of discharging over-voltages occurring during switching of unloaded transformers, andlong lines.

3. Arrestors shall be complete with insulating base for mounting on structure. Self-contained discharge counters suitably enclosed for outdoor use and requiring no auxiliary or battery supply for operation shall be provided for each single pole unit with necessary connection. Suitable leakage current meters should also be supplied within the same enclosure. The reading of millimeter and counters shall be visible through an inspection glass panel

4. The surge arrestors shall conform to type tests and shall be subjected to routine and

acceptance tests in accordance with IEC-60099-4. The cantilever strength of the insulator shall be min. 350 kg for 33 kV level.

Rate System Voltage	
Rate Arrester Voltage	
Nominal discharge current	10 kA of 8/20 micro-sec wave
Minimum discharge capability	5 kilo joule/kV(referred to rated arrestor voltage corresponding to minimum discharge characteristics)
Maximum continuous operating voltage	24 kV rms
Max. residual voltage (1 kA)	70 kVp
Max. residual voltage at 10 kAnominal discharge current (8/20 micro sec wave)	85 kVp
Max. switching impulse residualVoltage at 500A peak	70 kVp
Max. steep current residual voltage	93 kVp at 10 kA
Long duration discharge class	2
High current short duration testvalue (4/10 micro-sec-wave)	100 kAp
Low current long duration testvalue (2000 micro sec.)	As per IEC
Pressure relief class	Class A
One minute power frequency withstand voltage of arrestorhousing (dry and wet)	70 kV (rms)
Impulse withstand voltage of arrestor housing with 1.2/50micro sec. Wave	170 kVp
Partial discharge at 1.05 MCOV (continuous operating voltage)	Not more than 50 pc

1.29.11 Post Insulator

1. The post insulators shall conform in general to latest IS:2544 and IEC – 60815, 60168.
2. Post type insulators shall consist of a porcelain part permanently secured in a metal base to be mounted on the supporting structures. They shall be capable of being mounted upright. They shall be designed to withstand any shocks to which they may be subjected to by the operation of the associated equipment. Only solid core insulators shall be accepted. Height of post insulator shall be preferably as given under parameters of this part.
3. Other requirements of insulator as given under auxiliary requirements shall also be applicable.
4. In accordance with the stipulations elsewhere the post insulators shall conform to type tests and acceptance, sample and routine tests as per IS:2544, IEC-60168 shall be carried out.

Type	Solid core
Voltage class	36 kV

Rated one minute power frequency withstand Voltage	70 kV (rms)
Rated Lightning Impulse withstandvoltage with 1.2/50 micro sec. wave	170kVp
Total min. cantilever strength	350 kg
Min. torsional moment (Nm)	As per IEC 60273
i) Top p.c.d (mm) ii) Bottom p.c.d (mm)	76 76
No. of bolts: Top : Bottom :	4 4
Diameter of bolt holes (mm) Top : Bottom :	 M12 M12

1.29.12 Switch Yard LED Lighting System

Adequate Switchyard LED lighting for both Switchyards shall be provided keeping the generalsecurity in mind using the auxiliary power supply (conventional) available at the location.

Contractor should submit Theoretical design calculations and detailed explanations along with drawings shall be provided and approved by MAHAGENCO.

1.29.13 Danger Plates

Size of each Danger Notice plates will be 200 mm x 150 mm made of mild steel sheet and at least 2 mm thick, and vitreous enameled white on both sides and with inscription in signal red colors on front side as required. The inscriptions shall be in Hindi and English.

1.29.14 Others

Any Electrical work for switchyard which is not mentioned or included here but necessary for the plant shall be borne by Contractor.

1.29.15 Warranty / Guarantee

The Contractor must ensure that the goods supplied under the contract are new, unusedand of most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the contract.

1. Solar PV Modules: Material/product Warranty should be at least 12 years and Performance / power output warranty of Solar Module(s) shall be for at least 90% of its rated power at the end of 12 years and 80% of its rated power at the end of 27 years from the date of receipt of modules on Site. The manufacturer should warrant for the linear output of Solar Module(s) and degradation of the PV modules will be linear over 27 years from the date of receipt of modules at site. The Manufacturer Detailed Warranty / Guarantee clause shall be furnished.
2. Module mounting structures should be warranted for a minimum period of 5 Years.
3. Inverter should be warranted up to 10 years (standard warranty 5 years + 5 years extended warranty)
4. Transformers, associated switch gear and others: Manufacture shall furnish in

details their warranties / guarantees for these items. Transformers, CT, PT & switch gears, DC Cables, HT cables, SCB & SMS, SCADA, CCTV System should be warranted for minimum period of 5 Years.

5. Before finalizing the purchase order all warranty/guarantees agreements of equipments & material should be approved from MAHAGENCO. During the period of Warranty / Guarantee the Contractor shall remain liable to replace any defective parts, that becomes defective in the plant, of his own manufacture or that of his sub- Contractors under the conditions provided for by the contract under and arising solely from faulty design, materials or workmanship, provided such defective parts are not repairable at site. After replacement, the defective parts shall be returned to the Contractors works at the expense of the Contractor unless otherwise arranged.
6. If any defects not remedied within a reasonable time, the Owner may proceed to do work at the Contractor's risk and cost, but without o other rights, which the Owner may have against the Contractor in respect of such defects.
7. At the end of guarantee period, the Contractor's liability shall cease. In respect of goods not covered by the first paragraph of this clause, the Owner shall be entitled to the benefit of such guarantee given to the Contractor by the original Contractor or manufacturer of such goods.
8. During the operation & maintenance and guarantee period, the Contractor shall be responsible for any defects in the work due to faulty workmanship or due to use of sub-standard materials in the work. Any defects in the work during the guarantee period shall therefore, be rectified by the Contractor without any extra cost to MAHAGENCO within a reasonable time as may be considered from the date of receipt of such intimation from MAHAGENCO failing which MAHAGENCO shall take up rectification work at the risk and cost of the Contractor.

1.29.16 Technical Data Sheet

Detailed technical specification of the proposed Solar PV Grid interactive system in response to section II of RfP shall be provided as part B. In addition to the description of the system, the Contractor shall furnish Technical Data Sheet as per the format given in Annexure 17.

C:- OPERATION AND MAINTENANCE SCOPE

1.0. GENERAL

1.0.1 The Contractor shall operate the Solar PV Power Plant including its associated HT line and all civil structures, Control Room building, Array Yard, Garden etc. for a period of 5 years from the date of handing over of the plant for O&M after completion of successful PG test & Final Acceptance Test.

1.0.2 Zero date of operation and maintenance of the solar plant shall begin on the date of handing over to O&M after successful completion of PG test & Final Acceptance Test of the Solar PV Power Plant.

1.0.3 Operation work includes day to day operation of Solar Power Plant including, maintenance of LT lines, HT lines and maintenance of all Civil Works.

1.0.4 The Contractor will furnish necessary details regarding technical competence, qualification

and number of different grades of personnel to be posted at site along with proposed maintenance (preventive) schedule from the date of commissioning.

1.0.5 The maintenance staff of the Contractor shall be available in the Power Plant for 24 hours every day irrespective of whether the plant is in operation or not unless otherwise instructed by MAHAGENCO in writing.

1.0.6 The Contractor's representatives/employees shall conform to all general regulations in force at site and to any special conditions affecting by local administration issued by MAHAGENCO or duly authorized representative of MAHAGENCO. All employees of the Contractor living at site shall be deemed to be aware of dangers and risks incidental to the conditions of MAHAGENCO's land and works from time to time and MAHAGENCO shall not be responsible for any injury arising there from.

1.0.7 MAHAGENCO reserves the right to ask the Contractor to remove/transfer any staff of the Contractor from site without assigning any reason whatsoever. Instructions issued in writing to the Contractor in this matter shall be binding and the Contractor shall replace the transferred/removed person with a suitable person immediately.

1.0.8 All persons deployed by the Contractor for regular operation and maintenance must remain in proper uniform while on duty. The Contractor shall supply uniforms, raincoats, toolset, gloves, gumboots and other items required for carrying out the services.

1.0.9 MAHAGENCO shall have power to disallow any maintenance personnel, if found unsuitable. The Contractor shall have to replace such persons within 24 hours.

1.0.10 The Contractor shall maintain attendance register for all their staff deployed for carrying out jobs on regular basis and shall be produced for verification on demand by authorized personal of MAHAGENCO.

1.0.11 The Contractor shall ensure that all safety measures are taken at the site to avoid the accidents to his employees or his co-Contractor's employees.

1.0.12 The Contractor shall comply with the provision of all relevant Acts of Central or State Governments including payment of Wages Act 1936, Minimum Wages Act 1948, Employer's Liability Act 1938, Workmen's Compensation Act 1923, Industrial Dispute Act 1947, Maturity Benefit Act 1961, Employees State Insurance Act 1948, Contract Labor (Regulations & Abolishment) Act 1970 or any modification thereof or any other law relating whereto and rules made there under from time to time.

1.0.13 In order to ensure longevity, safety of the core equipment and optimum performance of the system the Contractor should use only genuine spares of high quality standards.

1.0.14 The Contractor shall immediately report the accidents, if any, to the Engineer In charge & to all the concerned authorities as per prevailing laws of the state. A detailed Emergency Response Plan shall be submitted by the Contractor at the beginning of the O&M period.

1.0.15 The Contractor shall provide his maintenance staff at the power Plant for day-to-day operation and maintenance. The maintenance personnel shall be qualified, certified by competent authorities and well trained so that they can handle any type of operational hazards quickly and timely. The responsibility of providing suitable Personal Protection Equipments rests solely with the Contractor.

1.0.16 The Contractor shall arrange to provide proper and elaborate O&M training of Solar Power Plant and associated power evacuation arrangement to the MAHAGENCO's staff for successful takeover of the plant in due course of time.

1.0.17 All electricity charges for auxiliary power of plant shall be borne by Contractor during the

complete O&M period (5 years).

1.0.18 The security of the Power Plant will rest with the Contractor for entire contract period.

1.0.19 The maintenance personnel shall be in a position to check and test all the equipment regularly, so that, preventive maintenance, could be taken well in advance to save any equipment from damage. Abnormal behavior of any equipment shall be brought to the notice of MAHAGENCO not later than 2 hours for taking appropriate action.

1.0.20 All repairing & replacement works are to be completed by the Contractor within 24 hours from the time of occurrence of fault or defect. If it is not possible to set right the equipment within this time, the Contractor shall notify the MAHAGENCO indicating nature of fault& cause of damage etc. within 12 hours from the time of occurrence of the fault.

1.0.21 During operation and maintenance if there is any loss or damage to any component of the power plant due to miss-management/ miss-handling or due to any other reasons, what so ever, the Contractor shall be responsible for immediate replacement / rectification of the same. The damaged component may be repaired, if it is understood after examination that after repairing performance of the components shall not be degraded, otherwise the defective components shall have to be replaced by new one without any extra cost to the MAHAGENCO.

1.0.22 The scope of maintenance work shall include the following:

Regular operation and maintenance of the Solar PV Power Plant including water supply pump, if any, for a period of 5 years and submission of daily performance data of the power plant. The Contractor shall keep a Record Book in this respect clearly indicating date of checking & comments for action etc.

i. The scope of operation includes injecting power to the 220 kV MSEDCL/MSETCL Grid. Proper records of operation of Power Plant System are to be kept as per direction of MAHAGENCO.
ii. Cleaning of the Power Plant including array yard on regular basis. (Module cleaning cycle should not less than twice per month)
iii. Normal and preventive maintenance of the Power Plant such as cleaning of module surface, tightening of all electrical connections, Line accessories,Transformers and associated switch gear on the HT side.
iv. Keeping & recording daily log sheet as per approved format for the Power Plant to be supplied after commissioning of the Power Plant.
v. Operation of the Power Plant has to be in accordance with the availabilityof Solar Energy and feeding to the grid. Under no circumstances, the operator shall run the power plant damaging the substation grid.
vi. Contractor's employees shall use no part of the power plant building for residential or any other purpose except for running the plant.
vii. The Contractor shall submit monthly Performance report of Solar PV Power Plant indicating cumulative energy generation data as per approved format within 15 days of the following month.
viii. The Contractor shall preserve all recorded data in either manual or through computer format and shall submit to MAHAGENCO quarterly.
ix. The Contractor shall develop & maintain the garden on the nearby area of Main Control room, Administrative building cum rest house which will be

developed by the Contractor himself as per aesthetic requirement including daily watering and manuring as and when necessary and on regular basis.

x. During 5 year's maintenance period, the Contractor have pay all broad band / wifi/satellite internet & communication charges/bills for web box system & Scada monitoring also

xi. Contractor shall pay all statutory fees/charges for renewal of required certificates during O&M period. Contractor shall pay the borneall the charges/fees/taxes local Govt. bodies, regulatory & statutory bodies.

xii. During 5 year's maintenance period, the Contractor shall refill the Liquefied CO_2 Extinguisher as per manufacturer's recommendation before expiry.

1.1. PERFORMANCE MONITORING

As part of the performance monitoring, the following shall be carried out:

a) The EPC Contractor shall maintain the list of Module IDs along with performance characteristic data for each module. This data shall be submitted to MAHAGENCO as and when required.

b) The EPC Contractors shall provide access to MAHAGENCO or their authorized representatives for installing any additional monitoring equipment to facilitate on-line transfer of data/ Generation data.

c) Web-based monitoring should be available, which should not be machine dependent. The web- based monitoring should provide the same screens as available in the plant. Also it should be possible to download reports from a remote web-client in PDF or Excelformat.

d) The EPC Contractor shall follow the Maharashtra Electricity Regulatory Commission guidelines for Forecasting, Scheduling and Deviation settlement process for Solar Generation. The regulations in this regard by the CERC/MERC as per the Indian Electricity Grid Code (IEGC) is abided to EPC Contractor.

- EPC Contractor shall appoint QCA (Qualified Coordinating Agency) as per regulation for Forecasting, Scheduling and Deviation settlement process for Solar Generation at own cost for 5 years of contract period.
- Forecasting, Scheduling & Deviation settlement process charges / fees applicable should be paid by EPC Contractor.

e) As per requirement of SLDC, EPC Contractor shall establish the required SCADA system & communication facility from project to SLDC. EPC Contractor shall be responsible for the O&M of SCADA & communication system thereof for entire contract period at its own cost.

f) Contractor shall ensure that the facility at all times.

- Have SCADA installation/any other continuous communication facility for transferring the data of Solar Energy generated from the Facility's switchyard / Nearest Substation of MSEDCL/MSETCL to the State Grid's Sub-Station(SLDC)/ Control room;
- Have installed Special Energy Meter (SEM) with telecommunication facility with

availability based tariff (ABT) feature as per relevant CEA specifications / regulations as maybe applicable.

- **Moreover, it shall be mandatory to provide real time visibility of electricity generation to Maharashtra State Load Dispatch Center (MSLDC) at Airoli, Navi Mumbai, Maharashtra or MSETCL through RTU-DC, V-SAT or any other standard protocol decided by MSETCL.**

  Contractor should provide the day ahead schedule, forecasting, availability & performance of the solar power project as per the rules & regulations applicable.

1.2. MANDATORY SPARES & CONSUMABLES

Contractor shall maintain the mandatory spares, consumables and various components of SPP for smooth running during O&M period. Contractor shall also replenish the consumed mandatory spares during the O&M period to maintain the stock as mentioned in Bid Proposal Sheet. The Contractor shall mention the source of supply for each consumable, spares and components with all contact details. The Contractor shall submit the list of spares and consumables planned to be kept at site at the time of submission of final bid.

EPC contractor shall maintain sufficient spare for any failure restoration of plant & power evacuation line.

1.3. INSTRUMENTS FOR METEOROLOGICAL MEASUREMENTS (WEATHER MONITORING STATION)

1.3.1 Contractor shall provide at least following measuring instruments with all necessary software & hardware required to make it compatible with SCADA. The weather stations must be capable of recording and reporting all the parameters like air temperature, module temperature, relative humidity, wind speed, wind direction, rain accumulated, barometric pressure, Global Horizontal Irradiation and Tilted Surface Irradiation. Specifications of some instruments are as given below.

1.3.2 **Pyranometer**: Contractor shall provide pyranometer for measuring incident global solar radiation.The specifications are as follows:

- Spectral Response- 0.31 to 2.8 micron.
- Sensitivity - 9 micro-volt / w / m2
- Time response (95%): Max 15 s
- Non linearity: ±0.5%
- Temperature Response: ±2%
- Temperature Response= Max ±2%
- Tilt error: ±0.5%.
- Zero offset thermal radiation: ±7 w/m2
- Zero offset temperature change ±2 w/m2
- Operating temperature range: - 40 deg to +80 deg.
- Uncertainty (95% confidence Level): Hourly- Max-3%; Daily- Max-2%
- Non stability: Max ±0.8%
- Resolution: Min + / - 1 W/m2
- Input Power for Instrument & Peripherals: 230 VAC (If required)
- Output Signal: Analogue form which is compatible with the data

1.3.3 Each instrument shall be supplied with necessary cables. Calibration certificate with calibration traceability to World Radiation Reference (WRR) or World Radiation Centre (WRC) shall be furnished along with the equipment. The signal cable length shall not exceed 20m. Contractor shall provide Instrument manual in hard and soft form.

1.3.4 **Thermometer:** Contractor shall also provide at least one RTD type ambient temperature measuring instrument at suitable place in PV array. Instrument shall have a range of -5°C to 60°C.

1.4. TESTING INSTRUMENTS FOR ELECTRICAL & ELECTRONICS

Contractor shall also provide required set of onsite testing instruments/equipments viz. Thermo graphic cameras, earth resistance tester, rheostats, insulation tester, multi-meter, CRO, Function Generator, Transformer oil BDV kit, Relay testing kit, infrared thermal hand held temp. meter, inverter testing kit, SF6 gas filling Kit etc.

1.5. SYSTEM DOCUMENTATION

1.5.1 The Contractor shall submit & maintain all the Engineering drawings, data, design and engineering information in both soft copy (CD) and hard copy to MAHAGENCO along with a "Master Drawing List":

- SPV array and cable layout.
- Module foundation
- Main & service road with general drainage
- Main Control Room.
- 33/220 kV Pooling Substation.
- Earthing system

Any other Engineering drawings, data, design and engineering information (whether specifically mentioned in the document or not) required to fulfill the stated scope of work shall be deemed to be included.

1.6. SCOPE OF CIVIL MAINTENANCE

1.6.1. Cleaning of surface drain, sewerage line, septic tank, drainage outfall, down pipes, soil pipes, water pipe lines and also mention pre monsoon cleaning activity.

1.6.2. Repairing or replacement, whatever necessary, and cleaning of all joineries as and when necessary.

1.6.3. Repairing or replacement, whatever necessary, of door, window fixtures, toilet accessories as and when necessary.

1.6.4. Cleaning & maintaining of power plant area.

1.6.5. Painting of fencing once in two year.

1.6.6. Painting of iron parts of array structures posts once in a year.

1.6.7. All tit bit repair maintenance in case of building and all other structures as and whenrequired as per instruction of Project of CE (RE-P&P).

1.7. OTHERS

Any Electrical work which is not mentioned or included here but necessary for the plant shall be borne by Contract.

D:- COMPREHENSIVE OPERATION & MAINTENANCE

1.0. GENERAL

1.0.1. The Operation and Maintenance shall be comprehensive. The maintenance service provided shall ensure project functioning of the Solar PV system as a whole and Power Evacuation System to the extent covered in the contract. All preventive / routine maintenance and breakdown / corrective maintenance requiredfor ensuring maximum uptime shall have to be provided. Accordingly, the Comprehensive Operation & Maintenance shall have two distinct components as described below:

Preventive / predictive Maintenance: This shall be done by the Contractor regularly and shall include activities such as cleaning and checking the health of the Solar PV system, cleaning of module surface, tightening of all electrical connections, and any other activity that may be required for proper functioning of the Solar PV system as a whole. Necessary maintenance activities, Preventive and predictive for Transformers and associated switch gears also shall be included.

Breakdown / Corrective maintenance: Whenever a fault has occurred, the Contractor has to attend to rectify the fault & the fault must be rectified within 24 hrs time from the time of occurrence.

1.0.2. The Contractor may ensure adequate insurance of Solar PV systems against robbery, theft and acts of God such as natural calamities, flood etc.

1.0.3. Detailed scope of comprehensive operation & maintenance has been described in Section II - C of this document. However, operation of the Power Plant means operation of system as per bidding schedule and workmanship in order to keep the project trouble free covering the guarantee period.

1.0.4. Contact period shall be after the completion of commissioning, PG test, FAT test and thereafter up to 5 Years of Operation and Maintenance.

1.0.5. Terms of contract may be extended beyond the period of 5 years of Operation and Maintenance on mutually agreed terms and conditions between contactor and MAHAGENCO at least ninety (90) days prior to the expiry of the first term if contact.

1.0.6. EPC Contractor shall appoint QCA for Forecasting and Scheduling generation reports as per extant regulations (MERC Regulation -2018) for Forecasting, Scheduling, Deviation Settlement Mechanism and related matters at his own cost. The scope under this Clause shall also include establishing and maintaining forecasting tools. As well as preparation and submission of report to SLDC Kalwa as per regulations is in scope of QCA/Aggregator. If Charges (Penalties) in case of any deviation shall be borne by the EPC Contractor. Also, the service charges of QCA and any other applicable deviation settlement charges shall be in scope of EPC Contractor.

1.1. DEGRADATION OF SOLAR MODULES

1.1.1. During the contract period Contractor, will ensure guaranteed generation irrespective of module degradation. The manufacturer shall warrant the output of Solar Module(s) for at least 90% of its rated power at the end of 12 years and 80% of its rated power at the endof 27 years.

1.1.2. If Module(s) fail(s) to exhibit such power output at the end of 12 years, the Contractor will either

- Deliver additional PV Module(s) to replace the loss of power output with no change in area of land used (by providing the higher capacity & efficiency modules)

OR

- Replace the PV Module(s) with no change in area of land used

OR

- Compensate MAHAGENCO with an amount equivalent to the loss of revenue from 6th to 27th years which shall be calculated based on Net Present Value of amount of loss of revenues from 6th to 27th years discounted at the rate of MAHAGENCO's cost of capital.

1.1.3. Likewise, the Contractor warrants the availability of the Plant under the conditions contained and outlined in the Operation and Maintenance Contract.

1.1.4. During the Guarantee Period, the Contractor shall guarantee that the energy generated meets the minimums of sound wave quality according to current electro technical regulations. In the event the subsystem generator causes disturbances to the network over the permitted limit, the Contractor is obliged to adopt corrective measures at its expense

E :- QUALITY ASSURANCE, QUALITY CONTROL, INSPECTION & TESTING SYSTEM

The detailed item-wise quality assurance and inspection plan shall be finalized jointly with the successful Contractor after award of contract.

1.0. QUALITY ASSURANCE & QUALITY CONTROL

1.0.1. The Contractor shall submit along with the technical bid, comprehensive QA & QC systems adopted for this project for review and approval by MAHAGENCO. The Contractor shall list out all major items/equipment / components including equipment's mentioned in list along with their makes/manufacturers. Above lists will be submitted along with the bid. Following major equipment/ BOIs will be inspected in line with corresponding MQPs (Manufacturing Quality Plan), MQP will be mutually discussed and agreed with the successful Contractor. The cost of carrying out routine and sample testing will be deemed to be included in the cost of the equipment.

i. Crystalline & thin film Solar Module: Relevant IEC Standard
ii. Power Conditioning Unit:
iii. LT cables
iv. Transformer: IEC 60076

v. LT Switchgear: IEC 60947
vi. Pooling Substation equipment like Breaker: CT, PT, Isolator &conductor, surge arrestor
vii. SCADA and communication panel FAT testing
viii. SPV structure for SPV module

1.0.2. The word "Inspector" shall mean the Project Manager and/or his authorized representative and/or an outside inspection agency acting on behalf of the MAHAGENCO.

1.0.3. Contractor will furnish their program of manufacture so that MAHAGENCO inspector could plan their visit for inspection of equipment at the beginning of the project. Anychange in program will be informed to MAHAGENCO well in advance. Inspector shall have an open access for conducting quality inspection of the system, materials or workmanship at all reasonable time when deemed necessary. The Contractor shall extend necessary co-operation to MAHAGENCO inspection teams for effectively carrying out the inspection/testing.

1.0.4. MAHAGENCO shall take all necessary measures including deputing or deployment of inspection personnel as and when and wherever required to ensure that there is no delay at its end in supply of material/equipment due to inspection.

1.0.5. However such inspection does not absolve the Contractor, the responsibility to provide performance guarantee/warranty. The Contractor shall strictly comply with the quality requirements.

1.0.6. For all spares and replacement items, the quality requirement as agreed for the mainequipment supply shall be applicable.

1.1. MATERIAL SAMPLES

1.1.1. Apart from adhering to special provision made in the specifications regarding submission of samples, the Contractor shall within 30 days of the receipt of Letter of Award, provideto MAHAGENCO clearly identified and marked samples along with detailed literature of all materials it proposes to use irrespective of the fact that specific make / material might have been stipulated. If certain items proposed to be used are of such nature that samples cannot be presented or these are to be prepared at Site, detailed literature / test certificateof the same shall be provided. MAHAGENCO shall check the samples and give their comments and/or approval to the same. The right of passing or rejecting material, components or makes shall remain with MAHAGENCO.

1.1.2. One sample each shall be submitted at MAHAGENCO office and one sample each shall be maintained at the Site for inspection by MAHAGENCO. Wherever possible, like SCB, the samples shall be on returnable basis and Contractor can plan to use these at the end of the activity once inspection is completed. The following list is only an indicative one and MAHAGENCO can ask for any other material sample before use of the material on the Site and the Contractor shall be required to submit the same without fail.

i. String Combiner Box – one sample of complete assembled box along with one sample each of all the components used
ii. AC and DC wires and cables in appropriate lengths for all types to be used in the

project

iii. Module mounting structure legs and other members of appropriate lengths
iv. Nuts and bolts of all types to be used in the project
v. All types of connectors
vi. Watch tower legs and structural elements
vii. Earthing strips of all types proposed

The numbers and lengths, wherever applicable, shall be decided by MAHAGENCO and shall be communicated with the Successful Contractor immediately after the acceptance of the LOA.

1.2. FIELD INSPECTION & TESTING

1.2.1. Field Quality Plans (FQP) will detail out all the site tests / checks to be carried out during receipt, storage, erection of the equipment. The Contractor /sub-vendor shall also furnish copies of the erection & commissioning manuals, reference documents and inspection procedure through soft as well as hard copy. FQP will be mutually discussed and finalized preferably in the format mentioned. After FQP finalization / approval the same shall be submitted in compiled form on Data drive/HDD/Pen drive. These approved documents shall form a part of the contract. In these approved Quality Plans, Employer shall identify customer hold points (CHP), i.e. test/checks which shall be carried out in presence of the Employer's Project Manager or his authorized representative and beyond which the work will not proceed without consent of Employer/Authorized representative in writing. All deviations to this specification, approved quality plans and applicable standards must be documented and referred to Employer along with technical justification for approval and dispositioning.

1.2.2. The Contractor has to follow and comply with the requirements of sampling, testing and quality assurance for civil works pursuant to the details mentioned in RFP.

F :- Methodology of Approval of Electrical Drawings and preparation of Project Design Document(PDD)

The Contractor shall prepare a single Project Design Document (PDD) which shall contain its design basis & design calculations in all respects i.e. Civil, Electrical and Mechanical parts. All the drawing and documents shall follow their respective serial numbers. There shall be common references/sequence of numbers for the drawings and documents submitted by the Contractor. This can be compiled in the PDD after finalization andapproval.

For smoothness of the approval process of electrical drawings and documents the Contractor shall make submissions in three steps as detailed here. After having clear opinion and approval on the steps1and2 the drawings can be approved easily without many revisions and wastage of time forgetting approval. Before, or at the time of, submitting the drawings and the PDD for approval the vendor related information is essential and is to be furnished in systematic manner as given below:

1.0. STEPS FOR VENDOR APPROVAL:

1.0.1. At execution phase Contractor is not allowed to change the vendors offered in the bid proposal & accepted by MAHAGENCO for PV modules, DC cables, String Monitoring system, inverters, transformers, from the vendors offered by Contractor in the bid-proposal. In very rare case if the proposed vendor is not able to supply the material in such case, MAHAGENCO may allow to change the vendor on submission of the valid documentary evidence of inability to supply the material of proposed vendor. New proposed vendor shall meet the technical criteria & shall have higher quality than the old proposed vendor.

1.0.2. Steps for approval of the vendors other than the above are stated as under :

The Vendor shall meet all eligible criteria as mentioned in the RFP. Following documents must be submitted to the MAHAGENCO for approval of any vendor:

1. Name of the company, address, date of establishment, nature of business, name and quantity of item, annual manufacturing capacity, applicable IS/ASTM/IEC standards
2. Compliance of standards IEC/ASTM/IS and certification from accredited institutions
3. Experience in solar field: material supplied to solar power project; name of the power plant, capacity, quantity supplied, year of supply, etc.
4. Guaranteed Technical Parameters duly signed and sealed by vendor/manufacturer and Contractor.
5. Authorized technical specification datasheet of the equipment published in publicdomain / website.
6. Technical Experience and performance certificates as specified in the RFP froma competent authority/solar power project developer.
7. The material supply experience certificate as specified in the RFP shall be issued by the statutory auditor.
8. Manufacturing facility details complete with equipment and process details
9. Detailed Quality Assurance Plan along with testing facilities at factory.

1.1. STEPS FOR APPROVAL OF DRAWINGS:

1.1.1. Step 1: Applicable for all equipment in Solar Power Plant

1. Name of the vendors and equipment suppliers involved in solar power project.
2. Major and minor equipment along with detailed technical specifications andmodel/serial number, company details, etc.
3. Detailed drawings of major and minor equipment including rating and model/serial number
4. Foundation analysis for critical equipment such as inverter, transformer, circuit breaker, etc.
5. Cable layout details of the project and loss calculations
6. Test report for equipment supplied (same model) for previous projects
7. Supply schedule of equipment

1.1.2. Step 2: DC/AC side calculations and analysis

1. Load flow analysis
2. Unbalanced load analysis
3. Short circuit calculation and system study with fault level calculation for 25 kA / 1

second selected

4. Harmonics regulation philosophy and scheme in the inverter
5. Transient stability analysis
6. Protective device coordination analysis
7. Reliability assessment analysis
8. Lightning protection calculation as per IS : 2309
9. DC load flow analysis and power loss calculations
10. DC short circuit analysis
11. DC cable sizing calculations
12. Underground runway system analysis calculations as per IEC 60287
13. Power factor regulation philosophy and scheme in the inverter
14. Reactive power regulation philosophy and scheme in the inverter
15. Cable de-rating calculations
16. Earthing system design calculations for the power plant as per IEEE 80
17. Steady state temperature calculations
18. Lightning arrestor guaranteed particulars confirmation.
19. Lighting design and calculations for power plant
20. Synchronizing scheme
21. CT & PT VA burden calculations
22. Relay setting chart for AC side (inverter and transformer protections)
23. Calculation of Auxiliary Power requirement.

1.1.3. Step 3: Submission of all drawings for approval and information as the case may be:

The drawings shall be submitted along with step 1 and step 2 particulars. Without having details mentioned in Step 1 and 2 the drawings cannot be approved for the rating mentioned in the drawings. Below is the list of drawings that must be submitted. This list is not exhaustive and depending on design and requirements Contractor shall submit additional drawings or MAHAGENCO can also ask for any other drawings not listed here.

A	**DRAWING OF CIVIL WORK FOR ARRAY YARD**
1.	General Layout drawing of Solar PV power plant locating control room building, module yard, Internal roadways, drainage system, gate, water distribution line mentioning all lines and levels.
2.	General equipment layout drawings for control room, transformer, main switchyard(Pooling Substation), Single Line diagram, switch gear room etc.
3.	General layout of Solar PV module yard locating earth pits & earth continuity, cable trenches, yard LED lightings, lightning conductors with its corresponding earth pits and cable trays.
4.	Topographical survey for proposed area & civil drawing for Array yard
5.	Array yard layout
6.	Model mounting structure and design data
7.	Module Structure Foundation drawing
8.	Approach road and path way
9.	Water arrangement for module cleaning, Module cleaning system (Wet /Dry)

10	Water sewage and drainage system
11	Fencing to yard
12	Watch towers
	Other drawing as may be required by MAHAGENCO for clear understanding.
B	**DRAWING OF ELECTRICAL WORK FOR ARRAY YARD**
13	AC single line Drawing
14	DC single line Drawing
15	DC system design calculations
16	String Monitoring Scheme
17	Drawing for cable trenches and wiring
18	Array yard lightning protection
19	Drawing for Earthing system for Array yard
	Other drawing as may be required by MAHAGENCO for clear understanding.
	1.0 POWER CONTROL UNIT
20	Drawing for main control room building
21	Drawing for security cabin and boom barrier
22	Drawing for DC bus panel
23	Drawing for AC bus panel
24	Drawing for Circuit Breaker
25	Drawing for DC battery and charger
26	Drawings for protection system
27	Drawing for auxiliary power supply
28	Drawing for string monitoring & system
29	Drawing for web box and remote monitoring system
	2.0 Other drawing as may be required by MAHAGENCO for clear
30	Drawing for Control Panel monitoring desk
31	Structural details of construction works includes foundation, tie beam, column, lintel, chajja, roof beam with roof, and water storage tank with supporting structure details, parapet, plinth protection.
32	Details of power conditioning unit/inverter (Bill of Materials, Schematic diagram, Wiring diagram, Internal layouts etc.).
33	Drawing for cable and wires layout, routing & terminations along with cable schedule.
34	Drawing for control electrical wiring
35	Drawing for Auxiliary power supply
36	Drawing for DC Battery and battery charger
37	Line diagram, Block diagram & CKT diagram for Surveillance
38	Line diagram, Block diagram & CKT diagram for SCADA
39	Line diagram, Block diagram & CKT diagram for weather monitoring
40	Other drawing as may be required by MAHAGENCO for clear
C	**Main switchyard(Pooling Substation)**
41	Earthing system for 33 kV switchyard
42	Earthing system for main switchyard (Pooling Substation)
43	Drawing for Transformer
44	Drawing for lightning Arresters
45	Circuit Breakers for Main switchyard (Pooling Substation)
46	Cable routing & termination drawing along with cable schedule

47	Drawing for isolators for main switchyard (Pooling Substation)
48	Switch yard single line diagram for main switchyard (Pooling Substation)

1. These drawing along with design calculations shall show sufficient overall dimensions, clearance and space requirements of all apparatus to be furnished, to enable the MAHAGENCO to determine the design and layout of the installation.
2. Within 10 days of receipt of such drawings & design calculations, the MAHAGENCO shall convey his approval or otherwise of the same, and in the event of disapproving the drawing, the Contractor shall re-submit the revised drawings with proper "revision number" for approval after making necessary modification / correction.
3. No extension of time shall be allowed on account of the time consumed in submission and examination of defective drawings and resubmission of the corrected drawings.
4. Within a reasonable period from the date of receipt of approval, the Contractor shall submit six sets of drawings with two soft copies (CAD & pdf) to Chief Engineer (RE-P&P), MAHAGENCO), thereafter be deemed to be the "Contract Drawings".
5. These drawings, when so signed, shall become the property of MAHAGENCO. No exclusion from the drawings in any way will be allowed in execution except with written permission of CE (RE-P&P) of MAHAGENCO.
6. The Contractor, if required by the CE (RE-P&P) shall supply additional copies of any drawing without charging any extra cost, which may reasonably be required for the purpose of the contract.
7. Any tender drawings, technical data or correspondence which form the basis of an order or contract, as aforesaid, or which may be furnished by the Contractor for the MAHAGENCO's approval, or information, as provided under the said order or contract, shall be in English and if it is in any other language a complete translation in English shall be duly furnished. All Civil Drawings are to be get approved by the Authority designated by MAHAGENCO before starting any civil work. All design calculationsof structures are to be submitted for approval to MAHAGENCO.
8. The Contractor shall be responsible for and shall pay for any alterations of the work due to any discrepancies, errors and omissions in the drawings or other particulars supplied by him
9. whether such drawings or particulars have been approved by the MAHAGENCO or not, provided that such discrepancies, errors or omissions are due to inaccurate information or particulars furnished to the Contractor by the MAHAGENCO. Any alterations in the work, necessitated by reasons of such inaccurate information of particulars, shall be paid for by the MAHAGENCO.

1.2. USE OF CONTRACT DOCUMENTS & INFORMATION

1.2.1. The Contractor shall not, without the MAHAGENCO's prior written consent, disclose the contract or any provision thereof or any specification, plan, drawing, pattern therewith to any person other than person employed by the Contractor in performance of the contract. Disclosure to any such employed person shall be made in confidence and shall extend strictly for purpose of performance only.

1.2.2. The Contractor shall not, without MAHAGENCO's prior written consent, make use of any document or information enumerated in Para one under this clause except for purpose of performing the contract.

1.2.3. Any document other than the Contract itself, enumerated in Para one under this clause shall remain the property of the MAHAGENCO.

1.3. PATENT RIGHTS

1.3.1. The Contractor shall indemnify the MAHAGENCO against third party claims of infringement of patent, trademark or industrial design rights arising from use of goods or any part thereof in India.

1.4. MATERIALS AND WORKMANSHIP

1.4.1. All materials shall be of the best quality and workmanship capable of satisfactory operation under the operating and climatic conditions as may be specified. Unless otherwise specified, they shall conform in all respect to the latest edition of the relevant Bureau of Indian Standard (BIS) specification wherever Indian specifications apply or internationally accepted standard.

1.4.2. The vendors proposed by Contractor are considered final and change in any vendors after the contract of award is generally not acceptable. Change in vendor is acceptable only in exceptional case when the vendor has discontinued the production of proposed models or vendor is unable to supply proposed models. In case of change, new proposed equipment shall be of better & superior quality than the previously. The Contractor has to substantiate the same with proper documentary evidence as required by MAHAGENCO. MAHAGENCO and lender Bank of MAHAGENCO approval is necessary in this case.

1.4.3. If the Contractor shall offer equipment manufactured in accordance with other international well recognized standards, he shall, in that case, supply a copy in English of the Standard Specification adopted and shall clearly mention in what respect such standard specification differs from Indian Standard Specifications. The Plant, equipment, and materials offered by the Contractor shall comply with one consistent set of Standards only as far as possible.

1.5. MATERIAL STORAGE AT SITE:

The Contractor shall supply & deliver all equipment and materials for installation at site. The Contractor shall arrange for transportation, loading & unloading and safe storage of materials at project site at his own cost & risk.

The Contractor shall make the proper temporary sheds and fence for storing of material along with adequate security and surveillance. The storing and stacking of material should carried out as per the standard requirements of OEM. Proper Inventory of all material should be maintained and supervised in co-ordination with site in charge of Mahagenco.The material stored at site should be protected from damage due to adverse climatic conditions, theft, fire etc. contractor shall be liable and responsible for safety & insuranceof the stored material.

1.6. INTER-CHANGEABILITY

All the parts shall be made accurately to Standard gauges so as to facilitate replacement and repairs. All corresponding parts of similar apparatus shall be inter-changeable.

1.7. PACKING AND MARKING

1.7.1. The Contractor shall be responsible for securely protecting and packing the plant & equipment as per prescribed standards in force to withstand the journey and ensuring safety of materials and also arrival of materials at destination in original condition and good for contemplated use. Packing case size & weight shall take into consideration the remotenessof the goods final destination and absence of heavy material handling facilities at all points in transit.

1.7.2. Packing lists of materials shall be provided in each package to facilitate checking up of the contents at the destination.

1.7.3. In order to import any items, associated with the Solar PV Power Project, from abroad or from any other state in India, Contractor shall have to arrange any clearance, permission, if required at his own risk, from any Government (Government of Maharashtra & Government of India) or any Government (Government of Maharashtra & Government of India) controlled organization for transportation of materials from manufacturing shopto delivery at site. Necessary certificates if so required shall be issued by theMAHAGENCO within reasonable time after getting written request from the Contractor along with the necessary documents substantiating necessity of such approvals.

1.7.4. Disposal of hazardous packing material is the responsibility of Contractor and it shall be disposed immediately in view of safety & security of the plant. Contractor will be responsible for any damage or loss due to the packing materials.

SECTION III

GENERAL TERMS & CONDITIONS

III. SECTION III: GENERAL TERMS & CONDITIONS

1.0. PERFORMANCE GUARANTEE

i. The qualified bidder after award of contract shall be required to furnish, within 7 days from LOA, Bank Guarantee equivalent to 10% of total contract value inclusive of taxes toward contract performance security up to issue of Final Acceptance Test certificate and PG Test Certificate by MAHAGENCO, this Bank Guarantee shall be valid till 180 days beyond the contract period & further claim period of 180 days.

ii. Thereafter, Bank Guarantee equivalent to 10% of O&M contract value inclusive of taxes towards contract performance security, this Bank Guarantee shall be valid till 180 days beyond 5 years of O&M period & further claim period of 180 days. O&M Bank Guarantee should be submitted 15 days prior to commencement of O&M.

1.0.1. The Bank Guarantee shall remain binding not withstanding such variations, alterations or extensions of completion time as may be made, agreed to between the Contractor and MAHAGENCO.

1.0.2. The said Performance Security shall not in any way be construed as a limitation of the Contractor's responsibilities or liability pertaining to its obligations and/or guarantees under the Contract and shall be without prejudice and in addition to any other remedies available to MAHAGENCO in terms of the Contract and/or the applicable laws.

1.0.3. All Bank charges and all other charges in connection with bank guarantee shall be borne by the Contractor.

1.0.4. The proceeds of the Bank Guarantee shall be payable to the MAHAGENCO as compensation for any loss resulting from the Contractor's failure to complete his obligations during the successful completion of the Project and five (5) years O&M Contract period.

1.0.5. The Performance Bank Guarantee (Performance Security) of 10% shall be released within 7 days after successful completion of FAT & PG test of 62 MW_{AC} Solar PV Plant.

1.0.6. Contractor shall ensure the continuous running of Power Plant without any interruption within the contractual period of operation & maintenance of the power plant. The contractor shall detect the root cause of fault within 12 hrs and report to same to MAHAGENCO. All repairing & replacement works are to be completed by the Contractor within 36 hours from the time of occurrence of fault or defect.

1.0.7. However, in case Contractor fails to restore the generation and evacuation of power **beyond the time line he has reported,** a performance penalty shall be imposed on the Contractor and the same shall be realized by invoking the bank guarantee. The penalty shall be assessed on the basis of loss of generation as per Clause 1.22 of section IV of this document.

PBG to be provided on Stamp Paper of Rs. 500/-.

1.0.8. Return of O&M Bank guarantee:-

MAHAGENCO will return the bank guarantee after 3 month of completion of O&M period (5years). BG will return only after satisfaction of following condition by MAHAGENCO

a. Contractor should not have any financial liability from bank/Investor/ promoter limited to Paras 62 MW_{AC} solar project. MAHAGENCO is privy to Paras 62

MW_{AC} solar Project.

b. Contractor should not have any manpower liability as per Contract Labour Regulate & Abolition Act limited to Paras 62 MW_{AC} solar project.

c. All valid statutory approval should be clear

   i. The Factories Act, 1948, (FA)

   ii. The Maharashtra Factories Rules, 1963, (MFR)

   iii. CEA/CEIG Safety Regulations, 2011, (CEASR)

   iv. Contract Labour Regulate & Abolition Act, (CLRAA) or any mandatory or statutory as and when required.

d. Before handing over the Solar Plant to MAHAGENCO, the land should be incumbrancer free and clean.

e. Contractor shall handover all spare ,tool and tackles etc.(No manpower) before handing over the Solar plant

f. Contractor shall conduct financial reconciliation and submit final financial closure report to MAHAGENCO limited to Paras 62 MW_{AC} solar project.

g. Contractor shall submit NO CLAIM certificate after completion of O&M before hand over the plant

1.1. CONTRACT DRAWING

The Contractor within 30 days of award of LoA shall submit 6 copies of draft/preliminary drawing enumerated below and in various other sections of the specifications for approval. Finally, the Contractor shall submit 6 no. of approved hard copies & two softcopies (one in CAD and other in pdf format) of each drawing "As approved".

1.2. POWER TO VARY OR OMIT WORK

1.2.1. No alterations, amendments, omissions, additions, subtractions, or variations of the work (hereinafter referred to as 'variation') under the contract shall be made by the Contractor except as directed by the CE(RE-P&P).

1.2.2. If any suggested variations, in the opinion of the Contractor, prevent him from fulfilling any of his obligations or guarantees under the contract, he shall notify the CE (RE-P&P) thereof in writing, and the CE(RE-P&P) shall decide forthwith whether or not the same shall be carried out, and if CE (RE-P&P) confirms his instruction, the Contractor shall carryout the work as per instruction.

1.2.3. The differences in cost, if any, occurred by such variations, shall be deducted from the contract price, as the case may be. However, no additional payment for such variation will be paid by the MAHAGENCO.

1.2.4. In the event of CE(RE-P&P) requiring any variations, reasonable and proper notice shall be given to the Contractor as well as to enable him to make arrangements accordingly, and in cases where goods or materials are already prepared/procured, or any designs, drawings or

patterns made or work done that require to be altered, a reasonable sum in respect thereof shall be allowed by the CE(RE-P&P).

1.2.5. In any case, no deviations are allowed in design or specification of the tender document at any stage.

1.3. NEGLIGENCE

1.3.1. If the Contractor neglect to manufacture or supply the plant and equipment with duediligence and expeditiousness or refuse or neglect to comply with any reasonable order givento him in writing by the CE (RE-P&P) or contravene any provisions of the contract, the MAHAGENCO may give seven days' notice in writing to the Contractor, to make good the failure, neglect or contravention complained of and, If the Contractor fail to comply with thenotice within reasonable time from the date of serving thereof, in the event of failure, neglect or contravention capable of being made good within that time, then in such case, if the MAHAGENCO shall think fit, it shall be lawful for him to take the manufacture or supply of plant wholly or in part, out of the Contractor's hand and give it to another person on contract at a reasonable price and the MAHAGENCO shall be entitled to retain any balance which may be otherwise due on the contract by him to the Contractor or such part thereof as may be necessary, to the payment of the cost of manufacture or supply of such plant as aforesaid.

1.3.2. If the cost of executing the work as aforesaid shall exceed the balance due to the Contractor and the Contractor fails to make good such deficiency, the MAHAGENCO shall take action in the manner it may consider deem fit in terms of the contract.

1.4. STATUTORY RESPONSIBILITY

1.4.1. The Contractor shall comply with all applicable laws or ordinances, codes, approved standards, rules, and regulations and shall procure all necessary Municipal, Panchayat and Government permits, licenses at its own cost. Also, fees, royalties, charges etc. shall be borne by the Contractor at his own cost.

1.4.2. The Contractor shall leave the MAHAGENCO and the CE(RE-P&P) harmless as a result of any infractions thereof. If required, the Contractor shall renew the above permits & licenses in case such situation warrants.

1.5. INSOLVENCY AND BREACH OF CONTRACT

1.5.1. The MAHAGENCO may at any time by notice in writing summarily terminate the Contract without compensation to the Contractor in any of the following events:

1.5.2. If the Contractor being an individual or if a firm, any partner thereof shall at any time, be adjudged insolvent or shall have a receiving order or order from administration of his estate made against him or shall take any proceeding for composition under any Insolvency Act for the time being in force or make any conveyance or assignment with his creditors or suspend payment or if the firm be dissolved under Partnership Act,

OR

1.5.3. If the Contractor being a Company is wound up voluntarily or by the order of a court

or a Receiver, Liquidator or manager on behalf of the Debenture holder is appointed or circumstances have arisen which entitle the Court or debenture holder to appoint a Receiver, Liquidator or Manager,

OR

1.5.4. If the Contractor commits any breach of the contract not herein specifically providedfor, provided always that such determination shall not prejudice any right of action or remedy which shall have accrued or shall accrue thereafter to the MAHAGENCO and provided also that the Contractor shall be liable to pay to the MAHAGENCO. The Contractor shall under no circumstances be entitled to pay again or repurchase.

1.6. TIME OF COMPLETION

1.6.1. The Contractor shall provide full program of the supply in detail and deliveryschedule along with work schedule thereto. Strict adherence and guaranteed delivery schedule mentioned in terms & conditions shall be the essence of the contract and delivery must be maintained. The work must be completed as per the TIME LINE below from the date of handing over of site. The Contractor shall also provide a Bar/PERT Chart indicating completion schedule for various items involved in the work within the stipulated completion period and the Contractor shall strictly adhere to that schedule.

1.6.2. Since the land is clear and in possession of MAHAGENCO bidder shall take over the land immediately (within 15 days) after placing of LOA and fulfilling his contractual obligation. Time of completion schedule for entire 62 MW_{AC} Solar Power Plant (SPP) as follows,

Project Completion Schedule		
Sr.	**Stage/Ste**	**Reference**
		From D
1	Handing over of project land.	Zero Date (D)
2	Site development work	D+45
3	Approval of all major drawings	D+100
4	Completion of civil works including but not limited to Section -IIA of RfP Tender document	D+150
5	Completion of supply of equipments like: SPV Modules (including structures for the above), Power Conditioning Units, Power Evacuation equipments, etc.	D+270
6	Installation of all equipments & Interconnection of all equipments and completion of installation	D+330
7	Achievement of **Commissioning** with entire contracted capacity.	D+365

1.6.3. EXECUTION PLAN

a) The completion time is deemed to be essence of the Contract in order for the Plant to obtain the Tariff and shall be firm and binding for the Contractor. The Contractor shall complete the Project as per terms and conditions detailed herein. The Contractor has indicated, on a binding basis, duration of all the activities in a PERT Chart in conformity to the overall

schedule of the completion of Project. This PERT Chart shall form an integral part of the Contract and is included as Appendix 1.

b) The Contractor states that the Execution Plan has been based on the studies and documentation relating to the Project and is in accordance with the necessities and circumstances of the same. As such, the parties agree that the Execution Plan will be adhered to without any variation, having to punctually comply with all stipulated in it, without under any circumstances being able to advance or delay the stages fixed in it, unlessthere is a specific agreement between the Parties.

1.7. DELAY IN EXECUTION OR FAILURE TO SUPPLY

1.7.1. If the work is delayed on account of (i) Increase in quantity of work (ii) Suspension of work as ordered by MAHAGENCO (iii) Force Majeure conditions (iv) Any other causes, which, in absolute discretion of the CE(RE-P&P) are beyond the Contractor's control, the Contractor shall appeal to MAHAGENCO in the form of a written application along with the complete delay analysis before expiry of the such activity, bringing out the causes responsible for the delay, for granting suitable time extension.

1.7.2. If the Contractor is found responsible for any delay by any reasons which are not attributed to contractors accounts, in such case formal time extension shall be granted by MAHAGENCO.

1.7.3. If the Contractor fails to deliver the plant or fails to start the work within specified time frame after signing of contract agreement or leave the work site after partial execution of the work, MAHAGENCO shall have the right to get the work done through any other agency at the risk and cost of the Contractor. Further to this, MAHAGENCO may, without prejudice to the right of the MAHAGENCO to recover damages for breach of trust of the contract, may impose penalties.

1.8. LIQUIDATED DAMAGES

1.8.1. In case of contractor fails to achieve milestone no.2 (Supply milestone) by the due date indicated in "Time of Completion' then the Owner shall levy the Liquidated Damages on the Contractor at the rate of 5% of total supply price (Milestone no.2) inclusive of taxes.

1.8.2. In case the Contractor fails to achieve Milestone no.1, 3, 4 & 5 by the due date indicated in "Time of Completion' then the Owner shall levy the Liquidated Damages on the Contractor at the rate of 1.0% (one percent) per week of delay or part thereof, subject to a maximum of 5.0% (five percent) of total contract price inclusive of taxes (exclusive of O&M cost).

LD amount will be inclusive of taxes. Also Goods & Service Tax (GST) if applicable on Liquidated Damages (LD) as per GST Law, shall be recovered from any due claim OR payment to the EPC Contractor.

1.9. TERMINATION FOR DEFAULT

1.9.1. The MAHAGENCO may, without prejudice to any other remedy for breach of contract, by written notice of default sent to the Contractor, terminate the contract in whole or part:

1.9.2. If the Contractor fails to deliver or execute any or all of the goods within the time period(s) under the contract or any extension thereof granted by the MAHAGENCO pursuant to the clause for Delay in Execution or Failure to Supply or If the Contractor fails to perform any

other obligations(s) under the contract.

1.9.3. In the event the MAHAGENCO terminates the contract in whole or in part, pursuant to above, the MAHAGENCO may procure, upon such terms and in such manner as it deems appropriate, Goods similar to those undelivered, the Contractor shall be liable to the MAHAGENCO for any excess costs for such similar goods. However, the Contractor shall continue the performance of the contract to the extent not terminated.

1.10. BREACH OF THE CONTRACT

In case of non-performance in any form or change of the covenant and conditions of the Contract by the Contractor, MAHAGENCO shall have the power to cancel the order or a portion thereof and if so purchase or authorize purchase of the plant/equipment not so delivered or order plant/equipment of similar description (opinion of MAHAGENCO shall be final) at risk and cost of contractor.

1.11. FORCE MAJEURE

1.11.1. Natural Force Majeure Event:

c) Act of God, including, but not limited to lightning, drought, fire and explosion (to the extent originating from a source external to the site), earthquake, volcanic eruption, landslide, flood, cyclone, typhoon or tornado if it is declared / notified by the competent state / central authority / agency (as applicable), or verified to the satisfaction of MAHAGENCO;

d) Radioactive contamination or ionizing radiation originating from a source in India or resulting from another Force Majeure Event mentioned above excluding circumstances where the source or cause of contamination or radiation is brought or has been brought into or near the Power Project by the Affected Party or those employed or engaged by the Affected Party;

e) The discovery of geological conditions, toxic contamination or archaeological remains on the Project land that could not reasonably have been expected to be discovered through an inspection of the Project land;

or

f) Any event or circumstances of a nature analogous to any of the foregoing.

1.11.2. Non-Natural Force Majeure Event:

a) Any act of war (whether declared or undeclared), invasion, armed conflict or act of foreign enemy, blockade, embargo, revolution, riot, insurrection, terrorist or military action.

b) Nation/state-wide strike, lockout, boycotts or other industrial disputes which are not directly and solely attributable to the actions of the Affected Party but does not include strike or Labour unrest limited to the Affected Party or its Contractor.

c) Nationalization or any compulsory acquisition by any Indian Governmental Instrumentality/ State Government in national interest or expropriation of any material Project assets or rights of the Contractor, as a result of which the Contractor or its shareholders are deprived (wholly or partly) of their rights or entitlements under the Agreement. Provided that such action does not constitute remedies or sanctions lawfully exercised by the owner or any other Government Authority as a result of any breach of any of the Applicable Laws or the Applicable Permits by the owner or Contractor related parties;

d) Action of a Government Authority having Material Adverse Effect including but not limited to change in law, only if consequences thereof cannot be dealt with under and in accordance with the provisions of clause 1.36 of section-III ; any unlawful or unauthorized or without jurisdiction revocation of, or delay in, or refusal, or failure to renew or grant without valid cause, any Permits of the Contractor or any of the clearance, license, authorization to be obtained by the Contractors to perform their respective obligations under the relevant Agreement and/or the Project Documents; provided that such delay, modification, denial, refusal or revocation did not result from Contractor's or any Contractors inability or failure to comply with any condition relating to grant, maintenance or renewal of such Permits or clearance, license, authorization, as the case may be.

Clarification: The phrase "Change in Law" would include changes brought out through change in Law, Rules, Regulations or orders of competent authorities.

1.11.3. Force Majeure Exclusions

a) Force Majeure shall not include (i) any event or circumstance which is within the reasonable control of the Parties and (ii) the following conditions, except to the extent that they are consequences of an event of Force Majeure:

i. Unavailability, late delivery, or changes in cost of the plant, machinery, equipment, materials, spare parts or consumables for the Power Project;

ii. Delay in the performance of any Contractor, sub-Contractor or their agents;

iii. Non-performance resulting from normal wear and tear typically experienced in power generation materials and equipment;

iv. Strikes at the facilities of the Affected Party;

v. Insufficiency of finances or funds or the agreement becoming onerous to perform; and

vi. Non-performance caused by, or connected with, the Affected Party's:
   a. Negligent or intentional acts, errors or omissions;
   b. Failure to comply with an Indian Law; or
   c. Breach of, or default under this Agreement.

1.11.4. Notification of Force Majeure Event:

a) The Affected Party shall give notice to the other Party of any event of Force Majeure as soon as reasonably practicable, but not later than 7 days after the date on which such Party knew or should reasonably have known of the commencement of the event of Force Majeure. If an event of Force Majeure results in a breakdown of communications rendering it unreasonable to give notice within the applicable time limit specified herein, then the Party claiming Force Majeure shall give such notice as soon as reasonably practicable after reinstatement of communications, but not later than one (1) day after such reinstatement.

b) Provided that such notice shall be a pre-condition to the Affected Party's entitlement to claim relief under this agreement. Such notice shall include full particulars of the event of Force Majeure, its effects on the Party claiming relief and the remedial measures proposed. The Affected Party shall give the other Party regular (and not less than weekly) reports on the progress of those remedial measures and such other information as the other Party may

reasonably request about the Force Majeure Event.

c) The Affected Party shall give notice to the other Party of (i) the cessation of the relevant event of Force Majeure; and (ii) the cessation of the effects of such event of Force Majeure on the performance of its obligations under this agreement, as soon as practicable after becoming aware of each of these cessations.

1.11.5. Performance Excused:

d) The Affected Party, to the extent rendered unable to perform its obligations or part of the obligation thereof under this agreement as a consequence of the Force Majeure Event, shall be excused from performance of the obligations, provided that the period shall not exceed 180 (One hundred and eighty) Days from the date of issuance of the FM Notice. The Parties may mutually agree to extend the period for which performance is excused due to a Force Majeure Event.

e) For the time period, as mutually agreed by the Parties, during which the performance shall be excused, the Contractor shall be entitled for a day to day extension of the period provided for Financial Closure or Scheduled Commissioning Period, as the case may be.

f) Provided always that a Party shall be excused from performance only to the extent reasonably warranted by the Force Majeure Event.

g) Provided further that, nothing shall absolve the Affected Party from any payment obligations accrued prior to the occurrence of the underlying Force Majeure Event.

h) **No Liability for Other Losses:** Save as otherwise provided in this agreement, no Party shall be liable in any manner, whatsoever, to the other Parties in respect of any Loss relatingto or arising out of the occurrence or existence of any Force Majeure Event.

i) **Resumption of Performance:** During the period that a Force Majeure Event is subsisting, the Affected Party shall, in consultation with the other Parties, make all reasonable efforts to limit or mitigate the effects of such Force Majeure Event on the performance of its obligations under this agreement. The Affected Party shall also make efforts to resume performance of its obligations under this Agreement as soon as possible and upon resumption, shall notify other Parties of the same in writing. The other Parties shall afford all reasonable assistance to the Affected Party in this regard.

1.11.6. Termination Due to Force Majeure Event:

a) If, prior to the completion of the 180 (One hundred and eighty) Days period (or any extended period) for a Force Majeure Event commencing from the date of issuance of the Force Majeure Notice, the Parties are of the reasonable view that a Force Majeure Event is likely to continue beyond such 180 (One hundred and eighty) Days period or anyextended period agreed in pursuance of clause 27.5 (Performance Excused); or that it is uneconomic or impractical to restore the affected Unit, then the Parties may mutually decideto terminate the agreements, and the termination shall take effect from the date on which such decision is taken.

b) Without prejudice to the provisions of clause above, the Affected Party shall, after the expiry of the period of 180 (One hundred and eighty) days or any other mutually extended period, be entitled to forthwith terminate this agreement in its sole discretion by issuing a notice to that effect.

c) On termination of the agreements pursuant to above clause:

i. No Termination Compensation shall be payable to Contractor.

ii. Contractor shall be eligible for undisputed payments under any agreement (Agreements under Umbrella agreement), before the occurrence of Force Majeure Event.

1.12. PROGRESS REPORT OF WORK

1.12.1. The Contractor shall submit daily, weekly & monthly progress report on execution of works conforming to bar chart, network like PERT. In case of any slippage(s) or delay in execution of work reasons for such delay along with details of hindrances will be submitted by the Contractor along with modified Bar Chart mentioning the action plan being taken to keep the due date of completion of project unchanged. If required, Contractor shall use additional manpower to keep the due date of completion of project unchanged.

1.12.2. The authorized representative of Contractor shall review the progress of project work every fortnight on a prefixed day at project site with the CE (RE-P&P) or his representative as per the network and record the minutes in a register.

1.13. INSURANCE

1.13.1. During the Contract period, all Insurance related expenses shall be borne by Contractor. At the beginning of each year of O&M, the Contractor shall show adequate insurance coverage of the entire project up to the contract period. In case the insurance coverage is notup to the expectation of MAHAGENCO, MAHAGENCO shall take up the Insurance and all the charges related to Insurance shall be deducted from the payments due to the Contractors.

1.13.2. The goods supplied under the contract shall be fully insured as long as the plant continues to remain under the custody of the Contractor against the loss or damage incidental to manufacture or acquisition, transportation, storage and delivery in such a manner that MAHAGENCO shall not incur any financial loss.

1.13.3. In case of any loss or damage or pilferage or theft or fire accident or combination of the said incidents etc. under the coverage of insurance, the Contractor shall lodge the claim as per rules of insurance. Any FIR required to be lodged to local Police Station shall be the responsibility of Contractor.

1.13.4. The Contractor shall arrange to supply/rectify/recover the materials even if the claim is unsettled for timely completion of the project. The final financial settlement with theinsurance company shall be rested upon the Contractor.

1.13.5. In case of any delay of the project attributable to the Contractor, the Contractor himself in consultation with MAHAGENCO shall take the extension of insurance. Any financial implications shall, however, be borne by the Contractor

1.13.6. The Contractor shall arrange for providing insurance coverage to his workmen under Workmen's Compensation Act or similar Rules and Acts as applicable during execution of work for covering risk against any mishap to his workmen. Contractor shall also undertake a

Third-Party Insurance. MAHAGENCO will not be responsible for any such loss or mishap.

1.13.7. Fire insurance is to be arranged by the Contractor up to the completion of five (5) years O&M contract.

1.14. STATUTORY ACTS, RULES AND STANDARDS

The work shall be executed in conformity with the relevant standard of Bureau of Indian Standards (or equivalent International Standard), Indian Electricity Rules, 1956 (as amended up to date), Indian Electricity Act, BARC/DAE rules, Explosive Act 1948, Petroleum Act 1934, National Building Code and relevant Rules in vogue at the time of execution including operation & maintenance period. All the fees/cost regarding renewalsof all required statutory certificates shall be borne by Contractor during contract period. Also, all the taxes, royalties, fees, gram panchayat tax, Property tax and non agriculture tax applicable as per government rules shall be borne by Contractor behalf of MAHAGENCO.

1.15. TOOLS & TACKLES

The Contractor shall maintain required suitable tools , tackles & testing equipments for installation & erection of plant and O&M thereof. All these tools, tackles & testing equipments shall be conforming to relevant IEC/BIS with safety and technical standards for proper execution of work and O&M. MAHAGENCO. These tools, tackles and testing& measuring instruments shall be as per recent industry practices along with tender specifications and contractor shall hand over them in working conditions to Mahagenco at the end of O&M period.

1.16. SAFETY MEASURES

The Contractor shall have to provide necessary and adequate safety measures including personal protective equipment and precautions to avoid any accident, which may cause damage to any equipment/material or injury to workmen. MAHAGENCO shall not be responsible for any such accidents. Each solar plant safety and security will be solely responsibility of EPC Contractor during contract period, however as all proposed site for solar power plant at Paras, Dist. Akola, Maharashtra. EPC Contractor is abided to safety & security rules as per the safety standard.

The contract shall be governed by all applicable acts, rules, regulation and internal standing instructions and Standard Operating Procedures (SOPs), such as:

a. The Factories Act, 1948,(FA)
b. The Maharashtra Factories Rules, 1963, (MFR)
c. CEA/CEIG Safety Regulations, 2011, (CEASR)
d. Workmen's Compensation Act, 1932, (WCA)
e. Minimum Wages Act, (MW_{AC})
f. Contract Labour Regulate & Abolition Act, (CLRAA)
g. The Maharashtra BOCW Rules, 2007, (BOCWR)
h. The Environment Protection Rules, 1986, amendment 2010, (EPR)
i. The Hazardous Waste (Management & Handling) Rules, 2008, amendment 2010, (HWMHR)
j. The Water (Prevention & Control of Pollution) Rules, 1975, (WPCPR)
k. The Central Motor Vehicles Act, 1988, (CMVA)
l. The Central Motor Vehicles Rules, 1989, (CMVR)
m. The Petroleum Act, 1934, (PA)
n. The Petroleum Rules, 2002, (PR)
o. The Explosives Act, 1884, (EA)
p. The Explosives Rules, 1983, (ER)

q. The Static and Mobile Pressure Vessels (Unfired) Rules, 1981, (SMPVR)
r. The Gas Cylinders Rules, 2004 (GCR)
s. The Public Liability Insurance Act, 1991, (PLIA)
t. The Public Liability Insurance Rules, 1991, (PLIR)
u. The Environment Protection Act, 1986, (EPA)
v. The Chemical Accidents (Emergency Planning, Preparedness, and Response) Rules, 1996, (CAR)

1.17. HAZARDOUS MATERIAL AND ENVIRONMENTAL LIABILITIES

1.17.1. Any hazardous material used during construction or used as part of the plant has to be taken back by the supplier for recycling or dumping purpose after its operating / working life, so that it may not affect the environment or any living being.

1.17.2. The EPC Contractor will ensure that all Solar PV modules from their plant after their 'end of life' (when they become defective/ non-operational/ non-repairable) are disposed in accordance with the "e-waste (Management and Handling) Rules, 2011" notified by the Government and as revised and amended from time to time.

1.17.3. EPC Contractor shall comply with MPCB regulation.

1.17.4. The Contractor is obliged to follow all the legal regulations regarding the environment, being responsible for putting them into practice, as well as for the consequences in the case of breaching them, not only with reference to their own activities, but also those of third parties subcontracted by it.

1.17.5. The Contractor undertakes to dispose of all packaging and industrial waste created by them during its activity and to have such waste treated according to the environmental legislation.

1.18. STOPPAGE OF WORK

1.18.1. MAHAGENCO not liable to pay compensation

- The Contractor shall have no claim against the MAHAGENCO for any damages or for compensation for the reason of any failure or omission on the part of the MAHAGENCO to carry out the provisions of the Contract for any reason beyond its control. However, the MAHAGENCO would consider such instances on their merit in good faith.
- MAHAGENCO shall not be responsible and not liable to pay any compensation due to stoppage of work as a reaction from local public due to any undue action on the part of the Contractor causing annoyance to local people.
- Employees and Officers of MAHAGENCO not individually liable
- No office bearer of the MAHAGENCO shall in any way be personally bound or liable for the acts or obligations of the MAHAGENCO under the Contract or answerable for any default or omission in the observance of performance of any acts, matters, of things, which are herein contained.

1.19. HINDRANCE REGISTER

The Contractor may also maintain a Hindrance Register where reasons for delay may be recorded from time to time and at the time of occurrence of the hindrance and get it duly certified by the Site - in - Charge or his authorized representative.

1.20. RESPONSIBILITY OF THE Contractor

1.20.1. The Contractor shall provide guarantee and be entirely responsible for the execution of the contract in accordance with the specification, schedules, and annexure. He shall further provide guarantee and be responsible for the quality and workmanship of all materials and completed works, correct designs and drawings, correct delivery of material, erection, testing and commissioning including operation & maintenance.

1.20.2. Contractor shall provide a good quality accommodation and a four-wheeler with driver for two officers of MAHAGENCO appointed for site supervision up to the date of handing over of plant for O&M. In addition to this, an office sitting space for these two officers along with furniture, site pota cabins shall be provided by the Contractor till completion of the office.

1.21. RIGHT OF MAHAGENCO TO MAKE CHANGE(S) IN DESIGN

MAHAGENCO shall reserve the right to make any change in the design, which may be necessary in the opinion of the CE(RE-P&P) to make the plant and materials conform tothe provisions and contents of the specification without extra cost to the MAHAGENCO.

1.22. MANUALS

The Contractor shall supply all necessary erection and commissioning manuals, O&M manuals etc. as and when required. Six sets of test results, manuals etc. shall be submitted by the Contractor on completion of the erection and commissioning work.

And as proof of agreement they sign this Contract in duplicate and for a single purpose at the place and date indicated above.

1.23. GOVERNING LANGUAGE

The contract shall be written in English Language. All correspondence and documents pertaining to the contract, which are exchanged by the MAHAGENCO & Contractor, shall be written in English.

1.24. ORDER AMENDMENTS

No variation in or modification of the terms of the contract shall be made except by written amendments issued by the MAHAGENCO.

1.25. ASSIGNMENTS

The Contractor shall not assign in whole or in part, its obligations to perform under the contract except with the MAHAGENCO's prior written consent.

1.26. SUBLETTING OF CONTRACT

The Contractor shall not, without the prior consent in writing of the MAHAGENCO, assign or sublet or transfer his contract, or a substantial part thereof other than raw materials, or for any part of the work of which makers are named in the contract, provided that any such consent shall not relieve the Contractor from any obligation, duty or responsibility under the contract.

1.27. SUB CONTRACTS

The Contractor shall notify the MAHAGENCO in writing of all sub contracts awarded under the contract if not already specified in his offer. Such notification in his original offer or later shall not relieve the Contractor from any liability or obligation under the contract

In case, the Contractor engages any Sub-Contractor to carry out a part of the work, the Sub-Contractor shall have requisite Government License for carrying out such part of the work and price approval of MAHAGENCO will be required.

1.28. INSPECTION

1.28.1. All tests shall be witnessed or supervised by the Owner and/or his representative, without being liable to any payment to the Contractor all the equipment, Project equipment, instruments and Project, as many times as may be reasonably necessary in order to verify the progress of the execution of this Contract.

1.28.2. All test results have to be approved by the Owner or his representative. Additionally, flasher protocols and tests results of the tests as per Clause 5.10.1 above. None of the approvals, inspections, examinations or tests performed by the Owner will free the Contractor from any of their responsibilities and obligations by virtue of this Contract.

1.28.3. The co-ordination and inspection of the day-to-day work under the Contract shall be the responsibility of the CE (RE-P&P) or his authorized representative. The Contractor in which the aforesaid written instructions will be entered will maintain a work order book. The Contractor or his authorized representative will sign these by way of acknowledgement within 12 hours.

1.28.4. CE (RE-P&P) or his authorized representative shall have, at all reasonable time, access to the Contractor's premises and also shall have the power, at all reasonable times, to inspect and examine the materials and workmanship of project work during its manufacture, shop assembly and testing. If part of the plant is required to be manufactured in the premises other than the Contractor's, the necessary permission for inspection shall be obtained by the Contractor from the CE (RE-P&P) or his duly authorized representative.

1.28.5. The CE (RE-P&P) shall have the right to serve notice in writing to the Contractor on any grounds of objections, which he may have in respect of the work. The Contractor has to satisfy the objection, otherwise, CE(RE-P&P) at his liberty may reject all or any component of plant or workmanship connected with such work.

1.28.6. The Contractor shall issue request letter to the CE(RE-P&P) or his authorized representative for testing of any component of the plant, which is ready for testing at least 15 days in advance from the date of actual date of testing at the premises of the Contractor or elsewhere. When the inspection and the tests have been satisfactorily completed at the factory / Contractor's works, CE(RE-P&P) shall issue a certificate to that effect within a week after receive of inspection & test report. However, CE(RE-P&P) at its own discretion may waive the inspection and testing in writing under very special circumstances. In such case, the Contractor may proceed with the tests which shall be deemed to have been made in the CE(RE-P&P)'s presence, and he shall forthwith forward six sets of duly certified copies of test results and certificates to the CE(RE-P&P) for approval of the MAHAGENCO. The

Contractor, on receipt of written acceptance from MAHAGENCO, may dispatch the equipment for erection & installation.

1.28.7. For all tests to be carried out, whether in the premises of the Contractor or any Sub-Contractor, the Contractor, shall provide labour, materials, electricity, fuel, water, stores, apparatus and instruments etc. free of charge as may reasonably be demanded to carry out such tests of the plant in accordance with the contract. The Contractor shall provide all facilities to the CE(RE-P&P) or his authorized representative to accomplish such testing.

1.28.8. The CE(RE-P&P) or his authorized representative shall have the right to carry out inward inspection of the items on delivery at site and if the items have been found to be not in line with the approved specifications, shall have the liberty to reject the same.

1.28.9. In case of any class of item for which there is no such specification supplied by the MAHAGENCO, supplies will be made by the Contractor in accordance with Indian Standard Specification and where it does not cover the same, the same should be carried out as per standard engineering practice with the approval of the CE (RE-P&P).

1.29. TESTING OF ANY COMPONENT

1.29.1. PV Modules shall be tested as per the Section II of RFP.

1.29.2. If MAHAGENCO desires, testing of any component(s) of the plant be carried out by an independent agency. The inspection fee, if any, shall be paid by the Contractor.

1.29.3. The Contractor has to provide the necessary testing reports to the MAHAGENCO as and when required.

1.29.4. Neither the waiving of inspection nor acceptance after inspection by the MAHAGENCO shall, in anyway, absolve the Contractor of the responsibility of supplying the plant and equipment strictly in accordance with specification and drawings etc.

1.30. DELIVERY OF EQUIPMENT

1.30.1. The Contractor shall deliver the equipment of the plant and machineries in accordance with the terms of the contract at the time(s) to the place(s) and in the manner specified in the contract. The Contractor shall comply with instructions that may be given by the MAHAGENCO from time to time regarding the transit of the plant and material.

1.30.2. Notification of delivery or dispatch in regard to each and every consignment shall be made to the MAHAGENCO immediately after dispatch or delivery from the manufacturing works.The Contractor shall supply to the consignee Invoice in triplicate and packing account of all stores delivered or dispatched by him.

1.30.3. In case of any occurrence of loss or damage in transit, it shall be the liability of the Contractor to initiate or pursue the claim with insurance company. He shall take immediate steps to repair the damaged apparatus or replacement thereto. MAHAGENCO on merit will consider any extension of time limit required in such contingency.

1.31. CE (RE-P&P) DECISION

In respect of all matters, which are left to the decision of the CE(RE-P&P) in line with the

contract, including the granting or withholding certificates, the CE(RE-P&P) shall, if required to do so by the Contractor, give in writing a final decision thereon. If the final decision is not accepted by the Contractor the matter will, at the request of the Contractor be referred to arbitration under the provision for arbitration hereinafter contained but, subject to the right of reference to arbitration; such decision shall be final and binding on the Contractor.

1.32. LIABILITIES DURING TRANSIT

The Contractor shall be responsible for loss, damages, or depreciation to goods or of plant, equipment, and machineries up to delivery at site.

1.33. DEDUCTION FROM CONTRACT PRICE

1.33.1. All costs, claims, damages or expenses, which the MAHAGENCO may have paid for which the Contractor is liable, will be deducted by the MAHAGENCO from deposited PBG or Security Money or from any money due or which become due to him under this contract or any contract are being executed elsewhere with MAHAGENCO.

1.33.2. Any sum of money due and payable to the Contractor, as per the contract agreement, may be appropriated by the MAHAGENCO and set off against any claim of the MAHAGENCO, for the payment of a sum of money arising out of or under any other contractmade by the Contractor with the MAHAGENCO.

1.33.3. It is an agreed term of the contract that the sum of money, withheld or obtained under this clause by the MAHAGENCO, will be kept withhold or retained as such by the MAHAGENCO or till this claim arising out of in the same contract is either mutually settled or determined by the arbitrator, or by competent court, as the case may be, and that the Contractor shall have no claim for interest or damages whatsoever on this account or any other account in respect of any sum of money withheld or retained under this clause and dulynotified as such to the Contractor.

1.34. TERMS OF PAYMENT

1.34.1. Subject to any deduction which the MAHAGENCO is authorized to make under this contract, and or to any additions or deductions provided for in this contract, the Contractor shall be entitled to payment as follows:

1.34.2. All payments shall be made in Indian Rupees, unless otherwise specified in the order.

1.34.3. All payment shall be made on the basis of actual measurement for the quantified items as per schedule of works.

1.34.4. The Contractor shall submit the tax invoice for the work executed showing separately GST, customs duties, excise duties and any other statutory levies in the bill / invoice.

1.34.5. After the completion of each milestone, MAHAGENCO will conduct a thorough examination of the activities performed and completed by Contractor and shall issue a milestone completion certificate for the respective milestone, subject to MAHAGENCO's complete satisfaction.

1.34.6. The payment on successful completion of O&M period for each month till the end of 5th year will be paid monthly.

1.35. SCHEDULE OF PAYMENT

1.35.1. The payment will be made to the Contractor on award of the contract as follows:

Mile stone No.	Payment Milestone for EPC Project		97 % of Contract Price (X) inclusive of applicable taxes.
1.	Design engineering & approval of drawings	1%	2%
	Site development work	1%	
2.	**Supply of all Equipments**		75 % (Pro-Rata)
	a. SPV Modules	52%	
	b. SMB, DC cable & Inverter	7.5%	
	c. Power Transformers, Breakers, Lightning Arrestors, Current Transformers & Potential Transformers, AC cable	5%	
	d. HT Power evacuation system & Pooling substation, Transmission tower, Composite 33 kV Breaker Panels	8%	
	e. Power Conditioning Units, Conductors, Connectors and String Combiner Boxes, etc.	2.5%	
3.	**Completion of Civil Work**: Module mounting structure foundation and structure etc.	3% (Pro-Rata)	10.5 % (Pro-Rata)
	Completion of Control room, Inverter room, SCADA room and Metering Room	2.5% (Pro-Rata)	
	Completion of E&M work: Installation and interconnection of major equipment's SPV Modules (including structures for the above), Power Conditioning Units, Transformers including 33/220 kV Pooling station, 220 kV Transmission line (Underground/Overhead) along with interconnection and construction of Bays at 220 kV MSETCL Paras Substation, internal roads and Drains	5% (Pro-Rata)	
4.	On successful commissioning of entire Solar Photo Voltaic Plant on certification by the Project Manager.	5%	5 %
5.	On Completion of the Facility as specified in RfP as per Clause no. 1.4 of Section-IV and issuance of Completion Certificate by the Project Manager.	2.5%	2.5%
6.	On successful completion of Performance Guarantee tests of entire Solar Photo Voltaic Plant	5 %	5 %
	Payment Milestone for O&M (3.0 % of Contract Price (X) inclusive of applicable taxes.)		
7.	For O&M period of the contract (Starts after completion of milestone no 6.) Payment will be done in 60 Monthly bills during 5 years of O&M contract period.)		Monthly

The Contractor shall raise progressive invoices of items/works/services on MAHAGENCO based on the payment milestones as indicated above after issue of milestone completion certificate. All payments will be released only after completion of the entire activities involved in achieving the respective milestones.

For milestone No.2, contractor should ensure the supply of major equipments as per the requirement and interlinked works completed as per Milestone No. 1, in any condition the supplied material should be utilized within 60 days from receipt of material. If in any case, the material supplied is not utilized by contractor within 60 days, in such case Mahagenco shall not release the payment for the further supply portion of same material/item. Milestone No.2 'Supply of Equipment's' Pro-rata payments can be considered subject to maximum of five installments with net payable value against each installment.

The advance of 5% of Contract Price excluding O&M amount will be released on fulfilment of the following;

a. Acceptance of Letter of Award by the Contractor and signing of Contract Agreement & advance to be released on commencement of site mobilization.

b. Submission of Performance Security by the Contractor and acceptance of the same by the MAHAGENCO.

c. Submission of Advance payment Bank Guarantee by the Contractor from an Indian Nationalized Bank for an amount equivalent to the advance and acceptance of same by the MAHAGENCO.

If the milestone No.2 is not fully completed within 270 days from zero date then the interest to be charged from 271st day at the rate of 1.25% in excess of the SBI, 1 year Marginal Cost of funds Based Lending Rate (MCLR) per annum/any replacement thereof by SBI. Also if there is delay in submission of supply bills beyond 280 days from zero date, the interest on the advance would be applicable. Advance bank guarantee to be valid minimum for a period till 270 days from zero date. On credit of advance, contractor has to submit receipt voucher as per GST act.
Being interest free (for stipulated period) advance, it shall not vary once Contract has been signed.

1.35.2. Advance paid to Contractor of 5 % of contract value shall be recovered from Invoice payment for Milestone no. 2 of " Supply of all equipment's". Outstanding advance shall be the difference between the total advance paid by the Owner and the advance adjusted cumulatively.

1.35.3. The Contractor may, if so desire, reduce the value of Bank Guarantee(s) submitted for receipt of advance, periodically every six (6) months to the extent of advance actually adjusted. Before reducing the value of bank guarantee, confirmation shall be obtained aboutadjusted advance from the Owner.

1.36. VARIATION

1.36.1. In the event of introduction of new legislation or any change or amendment or enforcement of any Act or Law, rules or regulations, policies of the Government or Public Body which becomes applicable or effective after the date of submission of Price Bid and which results in increase to the Price Bid through increased liability of taxes (other than personnel taxes), the Contractor shall be indemnified for any such increased cost by MAHAGENCO subject

to production of documentary proof to, the satisfaction of MAHAGENCO, to the extent which is directly attributable to such introduction of new legislation or change or amendmentas mentioned above, **however Anti-Dumping Duty, Safeguard Duty and BCD shall not be considered for change in law.**

1.36.2. Similarly, if introduction of a new legislation or any change or amendment or enforcement of any Act or Law, rules or regulation, policies of the Government or Public Body which becomes applicable or effective after the date of submission of Price Bid and which results in reduction to the Price Bid through reduced liability of taxes (other than personnel taxes), the Contractor shall pass on such benefits of such reduced taxes, duties or fees to MAHAGENCO to the extent, which is directly attributable to such introduction of new legislation or change or amendment as mentioned above.

1.36.3. In the event of any change in the current status of the project after the date of submission of Price Bid and which results in increase to the Price Bid through reduction of any considered available benefit, drawback or concession directly resulting in increased liability of taxes (other than personnel taxes), the Contractor shall be indemnified for any such increased cost by MAHAGENCO subject to production of documentary proof to, the satisfaction of MAHAGENCO, to the extent which is directly attributable to such change in status.

1.36.4. Similarly, in the event of any change in the current status of the project after the date of submission of Price Bid and which results in reduction to the Price Bid through addition/ extension of any available benefit, drawback or concession directly resulting in reduction of liability of taxes (other than personnel taxes), the Contractor shall pass on such benefits to MAHAGENCO to the extent which is directly attributable to such change in status.

1.36.5. In case of introduction of new legislation or change or amendment in any act or law after the Schedule/extended Completion Date, but which comes into force or becomes effective retrospectively from a date on or before the Scheduled/extended Completion Date and which results in any increase / decrease in the duties, taxes and cess under the Contract, then such increase/decrease, subject to the stipulated conditions shall be to MAHAGENCO account.

1.36.6. All duties, taxes, cess (except where otherwise expressly provided in the contract) as may be levied / imposed in consequence of execution of the Works or in relation thereto or in connection therewith as per the Acts, Laws, Rules, Regulations in force on the date of submission of Price Bid or revised price bid, if any, for this Contract shall be to Contractor's account and shall be included in the price bid.

1.36.7. The information regarding applicability of indirect taxes and availability of incentives, benefits, concessions, liabilities etc. given under the clause or in relation thereto or in connection therewith as per the Acts, Laws, Rules, Regulations in force and regulationsas understood by MAHAGENCO. However, the Contractor shall independently evaluate such incentives, benefits, concessions, liabilities etc. before considering the same while quoting the price bid.

1.36.8. MNRE exemption in the taxes & duties may be availed for the equipment's supplied in the solar power plant subjected to that the Contractor will be responsible for any delay in the supply of material due to the MNRE procedural delay.

1.36.9. MAHAGENCO Shall not be liable for any extra rise in project cost due to anti-dumping and safeguard duties.

1.37. WARRANTY / GUARANTEE

(WARRANTY / GUARANTEE of equipments/ material to be in the name of MAHAGENCO)

1.37.1. The Contractor must ensure that the goods supplied under the contract are new, unused and of most recent or current models and incorporate all recent improvements in design and materials unless provided otherwise in the contract.

1.37.2. The warranty / guarantee period shall be as follows:

1. Solar PV Modules: Material/product Warranty shall be at least 12 years and Performance / power output warranty of Solar Module(s) shall be for at least 90% of its rated power at the end of 12 years and 80% of its rated power at the end of 27 years from the date of receipt of modules on Site. The manufacturer shall warrant for the linear output of Solar Module(s) and degradation of the PV modules will be linear over 27 years from the date of receipt of modules at site. The Manufacturer Detailed Warranty / Guarantee clause shall be furnished.
2. Module mounting structures shall be warranted for a minimum period of 5 Years.
3. Inverter shall be warranted up to 10 years (standard warranty 5 years + 5 years extended warranty)
4. Transformers, associated switch gear and others: Manufacture shall furnish in details their warranties / guarantees for these items. Transformers, CT, PT & switch gears, DC Cables, HT cables, SCB & SMS, SCADA, CCTV System shall be warranted for minimum period of 5 Years.

1.37.3. Before finalizing the purchase order all warranty/guarantees agreements of equipments & material shall be approved from MAHAGENCO. During the period of Warranty / Guarantee the Contractor shall remain liable to replace any defective parts, that becomes defective in the plant, of his own manufacture or that of his sub-Contractors under the conditions providedfor by the contract under and arising solely from faulty design, materials or workmanship, thefts provided such defective parts are not repairable at site. After replacement, the defectiveparts shall be returned to the Contractors works at the expense of the Contractor unless otherwise arranged.

1.37.4. If any defects not remedied within a reasonable time, the MAHAGENCO may proceed to do work at the Contractor's risk and cost, but without prejudice to other rights, which the MAHAGENCO may have against the Contractor in respect of such defects.

1.37.5. At the end of guarantee period, the Contractor's liability shall cease. In respect of goods not covered clause 1.37.2 of this section, the MAHAGENCO shall be entitled to the benefit of such guarantee given to the Contractor by the original Contractor or manufacturer of such goods.

1.37.6. During the operation & maintenance and guarantee period, the Contractor shall be responsible for any defects in the work due to faulty workmanship or due to use of sub- standard materials in the work. Any defects in the work during the guarantee period shall therefore, be rectified by the Contractor without any extra cost to MAHAGENCO within a reasonable time as may be considered from the date of receipt of such intimation from MAHAGENCO failing which MAHAGENCO shall take up rectification work at the risk and cost of the Contractor.

1.38. ARBITRATION

1.38.1. Except where otherwise provided, if at any time, any question, dispute or difference, whatever shall arise between the Contractor and the MAHAGENCO upon or in relation to orin connection with this contract either of the parties may give to the other notice in writing ofthe existence of such a question, on rejection of the matter, the dispute or difference shall bereferred to the sole arbitrator jointly appointed by MAHAGENCO and the Contractor at the time of dispute after ascertaining the terms of reference mutually.

1.38.2. The Arbitrator will preferably be a member of Arbitration Council and arbitration proceedings will take place as per provisions of Arbitration and Conciliation Act, 1996 or any statutory modifications or re- enactment thereof, and the rules made there under and for the time being in force shall apply.

1.38.3. The Contractor will ensure that the work under this contract shall continue during arbitration proceedings and dispute and no payments due from or payment by the MAHAGENCO shall be withheld on account of such proceedings except to the extent whichmay be in dispute.

1.39. COURT OF COMPETENT JURISDICTION

The Bombay High Court will only have jurisdiction in this case.

1.40. LAW & PROCEDURE

The law which is to apply to the contract and under which the contract is to be construed shall be Indian Law. The Law governing the procedure and administration of any arbitrationinstituted under the Clause for Arbitration shall be the Indian Law.

1.41. CONSTRUCTION OF CONTRACT

The contract shall in all respect be construed and operated, as a contract as defined in the Indian Contracts Act, 1872, and all the payments there under shall be made in Indian Rupees unless otherwise specified.

1.42. NOTICES

1.42.1. For all purpose of the contract, including arbitration there under, the address of the Contractor mentioned in the tender shall be the address to which all communicationsaddressed to the Contractor shall be sent, unless the Contractor has notified a change by a separate letter containing no other communication and sent by registered post with acknowledgement due to the Project Manager. The Contractor shall be solely responsible forthe consequence of an omission to notify change of address in the manner aforesaid.

1.42.2. Any communication or notice on behalf of the MAHAGENCO in relation to the contract agreement may be issued to the Contractor by Project Manager and all such communication and notice may be served on the Contractor either by registered post or under certificate of posting or by ordinary post or by hand delivery at the option of the officer.

1.42.3. Instructions or notices to the Contractor and notices from the Contractor to the MAHAGENCO recorded in a minute signed by the authorized representatives of both MAHAGENCO & Contractor. Such notice or instruction shall be valid notice of instruction for the purpose of contract.

1.43. REPRESENTATIVES

1.43.1. Representatives of the Contractor

i. The Contractor will appoint an individual (the "Project Manager") as responsible for vouching for the correct execution of the Project and of this Contract. His functions will

include the managing and supervising of all activities necessary so that the supply and other services undertaken by the Contractor in this Contract are performed as agreed. Likewise, he will take charge to coordinate the activities performed by the Contractor. The signature by the Project Manager will bind the Contractor for all legal effects.

ii. The Contractor will designate from its team a project manager or who will be entrusted with representing it in the project (hereinafter the "Project Manager of the Contractor").

iii. All persons representing the Contractor by virtue of this Contract will have the experience and training necessary to assume the aforementioned tasks.

1.43.2. Representatives of the Owner

i. The Owner will appoint a representative for the Project who will act as principal spokesperson between the Owner (the "Representative of the Owner") and the Contractor, who will convey the Owner's instructions and who will receive notifications from the Contractor and the Owner. The Representative of the Owner will bind the Owner for all legal purposes.

ii. The Owner will charge on his expenses a technical consultant, also referred to as the Project Management Consultant, to visit the Installations and the Site and to check whether and to which extent the fulfilment of the Contract has been reached.

1.44. RISK PURCHASE

If the Contractor fails, on receipt of the order, to take up the work within a reasonable period or leave the work site after partial execution of the work MAHAGENCO shall have the liberty to get the work done through other agency at his own risk and additional cost if any. If the situation, so warrants, to compel MAHAGENCO to cancel the order placed on the Contractor, he shall be liable to compensate the loss or damage, which MAHAGENCO may sustain due to reasons of failure on his part to execute the work in time.

1.45. EXECUTION OF CONTRACT AGREEMENT

All the expenses towards execution and distribution of the copy of the contract agreement shall be borne by the contactor. Stamp duty as per the statutory/ Government norms shallbe borne by contactor. After signing of two original copies of contact agreement theContractor shall submit two copies to MAHAGENCO.

1.46. CORPORATE SOCIAL RESPONSIBILITY:

Contractor as per Government guidelines and prevailing norms has to make CSR to the nearby or around plant as suggested by MAHAGENCO under the CSR obligation of the MAHAGENCO. Bidder shall quote the price including this CSR activity.

1.47. OFFICE CUM GUEST HOUSE AND ADMINISTRATIVE BUILDING

[Deleted]

1.48. INFORMATION AVAILABLE

1.48.1. In particular, the Contractor when determining the Price shall for all purposes whatsoever is deemed to have himself independently obtained all necessary information for this purpose, the Contractor shall also be deemed to have examined the Bid Document, to have obtained his own information in all matters whatsoever that might affect the carrying out of the Project at the scheduled rates and to have satisfied himself to the sufficiency of his

bid. Any error in description or quantity or omission there from shall not violate the Contract or release the Contractor from executing the Project under the Price. He is deemed to know the scope, nature and magnitude of the Project and the requirements of material, labour involved etc. and as to what all Project he has to complete in accordance with the Contract Documents whatever be the defects, omission or errors that may be found in the Documents.

1.48.2. The Contractor shall be deemed to have visited surroundings, to have satisfied himself to the nature of all existing structures, if any and also as to the nature and the conditions of the railways, roads, bridges and culverts, means of transportation and communications whether by road, water or air, and as to possible interruptions thereto and the access to site, to have made inquiries examined and satisfied himself as to the sites, for obtaining sand, stones, bricks and other materials, the sites for disposal of surplus materials, the available accommodation as to whatever required depots and such other buildings as may be necessary for executing and completion of Project, to have made local independent inquiries as to the sub-soil, sub-soil waste land variations thereof, storms, prevailing climatic conditions and all other similar matters affecting these work. He is deemed to have acquainted himself as to his liability for payment of Government taxes, duties and other charges.

1.48.3. Any neglect or failure on the part of the Contractor in obtaining necessary and reliable

1.48.4. information upon the foregoing or any other matters affecting the Contract shall not relieve him from any risks or liabilities or the entire responsibility from completion of the Project at the Price and time in strict accordance with the Contract Documents.

1.49. RISKS ASSUMPTION

1.49.1. The assumption of risks by the Owner regarding the equipment, components and parts and Works subject to this Contract will become effective at the time of the Provisional Delivery Certificate of the Plant, for which the Contractor should therefore take out at his own cost the corresponding insurance policies to cover such risk, in accordance with this Contract.

1.49.2. Irrespective of the transfer of ownership at any point of time, Contractor would be responsible for the care and protection of each equipment's and materials during the Contract Period.

1.49.3. Specially, but without limitation, the Contractor will be responsible for the care, safety and preservation of the Plant during the Contract period.

1.49.4. In addition to the above, inter alia:

- The Contractor shall provide and maintain at his own expense all security personnel, other arrangements including fencing, LED lighting etc., wherever necessary of the protection of the Project and for the safety convenience of those employed on the Project at site.
- From the commencement to completion of the Project, the Contractor shall take full responsibility for the care of all Project including all temporary Project and in case any damage, loss or injury shall happen to the Project or to any part thereof or to any temporary Project form any cause whatsoever, shall at his own cost repair and make good the same so that at completion, the work shall be in good order and in conformity in every respect with the requirements of the Contract and the CE (RE-P&P)'s instructions.

1.50. LIENS

If at any time, there should be evidence or any lien or claim for which the MAHAGENCO might have become liable and which is chargeable to the Contractor, the MAHAGENCO shall have the right to retain out of any payment then due or thereafter to become due an amount sufficient to completely indemnify MAHAGENCO against such lien or claim and if such lien or claim be valid, MAHAGENCO may pay and discharge the same and deduct the amount so paid from any money which may be or may become due and payable to the Contractor. If any lien or claim remain un-settled after all payments are made, the Contractor shall refund or pay to the MAHAGENCO all money that the latter may be compelled to pay in discharging such liens or claim including all costs and reasonable expenses.

SECTION- IV:

SPECIAL TERMS AND CONDITIONS

IV. SECTION IV: SPECIAL TERM & CONDITION

1.0. TRAINING OF MAHAGENCO'S PERSONNEL

1.0.1. The Contractor shall provide training to two teams of 5 personnel each (Engineers and Officers) of MAHAGENCO at his works and at site for erection, testing, commissioning and O&M. Expense towards stay, lodging and boarding and other expenses for the personnel shall be borne by Contractor.

1.0.2. The Contractor shall also provide access to MAHAGENCO personnel to the locationsof his successfully completed projects worldwide for the purpose of knowledge sharing during the period after the date of issue of LOA till the commencement of the O&M period. Expense towards travel, stay, lodging and boarding and other expenses for MAHAGENCO'spersonnel shall be borne by Contractor.

1.1. SYNCHRONIZING AND COMMISSIONING

1.1.1. Synchronizing and commissioning

1. The Contractor shall give MAHAGENCO at least thirty (30) days advanced preliminary written notice and at least fifteen (15) days advanced final written notice, of the date on which it intends to synchronize the Solar Power Plant to the Grid System.
2. Subject to clause no. 1.1 of Section -IV the Solar Power Plant may be synchronized by the Contractor to the Grid System when it meets all the connection conditions prescribed in applicable Grid Code then in effect and otherwise meets all other Indian legal requirements for synchronization to the Grid System.
3. All the necessary permissions from Electrical Inspector, MEDA, MSETCL, MSEDCL, SLDC, factory inspectors etc., as may be required, shall be taken up by the Contractor for the purpose of interconnection of the solar power plant with the grid. Grid connectivity related permits and approvals required to connect the plant with the proposed substation will be taken care by MAHAGENCO. In case of failure to commission the project within the time schedule where EPC contractor is accountable, any applicable fees paid for extension of grid connectivity or/& any grid connectivity fees payable on account of forfeiture shall be deducted from EPC developer.
4. In case of failure to commission the project within the time schedule where EPCcontractor is accountable, any applicable fees paid for extension of grid connectivity or/& any grid connectivity fees payable on account of forfeiture shall be deducted from EPC developer.
5. The synchronization equipment shall be installed by the Contractor at the Solar Power Plant at its own cost. The Contractor shall synchronize the Solar Power Plant with the Grid System only after the approval of synchronization scheme is granted by MAHAGENCO/ MSETCL. The head of the concerned sub-station/Grid System and checking/verification is made by MAHAGENCO/ the concerned authorities of the Grid System/MSETCL.
6. The Contractor shall immediately after synchronization/tripping of generator, inform MAHAGENCO/ the sub-station of the Grid System to which the Solar Power Plant is electrically connected in accordance with applicable Grid Code
7. **Appointment of Qualified Coordinating Agency (QCA)**
   As per MERC (forecasting, scheduling & deviation settlement for Solar & Wind generation) regulation -2018. The appointment of QCA , for corpus amount to MSLDC

through QCA etc. are required to be carried out by EPC Contractor before synchronizing of the generation for 5 year as per contract period.

1.1.2. Trial Run

Trial operation shall commence immediately after the synchronization of the Solar Power Plant with the grid before commissioning. During the trial operation and testing, the Solar Power Plant shall perform trouble free operation cumulative minimum 72 hours during which functionality of all plant components shall be demonstrated and the system shall bein Generating mode.

1.1.3. Pre-Commissioning Tests

The following tests and activities shall be completed by the Contractor before the declaration of COD of the solar power plant.

a. Relay testing
b. Transformer testing
c. Line charging
d. Transformer charging
e. Electrical safety & earthing
f. Trial Run

1.1.4. Commissioning

On successful completion of trial run and pre-commissioning tests of entire contracted capacity, the Solar Power Plant shall be commissioned in accordance with the provisions of this Contract, applicable rules and regulations, grid code and recommendations of MSETCL/MSEDCL/MSLDC.

1.2. COMMERCIAL OPERATION DATE OF THE SOLAR POWER PLANT

1.2.1. Once the commissioning of the Solar Power Plant is finished satisfactorily in accordance with the agreed schedule, MAHAGENCO and the Contractor will draw up the Commercial Operation Date of the Solar Power Plant, whose date will determine, amongst other issues, the beginning of the Guarantee Period for defects.

1.2.2. The only circumstances or causes for delay of the Commercial Operation Date of the Solar Power Plant are those specified in this Contract, and only in the case that they are not attributed to the Contractor. Under no circumstances will the exercise by MAHAGENCO of any of the rights established in the Contract give rise to an extension of the period for the Commercial Operation of the Solar Power Plant, unless this possibility is considered in this Contract. Similarly, failure to comply by the Contractor of any of the periods set out in the Execution Plan will not in itself give the Contractor the right to request an extension of the term set for the Commercial Operation of the Solar Power Plant.

1.2.3. Any reference to the Commercial Operation in this Contract will refer to the Commercial Operation of the Solar Power Plant unless it is indicated to the contrary.

1.3. CONDITIONS REGARDING COMMERCIAL OPERATION

1.3.1. The Commercial Operation of the Solar Power Plant will occur after completion of above

clause 1.1.2 ,1.1.3 & 1.1.4 above and entire capacity is connected to the corresponding electricity grid and working properly.

1.3.2. Before the Solar Power Plant is connected to the grid, the Contractor should inform, at least thirty (30) Days before the anticipated date in writing to MAHAGENCO, that then entire contracted capacity Solar Power Plant (i.e. $62MW_{AC}$) is ready for the Commercial Operation, as long as the following conditions are fulfilled:

1. The Contractor has finished the construction, supply, erection, installation & interconnections of the all equipment for contracted $62MW_{AC}$ capacity viz. MMS, PV Modules, Inverters, all electrical installations along with transformers of Solar Power Plant in accordance with this Contract, and it is free of defects;
2. All the permits, licenses and authorizations for running and maintaining the Solar Power Plant are in order according to the regulations in force.

1.4. PROJECT COMPLETION

1.4.1. The Contractor shall, within thirty (30) days of declaration of COD of the Solar Power Plant, complete all the associated electrical and civil works which shall include but not limited to the following:

a.Completion of roads (Internal, peripheral, Main access and any other approachroads).
b.Drainage.
c.Security and.Watch Towers

1.4.2. On successful completion of entire project activities free of defects and without any pending work including all contractual obligations, PG test and on issue of FAT certificate, MAHAGENCO shall issue a Project Completion Certificate to the Contractor. Whereas , on successful COD of project & successful completion of O&M period (5 years) of plant MAHAGENCO shall issue a Project Completion Certificate to the contractor.

1.4.3. In the event of any delay in obtaining Project schedule due to any Force Majeure event, the time period for Project schedule shall be extended for the period of such Force Majeure, subject to a maximum extension period of three (3) months continuous or non-continuous in aggregate. Thereafter, this Contract may be terminated by either MAHAGENCO or the Contractor by giving a Termination Notice of at least seven (7) days, in writing to the other Party. The termination of the Contract shall take effect upon the expiry of the last date of the said notice period.

1.4.4. In the event of any delay in obtaining Project completion except for those specified in clause 1.11 of Section III, the time period for Project schedule shall be extended only at the sole discretion of MAHAGENCO. Thereafter, this Contract may be terminated by either MAHAGENCO by giving a Termination Notice of at least seven (7) days, in writing to the other Party. The termination of the Contract shall take effect upon the expiry of the last date of the said notice period.

1.5. PERFORMANCE GUARANTEE (PG) TEST

1.5.1. The Performance Guarantee Test as to prove the Performance of the Contractor shall be

conducted at Site by the Contractor in presence of MAHAGENCO. The PG Test shall start immediately after the achievement of COD of the plant or any other date as may be agreed by MAHAGENCO and the Contractor. This test shall be binding on both the parties to determine compliance of the equipment with the functional guarantee.

1.5.2. If Contractor is not able to meet the requirements of PG test during these three (03) consecutive months, Contractor will be given more chances to do so up to a maximum period of 12months from the start of the first PG test i.e. the last such test must commence by the 10th month after start of PG Test. Further, if the Solar Power Plant is not able to achieve the quoted guaranteed generation, then the Contractor shall be liable to bear the loss in energy supplied at the point of interconnection from the plant by the Contractor.

1.5.3. On the successful completion of the Performance Guarantee Test to the satisfaction of MAHAGENCO, MAHAGENCO shall issue a Performance Guarantee Test Completion Certificate. In addition to this, the Performance Guarantee Test Completion Certificate shall not be issued to the Contractor unless the Contractor has obtained the Final Acceptance Test Certificate.

1.5.4. The PG test procedure shall be submitted by successful Contractor after the award of contract for review and finalization of Corporate Operation Services. Any special equipment, instrumentation tools and tackles required for the successful completion of the Performance Guarantee Test shall be provided by the Contractor free of cost. The accuracy class of the instrumentation shall be as per the clause 1.2 of Section II -C of this RFP. The procedure for PG demonstration test shall be as follows:

1. Actual energy exported from the plant supplied by the Contractor shall be noted for three consecutive months. The reading of Net Export units will be taken from the ABT meter reading which will be installed at point of interconnection i.e. 220 kV bus level of nearest Paras substation of MSETCL located near to respective site.
2. "Quoted Generation" for a month is a guaranteed generation quoted by Contractor in the technical data sheet at Annexure 17.
3. Contractor shall consider following factors & shall be taken into account while computing the "Quoted Generation".
   Solar radiations, Effect due to variation of meteorological parameters e.g. ambient temperature, wind speed, humidity, Dust Index, Soling loss, transformer loss, line loss, auxiliary power consumption etc.
4. The Quoted Generation (i.e guaranteed generation) will be compared with actual generation If the Contractor is not able to meet the requirement of PG test during these three consecutive months he will be given more chance to do so up to a maximum period of one year from the start of first PG test i.e. the last such test must commenceby 10th month after start of the first PG test so that it is completed by the 12th month after start of the first PG test.
5. Further, if the plant is not able to achieve the Quoted Generation during the PG Test period and there is a shortfall in energy generation, then the Contractor will compensate MAHAGENCO with an amount equivalent to the loss of revenue based on:
   "Penalty will be levied @ Rs.33 per kWh for shortfall in energy Generation."
   GST is applicable on penalty as per GST Law. If penalty is applicable, it shall be

recovered from any due OR payment to the EPC Contractor.

1.6. REJECTION OF DEFECTIVE PARTS

1.6.1. If the completed plant, or any portion thereof, before it is taken over, be found to be defective, or fails to fulfill the requirements of the contract, the CE (RE-P&P) shall issue a notice to the Contractor stating the particulars of such defects or failure. The Contractor shallstart the rectification with immediate effect to make good the defect, or alter the same to make it comply with the requirements of the contract. If the Contractor fails to do so withina reasonable time, the MAHAGENCO may reject and replace, at the risk & cost of the Contractor, the whole, or any portion of the plant, as per requirement of the contract. Such replacement shall be carried out by the MAHAGENCO within a reasonable time and a reasonable price and where possible to the same specifications under competitive conditions. In cases if such replacement is taken up by the MAHAGENCO, the extra cost, if any, of such replacement, shall be realized from the Security Money or from any money due or which become due to him under this contract or any contract are being executed elsewhere with MAHAGENCO. The extra cost may be ascertained as the difference between the pricespaid by the MAHAGENCO for such replacement and the contract price of the plant/equipment so replaced and any sum paid by the MAHAGENCO to the Contractor in respect of defective plant. If the MAHAGENCO does not repair or replace the defective plant/part of the plant within a reasonable time, the Contractor shall be liable only to repayto the MAHAGENCO all money paid by the MAHAGENCO to him in respect of such plant/part of the plant.

1.6.2. In the event of such rejection, the MAHAGENCO shall be entitled to the use of the plant/ part of the plant in responsible and proper manner, till such time, which is reasonably sufficient to enable him to obtain other replacement plant/ part of the plant.

1.7. FINAL ACCEPTANCE TEST

1.7.1. "Final Acceptance Test" On "Commissioning" & not before successful completion of PG test of the Solar PV Power Plant, the plant performance shall be observed on the real live condition basis for the trouble free operation for the period of 30 days. This period will be known as "Final Acceptance Test".

1.7.2. The Final Acceptance of the Solar Power Plant will be after the Final Acceptance Test has been completed successfully, as long as the following requirements are fulfilled:

1.7.3. All the claims of MAHAGENCO regarding guarantees are dealt with in accordance to the provisions of this Contract or, if applicable, the Parties have reached an agreement regarding application of such guarantees.

1.7.4. The Contractor has fulfilled each and every legal and Contractual obligation derived from this Contract.

1.7.5. All pending works and punch points are completed

1.8. MODE OF EXECUTION

1.8.1. The entire work shall be executed either on turnkey basis or separate contract basis

depending on the contracting option opted by the Contractor. Any minor item(s) not included in the schedule but required for completion of the work shall have to be carried out/supplied without any extra cost. Such works, not listed in the schedule of works but elaborately described to perform or to facilitate particular operation(s) required for completion of the project shall deemed to have been included in the scope of this work and the Contractor shall supply, install the same without any extra cost.

1.8.2. The Project will be performed in accordance with the Contract including the Contract Documents, the Specifications, the Technical Documentation approved by the Owner, the licences and authorisations and the current legislation, as well as the demands that, if required, are established by the applicable state regulations.

1.8.3. The foundation design of module structure and switchyard structure, buildings and any other civil works shall have to be approved by MAHAGENCO. In case of any defects arising in the buildings, module mounting structure foundation, switchyard structure foundation and any other civil works during guarantee period which is attributable to the Services provided by the Service Provider, the Contractor shall have to rectify the same at his own cost.

1.8.4. All the equipment and, in general, material used will be new, free from defects andofficially authorised, complying with all the current legislation, and will be adjusted to the characteristics, standard and specifications set forth in this Contract. The Contractor will be responsible for the unloading, receipt, storage, custody and preservation in the facilities of the equipment and afterwards in the Site up to the Provisional Delivery of the Plant. Test certificate in accordance with the specifications are to be furnished by the Contractor to MAHAGENCO for approval in respect of the materials procured by the Contractor.

1.8.5. The Contractor will always adapt to the instructions provided by the Owner in accordance with this Contract. Likewise, the existing public services will be maintained at all times and any essential interruption, which will be kept to a minimum, must be subject to prior approval by the Owner.

1.8.6. The Contractor will be responsible for taking to the Site, at its own cost, all necessary supplies (electricity, water, fuel, etc.) for the performing of the Project and fulfilling its obligations by virtue of this Contract.

1.8.7. All the activities of the Contract shall be executed in strict conformity with the provisions of the Contract documents and with such explanatory detailed drawings, specifications and instructions as may be furnished from time to time to the Contractor by the MAHAGENCO mentioned in the Contract or not. The Contractor shall be responsible for ensuring that the Contract is executed in the most substantial, proper and workmanlike manner with the quality of materials and workmanship in strict accordance with the specifications and to the entire satisfaction of the MAHAGENCO.

1.9. PROGRAMME OF WORK

The Contractor/ successful Bidder shall submit the programme of work within 15 days from the date of receipt of Letter of Award/formal order. The programme shall include a Bar

Chart indicating therein the starting position and completion date of each of the major items of work.

1.10. STARTING OF WORK

The Contractor shall be required to start the work within 07 (Seven) days from the date of issue of Letter of Award and shall thereof, report to the CE (RE-P&P) accordingly.

1.11. COMPLETION SCHEDULE

The Date of Commissioning of the entire contracted capacity will be as per project completion schedule. 5 years O&M Contract will be commencing after handing over of the plant for O&M. The Contractor shall prepare the completion schedule accordingly and in conformity with provisions of technical specifications and carry out the work as per this schedule subject to "Force Majeure" conditions. The Contractor shall mobilize resources keeping in view, the above scheduled completion period.

1.12. SITE INSPECTION & BASIS OF OFFER

1.12.1. The Bidder is advised to visit and examine the site of works and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Bid and entering into a Contract for the required job. The costs of visiting the site shall be borne by the Bidder.

1.12.2. The Bidder or any of its personnel or agents shall be granted permission by the MSPGCL/ Owner to enter upon its premises and land for the purpose of such visits, but only upon the express conditions that the Bidder, its personnel and agents will release and indemnify the MSPGCL/ Owner and its personnel, agents from and against all liabilities in respect thereof and will be responsible for death or injury, loss or damage to property, and any other loss, damages, costs, and expenses incurred as a result of inspection.

1.12.3. The Bidder shall not be entitled to hold any claim against MSPGCL/ Owner for non-compliance due to lack of any kind of pre-requisite information as it is the sole responsibility of the Bidder to obtain all the necessary information.

1.12.4. The volume and quantity of work indicated in schedule of works may vary. The Contractor shall visit the site before quoting rate for civil works. After taking into consideration all aspects of the site, condition of soil etc., the Contractor shall quote for civil works. No extra claim will be entertained at post tender stage. The foundation design of module structure and the building shall have to be approved by MAHAGENCO. In case of any defects arisingin the building during guarantee period, the Contractor shall have to rectify the same at theirown cost.

1.13. PRICE QUOTE

The rate(s)/price/ percentage quoted against the work shall remain firm during the entire contract period.

1.14. TAX LAW

The offer will be considered including all prevailing taxes as given in price schedules

provided in electronic form in the Tender Document. **Anti-dumping Duty, safe guard duty and BCD shall not be applicable for change in law.**

Notwithstanding anything to the contrary contained herein, each party to the Contract shall be liable for the payment of any Direct Taxes payable by such party under applicable Law arising from the provisions of this Contract.

1.15. PROCUREMENT OF MATERIALS

The Contractor shall procure all necessary material required for the project work and arrange to store them properly. Test certificate in accordance with the specifications are to be furnished by the Contractor to MAHAGENCO for approval in respect of the materials procured by the Contractor.

1.16. SAMPLES

1.16.1. Apart from adhering to special provision made in the specification regarding submission of samples, the Contractor shall within 30 days of his receipt of Letter of Award, provide to MAHAGENCO samples along with detailed literature of all materials he proposes to use irrespective of the fact that specific make/material might have been stipulated. If certain items proposed to be used are of such nature that samples cannot be presented or prepared at site, detailed literature / test certificate of the same shall be provided instead. TheMAHAGENCO shall check the samples and give his comments and/or approval to the same.The right of passing or rejecting material, components or makes shall remain with MAHAGENCO.

1.16.2. One sample each shall be submitted at MAHAGENCO office and one sample each shall be maintained at the Site for inspection by MAHAGENCO. Wherever possible, like SCB, the samples shall be on returnable basis and Contractor can plan to use these at the end of the activity once inspection is completed. The following list is only an indicative one and MAHAGENCO can ask for any other material sample before use of the material on the Site and the Contractor shall be required to submit the same without fail.

1. String Combiner Box - one sample of complete assembled box along with one sample each of all the components used.
2. AC and DC wires and cables in appropriate lengths for all types to be used in the project
3. Module mounting structure legs and other members of appropriate lengths
4. Fasteners i.e. all types of Nut & bolts to be used in the project
5. All types of connectors
6. Watch tower legs and structural elements
7. Earthing strips of all types proposed

1.16.3. The numbers and lengths, wherever applicable, shall be decided by MAHAGENCO and shall be communicated with the Successful Contractor immediately after the acceptanceof the LOA.

1.17. NOTICE OF OPERATION

The Contractor shall not carry out important operation without the consent in writing of

the CE (RE-P&P) or his representative. For carrying out such important activity, the Contractor shall intimate to MAHAGENCO at least 48 hours before starting of the job.

1.18. REJECTION OF MATERIALS

MAHAGENCO's decision in regard to the quality of the material and workmanship will be final. The Contractors at his own cost and risk without any compensation shall immediately remove any material rejected by the Project Manager from the site of work.

1.19. LT POWER & WATER SUPPLY

The Contractor has to arranged HT/LT (Low Tension) power supply at respective site for construction purpose & O&M purpose at his own cost. The Contractor shall arrange suitable bore at each site and make arrangement for water requirement of the project at his own cost.

1.20. LABOUR ENGAGEMENT

The Contractor shall be responsible to provide all wages and allied benefits to his labors engaged for execution of the project work and also to carry out Operation & Maintenance service. The Contractor shall remain liable to the authorities concerned for compliance of the respective existing rules and regulations of the government for this purpose and shall remain liable for any contravention thereof.

1.21. HANDING OVER -TAKING OVER:

1.21.1. The work shall be taken over by MAHAGENCO upon issue of Final Acceptance Test Certificate by Mahagenco. During handing, over complete project work, the Contractor shall submit the following

1. All as- Built Drawings
2. Detailed Engineering Document with detailed specification, schematic drawing, circuit drawing and test results, manuals for all deliverable items, Operation, Maintenance & Safety Instruction Manual and other information about the project
3. Bill of material
4. Inventory of spares at projects site
5. Immediately after taking over of complete project(s), the same will be handed over to the Contractor for operation & maintenance for a period of 5 years from hand over date.

1.21.2. At the end of the contract period (5 years), the Contractor shall hand over the plant and equipment without any pending defect back to the owner in completely safe and healthy condition.

1.22. GUARANTEED ELECTRICAL ENERGY GENERATION DURING THE CONTRACT PERIOD:

1.22.1. For the cumulative capacity of 62 MW_{AC} solar power plant the Guaranteed Electrical Energy Generation during each year will be considered as the quoted generation by the

Contractor. Annual Quoted generation shall not be less than for the project location as shown as below i.e. **122.25 Million Units/year** for $62MW_{AC}$ as per respective sites GEEG in MUs.

1.22.2. ***Bids with yearly quoted generation below 122.25 MUs for cumulative capacity of 62MW$_{AC}$ as per respective sites GEEG in MUs will be rejected***.

The quoted guaranteed generation will be applicable for entire contract period. The module degradation will not be allowed from second year of operation. It is the EPC contractor's responsibility to envisage & install the extra DC capacity to accommodate any degradation during contract with other factors e.g. solar radiations, climate data etc.

The quoted guaranteed generation will be applicable for entire contract period. Bidder has to quote the guaranteed generation considering the all factors e.g. solar radiations, climate data, module degradation etc. Guaranteed Electrical Energy Generation is as follow-

Sr. No.	Project Location	Capacity in	GEEG in MUs	
1	Paras, Dist - Akola, Maharashtra	62	G'	**122.25**

1.22.3. Generation Linked Bank Guarantee

Following Generation linked BG shall be submitted by the bidder along with their online bid.

1.22.4. If bidder select DC:AC ratio greater than 1.40 up to 1.45 quoting Guaranteed annual generation, then bidder has to submit BG corresponding to 25 % value of the cost of incremental energy above reference value (corresponding to DC:AC ratio required of 1.40).

1.22.5. If bidder selects DC:AC ratio greater than 1.45 for quoting annual generation, then additional BG value shall be corresponding to 100% generation, then additional BG value shall be corresponding to 100% value of the cost of incremental energy above reference value (corresponding to DC:AC ratio of 1.45).

Bidder has to submit the annual generation in MU corresponding to DC: AC ratio of 1.40 as Reference Generation 1 and at DC ; AC ratio of 1.45 as Reference Generation 2; Quoted Guaranteed Annual generation G' shall be at actual DC : AC ratio selected by Bidder. These details shall be submitted by bidder in relevant attachment.

BG Calculation:

Case-1: Quoted generation is at DC:AC ratio greater than 1.4 and within 1.45 :

BG value = 0.25 X Number of units quoted above Reference Generation1 in MU X R X N (in million INR)

Case-2: Quoted generation is at DC:AC ratio greater than 1.45 :

BG value = {0.25 X (Reference Generation 2 in MU – Reference Generation 1 in MU) X R X N} + {(Actual Generation Quoted in MU – Reference Generation2 in MU) X R X N} (in Million INR)

Where, R = Tariff taken for arriving LD = INR 2.90/kWh &

N = Present worth factor taking discount factor of 12% for 25 years = 11.68.

1.22.6. Monthly Net actual energy exported will be measured at delivery point on the ABT meter installed at 220 kV bus level of 220 kV Paras substation of MSETCL located near to site.

1.22.7. During O & M period, the non- availability of the distribution line/transmission line after point of interconnection for evacuation of power more than 2 % i. e. 73 hours (Yearly) shall be considered for reduction of targeted generation. (grid outage or unavailability of power evacuation system after point of interconnection from 8 am to 6 pm only will be counted.) EPC Contractor shall submit grid outage certification from competent authority of STU/DISCOM.

1.22.8. If in any case the net actual units (kWh) generated for a year is below the quoted Guaranteed Electrical Energy Generation and up to 2% below quoted Guaranteed Electrical Energy Generation, the Contractor shall be liable to a penalty to the extent of 50% of the loss in revenue from the 62MW$_{AC}$ solar power plant to MAHAGENCO.

1.22.9. Further if net actual units (kWh) generated is beyond 2% below quoted Guaranteed Electrical Energy Generation, the Contractor shall be liable to a penalty to the extent of 100% of the loss in revenue from the 62MW$_{AC}$ solar power plant to MAHAGENCOand the same shall be realized by either Contractor making an upfront payment for the penalty or by MAHAGENCO adjusting the penalty against any payment due to the Contractor as per Clause 1.33 of Section III Or by MAHAGENCO invoking the bank guarantees. Upon such encashment and appropriation from the Performance Security, the Contractor shall, within 15 (fifteen) days thereof, replenish, in case of partial appropriation, the Performance Security to its original level, and in case of appropriation off the entire Performance Security provide a fresh Performance Security, as the case may be.

1.22.10. GST is applicable on penalty as per GST Law. If penalty is applicable, it shall be recovered from any due OR payment to the EPC Contractor.

The tariff used for the purpose of computation of the revenue shall be as per PPA applicable tariff which will be applicable as per the prevailing MERC RE Order.

1.23. TECHNICAL DATA SHEET

Detailed technical specification of the proposed Solar PV Grid interactive system in response to section II of RfP shall be provided as part B. In addition to the description of the system, the bidder shall furnish Technical Data Sheet as per the format given in **Annexure 17.**

1.24. DUTIES AND TAXES

The details mentioned in this section are only indicative in the nature. It is responsibility of the bidder to identify whether the particular exemption / benefit / concession is available or not at the time of considering the same in bid price including the rate of Taxes or even after the bidding till the completion of the tenure of O & M period for 5 years. If the any exemption / benefit / concession are not available, MAHAGENCO would not be held responsible for the same.

1.25. CUSTOMS DUTY

1.25.1. Customs duties inclusive of basic custom duty (BCD) levied under section 12 of theCustoms Act, 1962, IGST, education cess, secondary higher education cess and any other duties, cess or taxes of similar nature as applicable on all off shore supply of materials,

components, plant and machinery etc. should be included in the price bid and indicated separately by the bidder.

1.25.2. The Contractor shall be fully responsible for port and customs clearance including stevedoring, handling, unloading, loading, storage, inland transportation, transit insurance or any other charges of similar nature, if any, of materials, equipments and plant to the site as indicated by MAHAGENCO. Contractor shall be fully responsible for any delays, penalties, charges and losses, if any, in this regard

1.26. PROVISIONS UNDER GST LAWS FOR SOLAR POWER GENERATION SYSTEM

1.26.1 Vide Notification No. 24/2018-Central Tax(Rate) dated 31st December 2018, an explanation was inserted against serial no. 234 in notification no. 1/2017- Central Tax (Rate) which is as follows:

"If the goods specified in this entry are supplied, by a supplier, along with supplies of other goods and services, one of which being a taxable service specified in the entry at S. No. 38 of the Table mentioned in the notification No. 11/2017-Central Tax (Rate), dated 28th June, 2017 [G.S.R. 690(E)], the value of supply of goods for the purposes of this entry shall be deemed as seventy per cent. of the gross consideration charged for all such supplies,and the remaining thirty per cent. of the gross consideration charged shall be deemed as value of the said taxable service."

Therefore, if the goods mentioned in the serial no. 234 of notification no. 1/2017-Central Tax(Rate) are supplied by the supplier along with supplies of other goods and services, one of which being a taxable service as per serial no. 38 of notification no. 11/2017-Central Tax (rate), 70% of the total project cost will be deemed to be supply of goods and taxable @ 12% and balance 30% of gross consideration charged will be deemed as value of taxable service and taxable @ 18%.

1.26.2 Therefore, accordingly the benefits under GST such as ITC & other import benefits of IGST will vary & that the bidder needs to passed on the said benefits to MAHAGENCO.

1.26.3 EPC Contractor shall mandatorily file the returns under GST before due date & complywith the requirements of the law in time. Before releasing the payments to the EPC Contractor, MAHAGENCO shall ensure that the EPC Contractor has complied with all the statutory requirements under GST & that MAHAGENCO shall not be responsible for any delay in payments for noncompliance under GST.

1.26.4 A copy of GST registration Certificate needs to be supplied while submitting the bids wherever and whenever requested for as well.

1.26.5 In case Central Board of Indirect Taxes brings to the notice to MAHAGENCO, that the EPC Contractor has not remitted the amount towards GST collected from MAHAGENCO, to the Government exchequer, then that EPC Contractor may be debarred from bidding future tenders.

1.26.6 In case of statutory variation in GST during the period of contract, any increase in the rate needs to be absorbed and born by the EPC Contractor, whereas any decrease in the rate shall be passed on to MAHAGENCO.

1.27. LOCAL TAXES

Applicable local taxes should be included in bid price and separately specified by EPC Contractor.

1.28. O&M CONTRACT RENEWAL

Extension of O & M contract shall be done, after agreed by both the parties i.e. MAHAGENCO and the Contractor.

SECTION V:

Annexures for bid submission

V. SECTION V: FORMATS FOR BID SUBMISSION

The following formats are required to be submitted as part of the Bid. These formats are designed to demonstrate the Contractor's compliance with the Qualification Requirements set forth in Clause 1.14 of Section I and other Bid submission requirements specified andthe RFP

Annexure – 1 :- Formats for Eligibility of Offer

(Non-Financial Bid) (The format shall be on the Letter Head of the Bidding Company/ Lead Member of the
Bidding Consortium) No..... To,
The Chief Engineer (RE-P&P),
Maharashtra State Power Generation Company Ltd., HDIL Tower, A- Wing, 4 Floor
Bandra (East), Mumbai - 400051

Sub: Offer in response to Notice Inviting Tender No._____dated_____for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra . (as per annexure 19 of RfP)

Dear Sir,

We, the undersigned [insert name of the 'Bidder'] having read, examined and understood in details the RfP and Contract for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnectionat 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra . (as per annexure 19 of RfP).

We, hereby submit our Bid comprising of Financial Bid and Non-Financial Bid. We confirm that neither we nor any of our Parent Company/ Affiliate/ Ultimate Parent Company has submittedbid other than this bid directly or indirectly in response to the aforesaid RfP.

We give our unconditional acceptance to the RfP, dated XXXXXX and Contract attached thereto, issued by MAHAGENCO, as amended. In token of our acceptance to the Contract, thesame have been initialed by us and enclosed to the Bid. We shall ensure that Contractor shall execute such Contract as per the provisions of the RfP and provisions of such Contract shall be binding on us. (Please insert, in Case of Consortium):

We are having consortium agreement with M/s (legal name and country of incorporation to be given) who will be jointly and severally bound with us and be responsible to you for successful performance of the contract. Towards this we have submitted a deed of joint undertaking. Further, we have also enclosed a copy of the association agreement (between the bidder & the consortium associate).

Bid Security

We have enclosed a Bid Security of Rs._____(Insert Amount), in the form of bank guarantee no._____(Insert number of the bank guarantee) dated_____ [Insert date of bank guarantee] from _____ (Insert name of bank providing Bid Security) and valid up to_____.The offered quantum of power by us is_____MW_{AC} (Insert total capacity offered)

We have submitted our Price Bid strictly **on line only**, without any deviations, conditionsand without mentioning any assumptions or notes for the Price Bid in the said format.

Acceptance
We hereby unconditionally and irrevocably agree and accept that the decision made by MAHAGENCO in respect of any matter regarding or arising out of the RfP shall be binding on us. We hereby expressly waive any and all claims in respect of Bid process. We confirm that there areno litigations or disputes against us, which materially affect our ability to fulfill our obligations with regard to execution of Contract.

Codes and Standards:
We confirm that all the materials/equipment supplied by us under this bid shall be according to the various codes, standards, acts, laws, rules, etc. as specified in your bid specification and documents.

Appraisal of Site Condition:
We confirm that our representative has visited the project site and we are fully familiar with site conditions.

Familiarity with Relevant Indian Laws & Regulations:
We confirm that we have studied the provisions of the relevant Indian laws and regulations as required to enable us to submit this Bid and execute the Contract, in the event of our selection as Successful Bidder. We further undertake and agree that all such factors as mentioned in RfP have been fully examined and considered while submitting the Bid.

Contact Person
Details of the contact person are furnished as under:

a. Name:
b. Designation:
c. Company:
d. Address:
e. Phone Nos.:
f. Fax Nos.:
g. E-mail address:

It is confirmed that our Bid is consistent with all the requirements of submission as stated in the RfP and subsequent communications from MAHAGENCO.

The information submitted in our Bid is complete, strictly as per the requirements stipulated in the RfP and is correct to the best of our knowledge and understanding. We would be solely responsible for any errors or omissions in our Bid.

We confirm that all the terms and conditions of our Bid are valid for acceptance for a period of one hundred and eighty (180) days from the date of opening of price bid.

We confirm that no order / ruling has been passed by an Appropriate Commission or a competent court against us or any of our Affiliates in the preceding one (1) year from the date of opening of price bid for breach of any contract related to design and/or engineering and/or manufacture and/or supply and/or erection and/or testing and/or commissioning and/or operation & maintenance having duration of contract in excess of one (1) year and that the Bid Security submitted by us or any of our Affiliates has not been forfeited, either partly or wholly, in any bid process related to Contract

involving design and/or engineering and/or manufacture and/or supply and/or erection and/or testing and/or commissioning and/or operation & maintenance in the preceding one (1) year from the date of opening of price bid to any company/utility in India as per the provisions of clause **"Qualifying Requirement."**

We also declare that our company/all members of the consortium has/have not been included in the list of sanctions if the United Nations, nor of the EU, nor of the German Government, nor of the Indian Government nor in any other list of sanctions and affirm that our company/all members of the consortium will immediately inform MAHAGENCO if this situation occur at a later stage.

Thanking you,
We remain,Yours faithfully,

Signature of Authorized Person in whose name Power of Attorney / Board Resolution is being issued. Name:
Designation: Date:
Place:
Seal of Company

Annexure – 2 :- Format for Power of Attorney
(Non-Financial Bid)

POWER OF ATTORNEY

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution. Foreign companies submitting Bids are required to follow the applicable law in their country)

Power of Attorney to be provided by the Bidding Company/ Bidding Consortium in favor of its Representative/Lead Member as evidence of authorized signatory's authority.

Know all men by these presents, We.....(name and address of the registered office of the Bidding Company or Lead Member of the Bidding Consortium, as applicable) do hereby constitute, appoint and authorize Mr./Ms ……..…..(name and residential address) who is presently employed with us and holding the position of .....….as our true and lawful attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to submission of our Bid for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnectionat 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra in response to the RfP dated XXXXXX issued by MaharashtraState power Generation Company Limited ("MAHAGENCO" or "MSPGCL"), including signing and submission of the Bid and all other documents related to the Bid, including but not limited to undertakings, letters, certificates, acceptances, clarifications, guarantees or any other document which MAHAGENCO may require us to submit. The aforesaid Attorney is further authorized for making representations to MAHAGENCO, and providing information / responses to MAHAGENCO, representing us in all matters before MAHAGENCO, and generally dealing with MAHAGENCO in all matters in connection with our Bid till the completion of whole Contract as per the terms of the RfP.

We hereby agree to ratify all acts, deeds and things done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall be binding on us and shall always be deemed to have been done by us.

All the terms used herein but not defined shall have the meaning ascribed to such terms under the RfP.
Signed by the within named

..... [Insert the name of the executant company]

through the hand of
Mr .....
duly authorized by the Board to issue such Power of Attorney

Dated this.....day of .....

Signature of Attorney

(Name, designation and address of the Attorney)

Attested

(Signature of the executant)
(Name, designation and address of the executant)

Signature and stamp of Notary of the place of execution

Common seal of.....has been affixed in my/our presence pursuant to Board of Director's

Resolution dated..... WITNESS

1 ..... (Signature)

Name .....

Designation.....

2.
(Signature)

Name ..... Designation.....

Notes:

The mode of execution of the power of attorney shall be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and the same shall be under common seal of the executant affixed in accordance with the applicable procedure. Further, the person whose signatures are to be provided on the power of attorney shall be duly authorized by the executant(s) in this regard.

The person authorized under this Power of Attorney shall be a person holding the post of Manager or above designation in the company.

In case of the Bidding Company/Lead Member being a foreign company, the same shall be signedby a person of equivalent position.

In the event, power of attorney has been executed outside India, the same needs to be duly notarized by a notary public of the jurisdiction where it is executed.

Also, wherever required, the executant(s) shall submit for verification the extract of the charter documents and documents such as a Board resolution / power of attorney, in favor of the person executing this power of attorney for delegation of power hereunder on behalf of the executant(s).

Annexure – 3 :- Format for Consortium Agreement

Format for Consortium Agreement
(Non-Financial Bid)

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution, duly signed on each page. Foreign entities submitting Bid are required to follow the applicable law in their country)

FORM OF CONSORTIUM AGREEMENT BETWEEN M/S ....., M/S..... AND M/S..... FOR (.....)

THIS Consortium Agreement (hereinafter referred to as "Agreement") executed on this..... day of .....Two thousand..... between M/s..... a company incorporated under the laws of ..... and having its Registered Office at..... (hereinafter called the "Party 1", which expression shall include its successors, executors and permitted assigns), M/s ..... a company incorporated under the laws of ..... and having its Registered Office at .....(hereinafter called the "Party 2", which expression shall include its successors, executors and permitted assigns) and M/s..... a Company incorporated under the laws of ..... and having its Registered Office at ..... (here in after called the "Party 3", which expression shall include its successors, executors and permitted assigns) (The Bidding Consortium shall list the name, address of its registered office and other details of all the Consortium Members) for the purpose of submitting the Bid in response to the RFP and in the event of selection as Successful Bidder to comply with the requirements as specified in the RFP and ensure execution of the RFP Documents as may be required to be entered into with Maharashtra State Power Generation Company Limited (MAHAGENCO).

Party 1, Party 2, and Party 3 are hereinafter collectively referred to as the "Parties" and individually as a "Party".

WHEREAS Maharashtra State Power Generation Company Limited "MAHAGENCO" desired to enter into a Contract for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra . (As per Annexure 19 of RFP)

WHEREAS, Maharashtra State Power Generation Company Limited "MAHAGENCO" had invited Bids, vide RFP dated issued to..... [Insert the name of purchaser of RFP] AND WHEREAS Clause Qualifying Requirement of the RFP stipulates that the Bidders qualifying on the strength of a Bidding Consortium shall submit a legally enforceable Consortium Agreement in a format specified in the RFP, whereby the Consortium Members undertake to be liable for their respective equity investment commitment for the formation of a Project Company and undertake to submit the Contract Performance Guarantee as required as per the provisions of the RFP, as specified herein.

NOW THEREFORE, THIS INDENTURE WITNESS AS UNDER:

In consideration of the above premises and agreement all the parties in this Consortium do hereby mutually agree as follows:

In consideration of the selection of the Consortium as the Successful Bidder by MAHAGENCO, we the Members of the Consortium and Parties to the Consortium Agreement do hereby unequivocally agree that M/s..... (Insert name of the Lead Member), shall actas the Lead Member as defined in the RFP for self and agent for and on behalf of.....(the names of all the other Members of the Consortium to be filled in here).

The Lead Member is hereby authorized by the Members of Consortium and Parties to the Consortium Agreement to bind the Consortium and receive instructions for and on behalf of all Members.

The Lead Member shall be liable and responsible for ensuring the individual and collective commitment of each of the Members of the Consortium in discharging all their respective equity obligations. Each Consortium Member further undertakes to be individually liable for the performance of its part of the obligations without in any way limiting the scope of collective liability envisaged in this Agreement.

(Insert as applicable) The Consortium shall be responsible to incorporate a Project Company as a legal entity as per the provisions of the RFP, within fifteen (15) days of issue of LOA provided such a Project Company has not been incorporated by the Bidder prior to the submission of the Bid.

OR

The Consortium has incorporated a Project Company by the name ……..(Insert name ofthe Project Company) to undertake the responsibilities and obligations for execution of EPC contract/ project as per the provisions of the RFP Documents.

The percentage of equity holding of each Member of the Consortium in the Project Company shall be/is as follows:

Name	Percentage of equity holding in the Project Company
Party 1	….
….	….
Party n	….
Total	100%

[Note: The percentage equity holding for any Consortium Member cannot be zero in the above table. Lead Member's percentage equity holding cannot be less than 51% from the Effective Date up to a period of two (2) years after Scheduled COD or Revised Scheduled COD, as the case may be and the Technical Member's percentage equity holding cannot be less than 26% from the Effective Date up to a period of three (3) years after Scheduled COD or Revised Scheduled COD, as the case may be.]

In case of any breach of any of the equity investment commitment as specified in clause **(Insolvency & Breach of s) of section III** above by any of the Consortium Members for the formation of the Project Company, the Lead Member shall be liable to meet the equity obligation.

Except as specified in the Agreement, it is agreed that sharing of responsibilities as aforesaid and equity investment obligations thereto shall not in any way be a limitation of responsibility of the Lead Member under these presents.

It is further specifically agreed that the financial liability for equity contribution of Lead Member shall, not be limited in any way so as to restrict or limit its liabilities. The Lead Member shallbe liable irrespective of their scope of work or financial commitments.

This Consortium Agreement shall be construed and interpreted in accordance with the Laws of India and courts at Mumbai (Maharashtra) alone shall have the exclusive jurisdiction in all matters relating thereto and arising there under.

It is hereby agreed that the Lead Member shall furnish the Bid Security, as stipulated in the RFP, on behalf of the Consortium.

It is hereby agreed that in case of selection of Bidding Consortium as the Successful Bidder, the Parties to this Consortium Agreement do hereby agree that they shall furnish the Contract Performance Guarantee on behalf of the Contractor in favour of MAHAGENCO, as stipulated inthe RFP and Contract. The Lead Member shall be responsible for ensuring the submission of the CPG on behalf of all the Consortium Members.

It is further expressly agreed that the Consortium Agreement shall be irrevocable and, for the Successful Bidder, shall remain valid over the term of the Contract, unless expressly agreed to the contrary by MAHAGENCO.

The Lead Member is authorized and shall be fully responsible for the accuracy and veracity of the representations and information submitted by the Consortium Members respectively from time to time in response to the RFP for the purposes of the Bid.

It is expressly understood and agreed between the Members that the responsibilities and obligations of each of the Members shall be as delineated as annexed hereto as Annexure-I forming integral part of this Agreement. It is further agreed by the Members that the above sharing of responsibilities and obligations shall not in any way be a limitation of joint and several responsibilities and liabilities of the Members, with regards to all matters relating to the supply of power envisaged in the RFP Documents.

It is clearly agreed that the Lead Member shall ensure performance under the agreements and if one or more Consortium Members fail to perform its /their respective obligations under the agreement(s), the same shall be deemed to be a default by all the Consortium Members.

It is hereby expressly agreed between the Parties to this Consortium Agreement that neither Party shall assign or delegate its rights, duties or obligations under this Agreement except with prior written consent of MAHAGENCO.

This Consortium Agreement has been duly executed and delivered on behalf of each Party heretoand constitutes the legal, valid, binding and enforceable obligation of each such Party, sets forth the entire understanding of the Parties hereto with respect to the subject matter hereof; may not be amended or modified except in writing signed by each of the Parties and with prior written consent of MAHAGENCO:

IN WITNESS WHEREOF, the Parties to the Consortium Agreement have, through their authorized representatives, executed these presents and affixed common seals of their respective companies on the Day, Month and Year first mentioned above.

Common Seal of .....
has been affixed in my/our
pursuant to the
resolution
dated .....

For and on behalf of
Consortium Member (party 2) presence
M/s .....Board of Director's

……..
……
(Signature)
representative)
Name: …….....
Designation:……..
Place: …….
Date: ……

(Signature of authorized

Name: ……..
Designation: ……..

Witness :

1. …….

(Signature)

Name ……. Designation.....……..

2. …….

(Signature)

Name ……. Designation.....……..

Common Seal of .....
has been affixed in my/our
presence pursuant to the
Board of Director's
resolution dated .....

For and on behalf of
Consortium Member (Party 3)
M/s…….

……
……
(Signature)

Name:
Designation: Place:
Date:

(Signature of authorized
representative)
Name: Designation:

WITNESS 1

1. …….
(Signature)
Name ……. Designation.....……..

2. …….
(Signature)
Name ……. Designation.....……..

Attested:

…….
(Signature) (Notary Public)
Place: …….
Date: …….
Note: Each Consortium Member has to provide Power of Attorney for authorization to authorized signatory and certified true copy of the Board Resolution for issue of Power of Attorney clearly specifying the name of attorney as well as the executant, affixation of common seal and names of persons attesting the common seal.

Annexure – 4 :- Format for Letter of Consent from Consortium Members

Format for Letter of Consent from Consortium Members

(Non-Financial Bid)

(On the letter head of each Member of the Consortium including Lead Member) Date: _____
From: _____

_____
Tel.#: Fax#:
E-mail address #:

To,
The Chief Engineer (RE-P&P),
Maharashtra State Power Generation Company Ltd., HDIL Tower, A- Wing, 4 Floor
Bandra (East), Mumbai - 400051

Sub: Offer in response to Notice Inviting Tender No._____dated_____for design, engineering, manufacture, supply, erection, testing and commissioning of Grid InteractiveSolar Power Plant including 5 years operation & maintenance at Paras, Taluka – Balapur, Dist- Akola, Maharashtra. (As per Annexure 19 of RfP)

We, the undersigned Member of …… (Insert name of the Bidding Consortium) have read, examined and understood the RFP and Contract for the selection of Bidder(s) as prospective bidder for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra . (As per Annexure 19 of RfP) .

We hereby confirm our concurrence with the RfP including in particular the Consortium Agreement and the Bid submitted by .....(Insert name of the Lead Member) in response to the RfP. We confirm that the bid has been reviewed and each element of the bid is agreed to including but not limited to the investment commitment in the Project Company.

The details of contact person is furnished as under:

Name : …… Designation :
…….. Name of the Company: ……..
Address : ……
Phone Nos. : …… Fax Nos. :
……. E-mail address : ……..

Dated the ……. day of.....of 20…

Thanking you, Yours faithfully,

……..
(Signature of Authorized Signatory of Consortium Member: Name:
Designation : Company's Seal:)

Business Address:

Name and address of authorized signatory. Note:
Each Consortium Member has to provide Power of Attorney for authorization to authorized signatory and certified true copy of the Board Resolution for issue of Power of Attorney clearly specifying the name of attorney as well as the executant, affixation of common seal and names of persons attesting the common seal.
The letter of consent provided by Consortium Member(s) will be additionally signed by authorized signatory of the Lead Member.

Annexure – 5 :- Format for Bidder's Composition and Ownership Structure

Format for Bidder's Composition and Ownership Structure
(Non-Financial Bid)

Description of Bidder
Name of the Bidding Company / Joint Venture
Company
Name of the Lead Consortium Member

In case of Bidding Consortium

Sr.No.	Name of the Member Company	Role in the Bidding Consortium
1.		
2.		
3.		

Type of Technology to be used in the bidding:.....Capacity Offered: …….

(Please provide the following information for Bidder. If the Bidder is a Consortium, please provide this information for each Member including Lead Member)

Corporate Details:

Please provide the following information for the Bidder.

Company's Name, Address, Nationality and Director's details:
Name:_____
Registered/Principal Address: _____
_____
_____
Website Address: _____
Corporate Identification Number, if any: _____
Country of Origin: _____
Address for Correspondence: ……
……
……
Year of Incorporation: _____Company's Business Activities:

Name of the authorized representative:
Telephone Number:_____Email Address:___Telefax Number:
Status as a Bidder: Bidding Company
Lead Member of the Bidding Consortium_____
Member of the Bidding Consortium
Note: (tick the applicable serial number)
Company's Local Address in India (if incorporated outside India):

_____
_____
_____
Please provide the following documents:

Copy of the Memorandum and Articles of Association and certificate of incorporation or other equivalent organizational document (as applicable in the case of a foreign company), including their amendments, certified by the company secretary of the Bidding Company / each Member of the Consortium (as Attachment)

Authority letter in favor of Maharashtra State Power Generation Company Limited from the Bidding Company/each Member of the Consortium (as specified in Format) authorizing Authorized Representative to seek reference from their respective bankers, lenders, financing institutions and any other person as given below in the Format for Authorization of the RFP.

(Insert this point in case of Bidder being a Bidding Company) Whether the Bidder wishes to form a Project Company for execution of the contract..... (Yes/No)

(Insert this point in case of Bidder being a Bidding Company) Whether the Bidder has already formed a Project Company..... (Yes/No)

If Yes, the details of the Project Company as follows: Name of the Project Company …….. Name of the Equity Holder ……
Type and No. of Shares owned ……
% of equity holding …….
Extent of voting control(%) …….. Date of incorporation ……

Details of Ownership Structure:
Details of persons owning 10% or more of the total paid up equity of the Bidding Company / each Member of the Consortium.
Name of the Bidding Company/ Member of the Consortium.....Status of equity as on ……

Name of Equity Holder	Type and Number of	% of Equity Holding	Extent of Voting
1.			
2.			
3.			
…			

Notes:
Status of equity holding shall be provided not earlier than 30 (thirty) days prior to Bid Deadline.
The above table is to be filled in separately for each Consortium Member if applicable.

Documents submitted in support of establishing the relationship with the Parent Company / Affiliate with the Bidding Company or with the Member of the Bidding Consortium (including Lead Member) in terms of the provisions of Qualifying Requirements of this RFP:
1. ……
2. …….
3. ……..

4. ……

For and on behalf of Bidding Company/ Member of the Consortium
M/s…….
…… (Signature of authorized representative)
Name:……. Designation:…….
Stamp:…….

Date:…….
Place: …….

Note:
Each Consortium Member has to provide Power of Attorney as per format given for authorization to authorized signatory and certified true copy of the Board Resolution for issue of Power of Attorney clearly specifying the name of attorney as well as the executant, affixation of common seal and names of persons attesting the common seal.
The letter of consent provided by Consortium Member(s) will be additionally signed by authorized signatory of the Lead Member.

Annexure – 6 :- Format for authorization

Format for authorization

(On Non – judicial stamp paper duly attested by Notary Public)

(In case of Bidding Consortium to be given separately by each Member)

The undersigned hereby authorize(s) and request(s) all our Bankers, a list of which is attached herewith as Annexure 20 hereto, including its subsidiaries and branches, any person, firm, corporation or authorityto furnish pertinent information deemed necessary and requested by Maharashtra State Power Generation Company Limited to verify the authenticity of the documents / information submitted by us for meeting the Qualification Requirements in respect of our Bid for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra . (as per Annexure 19 of RfP) and / or regarding our financial standing and general reputation.

For and on behalf of M/s ..... (Insert Name of Bidding Company or Member of the Consortium)

……..
Signature and Name of the authorized representative of the Company

Company rubber stamp/seal

……
(Signature of Notary Public)

(Name and Address of the Attorney)
Place:…… Date:…….
(This Annexure- is integral part of this format) Note:

Each Consortium Member has to provide Power of Attorney for authorization to authorized signatory and certified true copy of the Board Resolution for issue of Power of Attorney clearly specifying the name of attorney as well as the executant, affixation of common seal and names of persons attesting the common seal.

The letter of consent provided by Consortium Member(s) will be additionally signed by authorized signatory of the Lead Member

Annexure – 7 :- Format for Financial Requirement (Net Worth)

Format for Financial Requirement (Net Worth)

(Non-Financial Bid)
(To be submitted by Bidders on official letter head of the Bidding Company/ Lead Member of the Bidding Consortium)

No _____ Dated _____

To,
The Chief Engineer (RE-P&P),
Maharashtra State Power Generation Company
Ltd., HDIL Tower, A- Wing, 4 Floor
Bandra (East), Mumbai - 400051

Sub: Offer in response to Notice Inviting Tender No._____dated_____for design, engineering, manufacture, supply, erection, testing and commissioning of Grid Interactive Solar Power Plant including 5 years' operation & maintenance at Paras, Taluka – Balapur, Dist-Akola, Maharashtra. (as per Annexure 19 of RfP)

Sir,

We submit our Bid for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra for which we submit details of our Qualification Requirements.

[Note: Applicable in case of Bidding Company]

We certify that the Financially Evaluated Entity (ies) had a Networth of Rs..... Crore or equivalent USD* computed as per instructions provided in Qualifying Requirement of this RFP based on unconsolidated audited annual accounts (refer Note-2 below) of any of the last three (3) financial years immediately preceding the date of opening of price bid.

Name of Financially Evaluated Entity**	Relationship with Bidding Company***	Net worth (Rs. Crore)	Financial Year
1			
2			
3			
….			
Total Networth			

* Equivalent USD shall be calculated as per provisions of Qualifying Requirement
** The Financially Evaluated Entity may be the Bidding Company itself
*** The column for "Relationship with Bidding Company" is to be filled in only in case financial capability of Parent Company and/ or Affiliate has been used for meeting Qualification requirements.
[Note: Applicable in case of Bidding Consortium, details to be provided for Lead Member

We certify that the Financially Evaluated Entity (ies) had a Networth of Rs ..... Crore or equivalent USD* computed as per instructions provided in Qualifying Requirement of the RFP and based on unconsolidated audited annual accounts (refer Note-2 below) of any of the last three (3) financial years immediately preceding the date of opening of price bid.

Name of Lead Member	Equity commitment in the Project Company (%)	Networth of Member (Rs. Crore) (As per table below)	Whether the Member meets the Networth Requirement
(1)	(2)	(3)	(5)
1			Yes/No

Member – I (Lead Member)
(Note: This shall be duly certified by the Lead Member's Statutory Auditor)

Name of Member:
Total Networth requirement: Rs_____crores
Percentage of equity commitment for the Project Company by the Member__%
Networth requirement for the _____Crores.
Member***: Rs.

Name of Financially Evaluated Entity**	Relationship with Lead Member of Bidding Consortium ***	Networth (Rs. Crore) ****	Financial Year
1			
2			
3			
….			
Total Networth			

* Equivalent USD shall be calculated as per provisions of Qualifying Requirement
** The Financially Evaluated Entity may be a Member of the Bidding Consortium itself
*** The column for "Relationship with Lead Member of Bidding Consortium" is to be filled in only in case financial capability of Parent Company and/ or Affiliate has been used for meeting Qualification Requirements.
**** Networth requirement is to be met by the Lead Member of the Bidding Consortium.

Yours faithfully

(Signature and stamp (on each page) of Authorized signatory authorized by Board of Bidding Company/ Member of Consortium) Name:
Date: Place:

(Signature and Stamp (on each page) of Statutory Auditors of Bidding Company/ Member of Consortium) with UDIN no.

Name: Date: Place:

Please also affix common seal of Bidding Company/ Member in a Bidding Consortium

Common Seal of .....has been affixed in my/our presence pursuant to the Board of Director's Resolution dated .....

…….
(Signature) Name: Designation:

WITNESS:

1. …….
(Signature)

Name ……. Designation .....Date:

2. …….
(Signature)

Name ……. Designation.....……..

Date: Notes:

Along with the above format, in a separate sheet, please provide details of computation of Networth duly certified by Statutory Auditor and also signed by Authorized signatory with UDIN no.

Audited consolidated annual accounts of the Bidder may also be used for the purpose of financial criteria provided the Bidder has at least 26% equity in each company whose accounts are merged in the audited consolidated accounts and provided further that the financial capability of such companies (of which accounts are being merged in the consolidated accounts) shall not be considered again for the purpose of evaluation of the Bid.

Annexure – 8 :- Format for Qualification Requirement (As per Clause 1.14 of SECTION -I)

(Non-Financial Bid)
(This format shall be on the Letter Head of the Bidding Company/ Lead Member of the Bidding Consortium)

To,
The Chief Engineer (RE-P&P),
Maharashtra State Power Generation Company Ltd., HDIL Tower, A- Wing, 4 Floor
Bandra (East), Mumbai - 400051

Dear Sir,

Sub: Bid for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra . (As per Annexure 19 of RFP) in response to the RFP.

We hereby submit following details/documents in support of meeting the Qualification Requirements of this RFP. The details are summarized in the format attached:

We the undersigned Bidder, having read and examined in details the Technical Specification for 62 MW_{AC} Grid Interactive Solar Power Plant. Technical Specification for Array Yard, Power Control Unit, Main switchyard (Pooling Substation) and Main Control Room, Comprehensive Operation and Maintenance, Quality Assurance, Quality Control Inspection and Testing and General Condition and are hereby submitting our offer to execute the contract as per specification as set forth in your RFP Documents. In this connection, we enclose a technical report (As per Annexure attached to this format) for your kind perusal.

Yours faithfully

(Signature and stamp (on each page) of Managing Director /Chief Executive Officer /Manager [refer
Notes 1and 2 below] of Bidding Company/ Member of Consortium) Name:
Date: Place:
Please also affix common seal of Bidding Company/ Member in a Bidding Consortium

Common Seal of..... has been affixed in my/our presence pursuant to the Board of Director's resolution dated .....

…….
(Signature) Name: Designation:

WITNESS:

1. …….
(Signature)

Name ……. Designation.....……..

Date:

2. …….
(Signature)

Name …….
Designation.....……..

Date: Notes:
Managing Director/ Chief Executive Officer, being a full-time director on the Board of the Bidding Company/ Member in case of a Consortium.

In case of Manager, the Company shall confirm through a copy of Board Resolution attested by Company Secretary that the concerned person is appointed as Manager as appointed under Section 269of the Companies Act, for the purpose in question. The Company Secretary shall also certify that the Company does not have a Managing Director or Chief Executive Officer. In case of the Bidding Company/Member being a foreign company, the same shall be signed by a person of equivalent position.

Summary of Details for meeting Technical Qualification Requirements
Technical Competence of the Bidder: Solar Power Projects
Project Experience

Name of the Solar Power Project*	Is the Bidder claiming Project experience of Parent/ Affiliate?	Name of the Parent/ Affiliate and relationship of the same with the Bidder	Capacity (MW_{AC})	Grid Connected / Off-grid	Technology used	Date of COD	Years of Operation	Details of supporting's attached
<Project-1>								
<Project-2>								
…								
<Project-n>								

O&M Experience

Name of the Solar Power Project*	Is the Bidder claiming O&M experience of Parent/ Affiliate?	Name of the Parent/ Affiliate and relationship of the same with the Bidder	Capacity (MW_{AC})	Grid Connected/ Off-grid	Technology used	Date of COD	Years of Operation	Details of supporting's attached
<Project-1>								
<Project-2>								
…								
<Project-n>								

* Only Projects at Single site to be included.

Annexure – 9 :- Format of Undertaking

Bidder's Undertaking

[On the Letter Head of the Bidding Company/Lead Member of Bidding Consortium]

To,
The Chief Engineer (RE-P&P),
Maharashtra State Power Generation Company Ltd., HDIL Tower, A- Wing, 4 Floor
Bandra (East), Mumbai - 400051

Dear Sir,

Sub: Bidders' Undertakings for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra. (as per Annexure 19 of RfP) in response to the RfP.

"We have carefully read and examined in detail the RfP, including in particular, regarding submission of an undertaking, as per the prescribed Format.

We give our unconditional acceptance to the RfP and Contract issued by MAHAGENCOas a part of the RFP, and as amended. We shall ensure that the Contractor shall execute such RfP Documents as per the provisions of the RfP.

We have submitted our Financial Bid(s) strictly online only, without any deviations, conditions and without mentioning any assumptions or notes for the Financial Bid in the said format.

We have submitted the Bid on the terms and conditions contained in the RfP.

Our Bid (including Financial Bid) is valid up to the period required under this RfP.

Our Bid (including Financial Bid) has been duly signed by authorized signatory and closed in the manner and to the extent indicated in the RfP and the Power of Attorney/ Board Resolution in requisite format as per RfP has been enclosed in original with this undertaking.

(Insert in case of incorporation of Project Company by the Bidding Company/Bidding Consortium) We undertake that if we are selected as the Successful Bidder we shall transfer all Consents, Clearances and Permits in the name of the Project Company within the period specified in the Contract, if such Consents, Clearances and Permits have been obtained in the name of a company other than the Project Company prior to the submission of our Bid.

(Insert in case of incorporation of Project Company by the Bidding Company/Bidding Consortium) We have also noted the amount of the equity investment required to be madein the Project Company by "us" (in case of Bidding Company)/ "each Member of Consortium" (in case of Bidding Consortium) to be incorporated to undertake the obligations under the Contract for Design, engineering, manufacture, supply, erection, testing and commissioning of 62 MW_{AC} Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with 220 kV associated underground cable/ overhead transmission line up to the point of interconnection including 5 years operation & maintenance at Paras, Taluka – Balapur, Dist-Akola, Maharashtra.(as per Annexure 19 of RfP)

(Insert in case of incorporation of Project Company by Bidding Consortium, repeat this para

for each member of consortium) In view of the above, we hereby undertake to you and confirm that in the event of failure of …….(Insert name of Member of the Consortium) to invest in full or in part, in the equity share capital of the Project Companyas specified in the Bid, we shall invest the said amount not invested by …….
(Insert name of Member of the Consortium).]").

(Insert in case of incorporation of Project Company by the Bidding Company/Bidding Consortium) In view of the above, we hereby undertake to you and confirm that we will invest in the equity share capital of the Project Company as specified in the Bid.

(Insert in case of incorporation of Project Company by Bidding Consortium) In view of the above, we hereby undertake to you and confirm that we will invest in the equity share capital of the Project Company as specified in the Bid and Consortium Agreement.

We have assumed that if we are selected as the Successful Bidder, the provisions of the Consortium Agreement submitted along with the Bid, to the extent and only in relation to equity lock in and our liability thereof shall get modified to give effect to the provisions of the RFP and Contract. (Applicable only in case of a Bidding Consortium)

We confirm that our Bid meets the following conditions:
The Scheduled COD is not later than the date specified in the RfP, subject to the provisions of the Contract. Financial Bid(s) is/are in the prescribed Format, and is submitted duly signed by the authorized signatory Financial Bid(s) is/are unconditional

We confirm that we comply with all the technical specifications and terms and conditions included in the RfP and RfP Documents.

We have neither made any statement nor provided any information in this Bid, which to the best of our knowledge is materially inaccurate or misleading. Further, all the confirmations, declarations and representations made in our Bid are true and accurate. In case this is found to be incorrect after our selection as Successful Bidder, we agree that the same would be treated as a Solar Power Company's event of default under Contract, and consequent provisions of Contract shall apply.

We have also noted the amount of the Contract Performance Guarantee required to be submitted as per the RfP by us for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra
. (as per Annexure 19 of RfP) in the event of it being selected as the Successful Bidder". (Location and site map to be added)

We have attached hereto certified true copy of the Board Resolution whereby the Board of Directors of our Company has approved issue of this Undertaking by the Company.

All the terms used herein but not defined, shall have the meaning as ascribed to the said terms under the RFP.

In view of the above, we hereby undertake to you and confirm that we will submit the Contract Performance Guarantee in full at any stage, as specified in the RFP.

(Note: Insert the following para in case of the Bidding Company/ Lead Member of Consortium is same as Financially Evaluated Entity/Technically Evaluated Entity)

We confirm that we are using our own technical and/or financial (Select technical for technically evaluated entity/ financial for financially evaluated entity/ or both) capability for meeting the Qualification Requirements as specified in Clause 1.14 of section I of the RfP.

……..
Signature and name of authorized signatory in whose name Power of Attorney/ Board
Resolution as per Q.R. is issued

Original Power of Attorney/ Board Resolution as per RFP is enclosed.
Rubber stamp of the Bidder to be affixed.

Annexure – 10 :- Undertaking from the Financially Evaluated Entity

Undertaking from the Financially Evaluated Entity and/ or Technically Evaluated Entity or its Parent Company/ Ultimate Parent Company (On the Letter Head of the Financially Evaluated Entity or its Parent Company/ Ultimate Parent Company)

Name:
Full Address: Telephone No.: E-mail address: Fax / No.:

To,
The Chief Engineer (RE-P&P),
Maharashtra State Power Generation Company Ltd., HDIL Tower, A- Wing, 4 Floor
Bandra (East), Mumbai - 400051

Dear Sir,

We refer to the Request for Proposal dated XXXXXX issued by you for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra . (as per Annexure 19 of RfP) "We have carefully read and examined in detail the RfP, including in particular, Q.R. of the RfP, regarding submission of an undertaking, as per the prescribed Format.

We have attached hereto certified true copy of the Board Resolution whereby the Board of Directors of our Company has approved issue of this Undertaking by the Company.

All the terms used herein but not defined, shall have the meaning as ascribed to the said terms under the RfP.

(Note: Insert the following para in case of the Bidding Company/ Lead Member of Consortium is not same as Financially Evaluated Entity/Technically Evaluated Entity)

We have also noted the amount of the Contract Performance Guarantee required to be submitted as per Clause of the RfP by the ..... (Insert the name of the Bidding Company) for design, engineering, manufacture, supply, erection, testing and commissioning of Grid Interactive Solar Power Plant including 5 years' operation & maintenance of the same in the event of it being selected as the Successful Bidder".

In view of the above, we hereby undertake to you and confirm that in the event of failure of ……. (Insert name of the Bidding Company) to submit the Contract Performance Guarantee in full or in part at any stage, as specified in the RfP, we shall submit the Contract Performance Guarantee for the amount not submitted by ..... (Insert name of the Bidding Company]".))

We confirm that M/s. ……. (Insert name of Bidding Company) has been authorized by us to use our technical/financial (Select technical for technically evaluated entity/ financial for financially evaluated entity) capability for meeting the Qualification Requirements as specified in the RFP referred to above.

[Note: Insert the following para in case of a Bidding Consortium OR a Bidding Company opting to invest through a Project Company]

We have also noted the amount of the equity investment required to be made in the Project Company by the …….. (Insert the name of the Bidding Company/Consortium Member) to be incorporated to undertake the obligations under the Contract for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra . (as per Annexure 19 of RfP)

In view of the above, we hereby undertake to you and confirm that in the event of failure of ……. (Insert name of the Bidding Company/Member of the Consortium) to invest in full or in part, in the equity share capital of the Project Company as specified in the Bid, we shall invest the said amount not invested by ……. (Insert name of the Bidding Company/Member of the Consortium).

……..

Signature and name of authorized signatory in whose name Power of Attorney/ Board Resolution is issued

Rubber stamp of the Bidder to be affixed. WITNESS

1. …….
(Signature)
Name …… Designation.....……..

2. …….
(Signature)
Name …… Designation.....……..

Note:
Each entity (Parent/Affiliate/Consortium Member) has to provide Power of Attorney for authorization to authorized signatory and certified true copy of the Board Resolution for issue of Power of Attorney clearly specifying the name of attorney as well as the executant, affixation of common seal and names of persons attesting the common seal. The letter of consent provided by Consortium Member(s) will be additionally signed by authorized signatory of the Lead Member.

Annexure – 11 :- Format for Board Resolution

Format for Board Resolution

(Non-Financial Bid)
Not required as Incorporation Certificate of Companies will be attached

(Format for the Board resolution to be passed by each Financially Evaluated Entity and Technically Evaluated Entity/ its Parent Company /Ultimate Parent Company)

The Board, after discussion, at the duly convened Meeting on …… (Insert date),with the consent of all the Directors present and in compliance of the provisions of the Companies Act, 1956, passed the following Resolution:

RESOLVED THAT pursuant to the provisions of the Companies Act, 1956 and compliance thereof and as permitted under the Memorandum and Articles of Association of the company, approval of the Board be and is hereby accorded for issuing an Undertaking to MAHAGENCO, in the format specified in the RfP, draft of which is attached hereto and initialed by the Chairman whereby the company undertakes to provide the_____percent (____ %) [Insert 100% in case of Bidding Company and percent of equity investment in the Project Company in case of Member of Consortium] of the Contract Performance Guarantee, as per the terms and conditions of the RfP, representing the total amount of Contract Performance Guarantee required to be provided by the _____ (Insert the name of the Bidding Company / Consortium Member), in case of failure of the _____ (Insert the name of the Bidding Company / Consortium Member) to provide such Contract Performance Guarantee.

[Note: Insert the following para in case of a Bidding Company opting to invest through a Project Company or a Consortium]

FURTHER RESOLVED THAT approval of the Board be and is hereby accorded to contribute such additional amount over and above the percentage limit (specified for the Lead. Member in the Consortium Agreement) to the extent becoming necessary towards the total equity share in the Project Company, obligatory on the part of the Consortium pursuant to the terms and conditions contained in the Consortium Agreement dated _____ executed by the Consortium as per the provisions of the RfP.
[Note: The following resolution no. 5 is to be provided by the Bidding Company /Lead Member and Technical Member of the Consortium only]

FURTHER RESOLVED THAT Mr. /Ms._____, be and is hereby authorized to take all the steps required to be taken by the Company for submission of Bid, including in particular, signing the Bid, making changes thereto and submitting amended Bid, all the documents related to the Bid, certified copy of this Board resolution or letter or undertakings etc., required to be submitted to MAHAGENCO as part of the Bid or such other documents as may be necessary in this regard.
Certified True Copy Signature and stamp of Company Secretary / Managing Director of Financially Evaluated Entity/ Technically Evaluated Entity/ its Parent Company /Ultimate Parent Company

Notes:

This certified true copy shall be submitted on the letterhead of the Company, signed by the Company Secretary / Managing Director of the Financially Evaluated Entity/ its Parent Company /Ultimate Parent Company.

The contents of the format may be suitably re-worded indicating the identity of the entity passing the resolution.

In case of the Board resolution being provided by a company incorporated in India, the Board resolution needs to be notarized by a notified notary. In the event the Board resolution is from a company incorporated outside India, the same needs to be duly notarized in its jurisdiction.

The paragraphs related to issue of Power of Attorney clearly mentioning the name of Attorney and Executant shall also be inserted as applicable by the Bidder. Also, the paragraphs related to affixation of Common Seal of the company along with the attestation of the same by the desired persons as per the Memorandum and Articles of Association of the company for the purpose of this bid clearly mentioning the name of these desired personsshall also be inserted as applicable by the Bidder.

This format may be modified only to the limited extent required to comply with the local regulations and laws applicable to a foreign entity submitting this resolution. For example, reference to Companies Act 1956 may be suitably modified to refer to the law applicable to the entity submitting the resolution. However, in such case, the foreign entity shall submit an unqualified opinion issued by the legal counsel of such foreign entity, stating that the Board resolutions are in compliance with the applicable laws of the respective jurisdictionsof the issuing company and the authorizations granted therein are true and valid.

Annexure – 12 :- Format for Bid Security against Bid

FORMAT OF THE UNCONDITIONAL AND IRREVOCABLE BANK GUARANTEE FOR BID SECURITY

(To be on non-judicial stamp paper of Rs. 500/- as per Stamp Act relevant to place of execution. Foreign entities submitting Bids are required to follow the applicable law in their country.)

In consideration of the ..... (Insert name of the Bidder) submitting the Bid inter alia for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra. (as per Annexure 19 of RfP)

In response to the RfP dated XXXXXX issued by Maharashtra State Power Generation Company Limited(hereinafter referred to as MAHAGENCO) and such MAHAGENCO agreeing to consider the Bid of..... [Insert the name of the Bidder] as per the terms of the RFP, the …… (Insert name and address of the bank issuing the Bid Security, and address of the head office) (here in after referred to as "Guarantor Bank") hereby agrees unequivocally, irrevocably and unconditionally to pay to MAHAGENCO at Mumbai (Maharashtra)forthwith on demand in writing from MAHAGENCO or any representative authorized by it in this behalf an amount not exceeding Rupees …… (Rs…….…….) only [Insert amount not less than **Rs. 10 Lac or Rupees T e n Lakh only**], on behalf of M/s.....[Insert name of the Bidder].

This guarantee shall be valid and binding on the Guarantor Bank up to and including XXXXX (Date of validity of Bid Security in accordance with Clause of this RFP) and shall not be terminable by notice or any change in the constitution of the Guarantor Bank or byany other reasons whatsoever and our liability hereunder shall not be impaired or discharged by any extension of time or variations or alternations made, given, or agreed with or without our knowledge or consent, by or between concerned parties.

Our liability under this Guarantee is restricted to Rupees …….. (Rs…….) only. Our Guarantee shall remain in force until XXXXX or its authorized representative shall be entitled to invoke this Guarantee until XXXXX.

The Guarantor Bank hereby expressly agrees that it shall not require any proof in addition to the written demand from MAHAGENCO or its authorized representative, made in any format, raised at the above mentioned address of the Guarantor Bank, in order to make the said payment to MAHAGENCO or its authorized representative.

The Guarantor Bank shall make payment hereunder on first demand without restriction or conditions and notwithstanding any objection, disputes, or disparities raised by the Bidder or any other person. The Guarantor Bank shall not require MAHAGENCO or its authorized representative to justify the invocation of this BANK GUARANTEE, nor shall the Guarantor Bank have any recourse against MAHAGENCO or its authorized representativein respect of any payment made hereunder.

This BANK GUARANTEE shall be interpreted in accordance with the laws of India and the courts at Mumbai (Maharashtra) shall have exclusive jurisdiction. This BANK GUARANTEE is payable in currency of India and payable at Mumbai.

The Guarantor Bank represents that this BANK GUARANTEE has been established in such form and with such content that it is fully enforceable in accordance with its terms as against the Guarantor Bank in the manner provided herein.

This BANK GUARANTEE shall not be affected in any manner by reason of merger, amalgamation, restructuring, liquidation, winding up, dissolution or any other change in the constitution of the Guarantor Bank.

This BANK GUARANTEE shall be a primary obligation of the Guarantor Bank and accordingly, MAHAGENCO or its authorized representative shall not be obliged before enforcing this BANK GUARANTEE to take any action in any court or arbitral proceedings against the Bidder, to make any claim against or any demand on the Bidder or to give any notice to the Bidder to enforce any security held by MAHAGENCO or its authorized representative or to exercise, levy or enforce any distress, diligence or other process against the Bidder.

The Guarantor Bank acknowledges that this BANK GUARANTEE is not personal to MAHAGENCO and may be assigned, in whole or in part, (whether absolutely or by way of security) by MAHAGENCO to any entity to whom it is entitled to assign its rights and obligations under the RFP Documents.

The Guarantor Bank hereby agrees and acknowledges that MAHAGENCO shall have a right to invoke this Bank Guarantee either in part or in full, as it may deem fit.

Notwithstanding anything contained hereinabove, our liability under this Guarantee is restricted to Rs …….. (Rs .....only) and it shall remain in force until XXXXX, with an additional claim period of one hundred and eighty (180) days thereafter. We are liable to pay the guaranteed amount or any part thereof under this BANK GUARANTEE only if MAHAGENCO or its authorized representative serves upon us a written claim or demand.

In witness whereof the Bank, through its authorized officer, has set its hand and stamp on this
…….. day of …… at …….
Witness:
1. ……. Signature
Signature
Name and address. Name:
2. …….. Designation with Bank Stamp
Signature
Name and address
Attorney as per power of attorney No. ……
For:
……. [Insert Name of the Bank]
Banker's Stamp and Full Address:
Dated this …… day of …… 20…..

Note: The Stamp Paper shall be in the name of the Executing Bank

Annexure – 13 :- Format for Disclosure

Format for Disclosure

(Non-Financial Bid)

(On the Letter Head of Bidding Company / Each Member in a Bidding Consortium)

Disclosure
To:
The Chief Engineer (RE-P&P),
Maharashtra State Power Generation Company Ltd.,
HDIL Tower, A- Wing, 4 Floor
Bandra (East), Mumbai - 400051

Sub: Bidders' Disclosure for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra. (as per Annexure 19 of RfP) in response to the RfP (dated)
We hereby declare that the following companies with which we have direct or indirect relationship are also separately participating in this Bidding Process as per following details.

Sr. No.	Name of the Company	Relationship

Further we confirm that we don't have any Conflict of Interest with any other Bidder participating in this bid process.

…….

Signature of Authorized Signatory

Notes:

In case there is no such company please fill in the column "Name of the Company" as Nil and under column of Relationship as "Not Applicable".

Each entity has to provide Power of Attorney for authorization to authorized signatory and certified true copy of the Board Resolution for issue of Power of Attorney clearly specifying the name of attorney as well as the executant, affixation of common seal and names of persons attesting the common seal.

The letter of consent provided by Consortium Member(s) will be additionally signed by authorized signatory of the Lead Member.

Annexure – 14 :- Format for Certification of Relationship

Format for Certification of Relationship

(Non-Financial Bid)
(Relationship of Parent Company or Affiliate with the Bidding Company or with the Member of the Bidding Consortium, including the Lead Member.)

To,
The Chief Engineer (RE-P&P),
Maharashtra State Power Generation Company Ltd., HDIL Tower, A- Wing, 4 Floor
Bandra (East), Mumbai - 400051

Dear Sir,

Sub: Bid for Design, Engineering, Supply, Erection, Testing and Commissioning of 62MWAC Cumulative Capacity Crystalline Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at Paras Substation including 5 years' Operation & Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection on EPC basis at Village: Paras, Taluka: Balapur, Dist.- Akola, Maharashtra.(as per Annexure 19 of RfP) in response to the RfP

We hereby certify that M/s…….., M/s……. ,M/s.....are the Affiliate(s) / Parent Company of the Bidding Company/Member of the Bidding Consortium as per the definition of Affiliate/Parent Company as provided in this RFP and based on details of equity holding as on seven (7) days prior to the date of opening of price bid.

The details of equity holding of the Bidding Company/Member of the Consortium in the Affiliate/Parent Company or vice versa as on seven (7) days prior to the date of opening of price bid are given as below:

Name of Bidding Company / Member of Bidding Consortium	Name of the Affiliate of the Bidding Company / Member of the Bidding Consortium*	Name of the Parent Company of the Bidding Company / Member of Bidding Consortium	Name of the company having common control on the Affiliate and the Bidding Company / Member of Bidding Consortium

* Bidding Company / Member of Bidding Consortium to hold at least twenty six percent (26%) in such Affiliate as on seven (7) days prior to the date of opening of price bid.

…….
(Insert Name and Signature of Statutory Auditor of the Bidder or practicing Company Secretary)

Annexure – 15 :- Format of checklist for submission of Bid and declaration of undertaking

Submission of Bid requirements	Response (Yes/No)
Covering Letter as per Format Original Power of Attorney as per Format Consortium Agreement as per Format (if Bid is submitted by a Bidding Consortium) Letter of consent from Consortium Members as per Format (if Bid is submitted by a Bidding Consortium) Bidder's composition and ownership structure as per Format Details of meeting Qualification Requirement. as per Format Documentary evidence for meeting the Qualification Requirement as per Format Bidder's Undertaking as per Format Undertaking from the Financially Evaluated Entity or its Parent Company/ Ultimate Parent Company as per Format Applicable Board Resolutions as per Format Bid Security as per Format Disclosure as per Format Certificate of relationship of Parent Company or Affiliate with the Bidding Company or with the Member of the Bidding Consortium, including the Lead Member as per Format; Checklist of submission of Bid as per this Format Calculation sheets detailing computation of Net worth considered for meeting Qualifying Requirements. Last 3 financial years' unconsolidated/consolidated audited annual accounts of the Bidder/ each Member (or Financially Evaluated Entity, if different from the Bidder/ each Member) duly certified by the Statutory Auditor. **Proof of positive networth & average annual turnover of Rs. 236 cr. & above for last three years.**	

Authority letter in favour of Maharashtra State Power Generation Company Limited "MAHAGENCO" from the Bidder MAHAGENCO to seek reference from their respective bankers & others. Submission of Technical documents and certificates as given in the table below Initialing of all pages of Bid by authorized signatory. Copy of this RFP and RFP Documents duly initialed by authorized signatory.	

Sr. No.	Checklist for submissions with Technical Bid	Response (Yes/No)
	Plant Layout Drawing	
	System Design Calculation sheets	
	Module Certificates – IEC all standards as mentioned in Technical requirements of PV modules	
	PID Certificates for solar modules	
	Proof of modules manufacturer's supply of **cumulative capacity of 500 MW and above** to Solar PV projects, for consecutive last five years.	
	Performance Certificate from Owner **for 10 MW single solar power project** where manufacturer has supplied modules and project is running successfully for **last one year.**	
	Module manufacturing facility equipment and processes (QAP).	
	Typical warranty certificate for solar module.	
	Typical insurance of module performance with detailed terms and conditions	
	Proof of MMS (Module Mounting Structure) manufacturer's supply of **minimum 25 MW** grid connect ground mounted Solar PV projects	
	MMS manufacturer's facility – Address, list of equipment, instruments and other facilities	
	Proof of DC Cable manufacturer's supply of **at least 500 MW cumulative capacity** SPV projects & supply of a single 25MW solar power project.	
	DC Cable manufacturing facility equipment list, including showing in-house electron beam cross link facility	
	DC Cable TUV certificate	
	DC Cable type test report	
	SCB (String Combiner Box) manufacturer's product TUV certificate	

	Proof of SCB and SMS manufacturer having supplied to SPV grid connect projects -copies of invoices by manufacturer	
	Certificate by developer / EPC company where SMS (String Monitoring System) was supplied to one SPV grid connect project and it is working satisfactorily.	
	SMS IEC certificate	

Sr. No.	**Checklist for submissions with Technical Bid**	**Response (Yes/No)**
	Inverter manufacturer's certificate for accepting proposed container	
	Proof of Inverter supply to at least 40 MW cumulative SPV grid connect projects	
	Circuit breaker IEC certificate	
	AC cables certificates	
	SCADA scheme	
	Energy meter make, registrations with different utilities and certificates	
	Typical cable trench drawings and layout, including CPPs	
	Proof of Transformer manufacturer's total supply of 80MW grid connect SPV projects and single grid connect SPV project of minimum 10MW operational for last two years (certificate from developer / EPC company)	
	Transformer IS certificate	
	Type test for transformer	
	Surge arrestors IEC / IS certificate	
	Isolator IEC certificate	
	Switchyard conductors IEC certificate	
	Emergency response plan during O&M Period	
	Weather station equipment certificates	
	CT & VT 1000MW manufactures supply documents - invoice copies	
	Detailed QA / QC plan as per RFP.	

Bidder shall submit above documents in physical along with bid for Q.R. verification .
Signature of authorized signatory in whose name Power of Attorney as per RFP is issued:
Name and designation of authorized signatory: ……..

Place: …….. Date: ……

Declaration of Undertaking

We underscore the importance of a free, fair and competitive procurement process that precludes abusive practices. In this respect, we have neither offered nor granted directly or indirectly any inadmissible advantages to any public servant or other person nor accepted such advantages in connection with our bid, nor will we offer or grant or accept any such incentives or conditions in the present procurement process or, in the event that we are awarded the contract, in the subsequent execution of the contract. We also declare that no conflict of interest exists in the meaning of the kind described in the corresponding Guidelines.

We also undersscore the importance of adhering to environmental and social standards in the implementation of the project. We undertake to comply with applicable labour laws and the Core Labour Standards of the International Labour Organization (ILO) as well as nationaland applicable international standards of environmental protection and health and safety standards.

We will inform our staff about their respective obligations and about their obligation to fulfil this declaration of undertaking and to obey the laws of the country of @ (name of country).

We also declare that our company/all members of the consortium has/have not been included in the list of sanctions of the United Nations, nor of the EU, nor of the German Government, nor in any other list of sanctions and affirm that our company/all membersof the consortium will immediately inform the client and if this situation should occur at a later stage.

We acknowledge that, in the event that our company (or a member of the consortium) is added to a list of sanctions that is legally binding on the client, the client is entitled to exclude our company/the consortium from the procurement procedure and, if the contract is awarded to our company/the consortium, to terminate the contract immediately if the statements made in the Declaration of Undertaking were objectively false or the reason for exclusion occurs after the Declaration of Undertaking has been issued.

.... (Place)

(Date) (Name of company)

..... (Signature(s))

Annexure -16 :- Performa for Contract Performance Security

CONTRACT PERFORMANCE SECURITY
(On Rs.500/- Stamp Paper)

BANK GUARANTEE NO. DATE

PERFORMANCE FOR CONTRACT PERFORMANCE SECURITY

BANK GUARANTEE NO.....& DATE
(FOR RS.....)

ISSUE DATE :
EXPIRY DATE :
CLAIM PERIOD:

NAME &ADDRESS OF BANK :……

To,
Maharashtra State Power Generation Co. Ltd.,
'HDIL TOWER', 4th floor,
Bandra (East),
MUMBAI -400 051

Whereas M/s. ……..(hereinafter called the Contractors/Successful bidder) have entered into a contract with the Maharashtra State Power Generation Co. Ltd. (hereinafter called the MSPGCL), vide Letter of Award No…… dated…… of the MSPGCL, for …….. for……year (period) ……to …… the order value of Rs. …… (in word :.....)

1. And whereas under the terms of the said Letter of Award, the Contractor is to furnish MSPGCL with a Bank Guarantee payable at Mumbai (address of branch) for an amount of 10% (ten percent) of the contract price for the due performance of the contract and fulfillment of the terms thereof, we…….. **(NAME & ADDRESS OF BANK**) (hereinafter referred to as the bank) do hereby agreed unequivocally and unconditionally to pay at Mumbai (Address of branch) to the MSPGCL an amount not exceeding Rs. …… (in word :- ……) against any loss or damage caused to or suffered or would be caused to or suffered by the MSPGCL by reason of any breach by the said Contractor(s) of any of the terms or conditions contained in the said contract.

2. We .....bank limited, do hereby undertake to pay the amounts due and payable at Mumbai (address of branch) under this Guarantee without any demur, merely on a written demand from the MSPGCL stating that the amount claimed is due by way of loss or damage caused to or would be caused to or suffered by the MSPGCL by reason of any breach by the same Contractor(s) of any of the terms and conditions contained in the said contract or by reasonof the Contractor's failure to perform the said contract. Any such demand made on the Bankshall be conclusive as regards the amount due and payable by the Bank under this guarantee.

However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. …… (in word :.....)

3. We .....bank limited, further agree that the bank guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said contract and that it shall continue to be enforceable till all the dues of the MSPGCL under or by virtue of the said contract have been fully paid and its claims satisfied or discharged (till claim period). The MSPGCL certifies that the terms and conditions of the said contract have been fully and properly carried out by the said Contractor (s) and accordingly discharge the guarantee. Unless a demand or claim under this guarantee is made on us in writing on or before expire of the period of six months from the time upto which the guarantee continue to be enforceable. we shall be discharged from all liability under this guarantee thereafter.

4. We ..... bank limited, further agree with the MSPGCL that the MSPGCL shall have the fullest liberty, without our consent and without affecting in any manner our obligations hereunder, to vary any of the terms and conditions of the said contractor to extend time of performance by the said Contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the MSPGCL against the said contractor (s) andto forebear or enforce any of the terms and conditions relating to the said contract and we shall not be relieved from our liability by reasons of any such variation or extension being granted to the said contractor (s) or for any forbearance, act or omission on the part of the MSPGCL or any indulgence by the MSPGCL to the said contractor (s) or by any such matter of thing whatsoever which under the law relating to sureties would but for this provision have effect ofso relieving us.

Notwithstanding anything contained above.

Our liabilities under this guarantee shall not exceed Rs. …… (in word :.....)

This Bank Guarantee valid up to ……(Date) and further claim period is upto ……(date).
We are liable to pay guaranteed amount or any part thereof under this bank guarantee payableat Mumbai (address of Branch0 only and only if you (MSPGCL) serve upon us a written claim or demand on or before (date).

In witness whereof We…… Bank Limited have executed this on this the……..day of…….

Signature.

Name & designation of the Signing Authority

For:
Bankers Rubber seal and full address

Annexure -17 :- Technical Data Sheet for 62 MW_{AC} Solar Power Plant

SOLAR PHOTOVOLTAIC PLANT

1.	Capacity of proposed grid interactive plant	
2.	Type of SPV module	
3.	Rating of SPV module 1. No of Modules per MW 2. Sub Array Rating 3. No. of Sub array	
4.	PCU 1. Make & Country of Origin 2. Capacity of each PCU 3. No. of PCUs for full Capacity	
5	SCADA for diagnosing & monitoring	
6.	Schematics and layout drawings 1. SPV Array 2. Power Evacuation system	
7.	Type of Main Control Room proposed	
8.	List of equipment to be housed Inside the Building.	
9.	List of equipment to be housed Outside the building.	
10.	Area required	
11.	Annual energy generation	
12.	Module washing method	Fixed pipeline/ mobile units

MONTHLY GENERATION OUTPUT AT 62 MWAC ENERGY METER FOR THE FIRST FULL YEAR (CUMULATIVE FOR THE PLANT)

Sr. No.	Month	Daily Global Average Radiation on horizontal surface as per Meteonorm ($kWh/(m^2 x\ Day)$)	Average Ambient Temperature (^oC)	Guaranteed Generation in Million Unit (MU)
1.	January			
2.	February			
3.	March			
4.	April			
5.	May			
6.	June			

7.	July			
8	August			
9.	September			
10.	October			
11.	November			
12.	December			
		Total		

PV MODULE DATA SHEET

Bidder should furnish the following data sheet in consultation with the panel manufacturer and should also provide the authentication certificate from the Manufacturer. Use separate sheets in case more than one make is proposed.

For Solar Modules

Sr. No.	**PARAMETERS**	**VALUES**	**REMARK**
1	Manufacturer		
2	Established (year)		
3	Complete Address.		
4	Manufacturing Factory address		
5	Module Model No.		
6	Rated power at (STC) in Watts peak		
7	Type (type of technology)		
8	Last year MW sell of the modules of above model		
9	Annual Manufacturing capacity of the above model in MW.	MW	
10	Annual Booked capacity of the above model in MW.	MW	
11	Total Capacity supplied to the Bidder	MW	
Physical parameters of module			
12	Length in inches.		
13	Width in inches.		
14	Depth in inches.		
15	Module Area in m^2		

16	Rough module area m^2		
17	Sensitive area (Cells) m^2		
18	Cell size in inches		
19	Total number of Cells in module		
20	Cells in series		
21	Cells in parallel		
22	Cells in series per bypass diode		
23	Number of bypass diodes		
24	Weight in Kg.		
25	Module frame material		
26	Weather module frame is anodized?		
27	Type of Glass used in module		
28	Any Additional feature please attach details		
Electrical Parameters			
29	Rated Power Tolerance (%)		
30	Rated Power per Square Foot(watts) of module		
31	Module Efficiency (%)		
32	Series Fuse Rating (amps)		
33	Connector Type		
34	Maximum Power Point Voltage (Vmpp)		
35	Maximum Power Point Current (Impp)		
36	Open-Circuit Voltage (Voc)		
37	Short Circuit Current (Isc)		
38	Maximum Power Temperature Coefficient (% per degree C)		
39	Open-Circuit Voltage Temperature Coefficient (mV per degree C)		
40	Short-Circuit Current Temperature		

	Coefficient (mA per degree C)		
41	Fill factor		
Commercial			
42	Materials Warranty (years)		
43	Standard degradation per year		
44	Power Warranty (years)		
45	Are panel insured ? (please furnish details)		

(Attach following curves)

a. V-I curve for incident irrad. For 200W/m^2,400 W/m^2, 600W/m^2, 800W/m^2, 1000W/m^2 at STC.

b. V-I curve for incident irrad. For 200W/m^2,400 W/m^2, 600W/m^2, 800W/m^2, 1000W/m^2 at 6 º C

c. V-I curve for incident irrad. For 200W/m^2,400 W/m^2, 600W/m^2, 800W/m^2, 1000W/m^2 at 45º C

d. V-I curve for incident irrad. For 200W/m^2,400 W/m^2, 600W/m^2, 800W/m^2, 1000W/m^2 at 37 º C.

e. Temperature Vs Power at incident irrad. For 200W/m^2,400 W/m^2, 600W/m^2, 800W/m^2, 1000W/m^2.

f. Efficiency Vs Temperature at incident irrad. For 200W/m^2,400 W/m^2, 600W/m^2, 800W/m^2, 1000W/m^2.

MODULE MOUNTING STRUCTURE

1.	Type	Fixed / Seasonal / Tracking system
2.	Overall Dimensions Design	
3.	Coating Dip (galvanization)	
4.	Wind rating (Max. design Wind speed)	
5.	Tilt angles	
6.	Foundation type	
7.	Number of Module per structure	
8.	Fixing type	
9.	Name and address of the Manufacturer	
10.	Total MW capacity of the grid connect SPV projects where the manufacturer has supplied MMS	

TECHNICAL DATA OF PCU

Bidder should furnish the following data sheet in consultation with the PCU manufacture should provide the authentication certificate from the Manufacturer.

Sr. No.	PARAMETERS		VALUES	REMARK
1	Manufacturer			
2	Established			
3	Address.			
4	Manufacturing Factory add.			
5	Model and nominal AC capacity			
6	Type (Central/ String)			
7	Last two years MW sale	MW		
8	Annual Manufacturing capacity	MW		
9	Annual Booked capacity in MW.	MW		
10	Total Capacity supplied to the	MW		
11	Name and address of the project of minimum 2MW useful for eligibility criterion			
Physical parameters of PCU				
12	Width	mm		
13	Height	mm		
14	Depth	mm		
15	Weight	kg		
	INPUT			
16	Operating mode			
17	Minimum MPP voltage	V		
18	Maximum MPP Voltage	V		
19	Absolute Max. PV Voltage,	V		
20	Nominal PV Power Pnom	kw		
21	Min Voltage for PNom	V		
22	Maximum PV current Imax	A		
23	Power Threshold	w		
24	DC voltage range MPPT	Upc		
25	Max permissible DC voltage	Upc		
26	Max permissible DC current	lpC		
27	Behaviour at Pnom			
28	Whether MPPT confirms to			
	Output Data			
29	Grid Voltage	V		
30	Grid frequency	Hz		
31	Maximum Efficiency	%		
32	European average efficiency	%		
33	Number of Phases			

34	Nominal Ac power	kW		
35	Maximum AC power	kW		
36	Maximum AC current	a		
37	Standby loss (no load loss)	%		
38	Sleep Mode Loss	%		
39	Operating voltage grid -20%	Uac		
40	Utility type			
41	Operating frequency grid	fac		
42	Voltage ripple PV voltage	Upp		
43	Phase shift	Cos		
44	Efficiency at 25%, 50%,	%		
45	Earthing of Inverter:			
46	Parameters on display panel			
47	Total Harmonic Distortion	%		
48	Other Standards			
49	Array isolation Monitoring			
50	Internal DC switch			
51	Internal AC switch			
52	Output voltage disconnect			
53	Enclosure Protection (IP24,			
54	Control (LCD or Any)			
55	Technology (TL, IGBT or			
56	Digital inputs & outputs			
57	Monitoring by ethernet,			
58	Remote & local supervision			
59	VAR Control range			
60	Anti-islanding protection			
61	Fault ride through protection			
62	Insulation monitoring of PV			
63	Ground fault detector			
64	Conformity and certification			
65	Warranty (years)			
66	Are PCUs insured?			
Attach following curves: Efficiency profile Vs input power Pout AC Vs Pin DC Efficiency Vs Pout Any Additional feature? (attach details)				

STRING MONITORING SYSTEM:

Bidder should furnish the following data sheet in consultation with the String Monitor System manufacture should provide the authentication certificate from the Manufacturer.

SR. NO.	PARAMETERS	VALUES
1.	Manufacturer	
2.	Corporate office Address.	
3.	Model	

4.	Type (Central/ String)	
5.	Details of 10MW of the grid connect SPV projects & date of commissioning where system is working.	
6.	Annual Manufacturing capacity of the above model in MW.	
7.	Annual Booked capacity of the above model in MW.	
8.	Total Capacity supplied to the Bidder in MW	
9.	Ambient temperature of outside air in summer	
10.	Humidity	
11.	DC System Voltage	
12.	On Load DC Voltage :	
13	IP protection	
14	Enclosure type & material	
15	No of Inputs	
16	Current Rating;	
17	Input Cable compatibility (specifications of cable)	
18	Fuse provision & Max fuse size	
19	Accuracy in %	
20	Max. PV short-circuit current per string	
21	Max. number of strings	
22	Fused inputs per measuring channel	
23	No. of Surge Protection devices	
24	Surge arrestors type specifications	
25	PV array configuration	
26	Number of measuring channels	
27	DC short-circuit current	
28	Output voltage	
29	Solar Connectors type specifications	
30	Output Cable compatibility & specifications	
31	DC Disconnector switch type & mode of operation	
32	Earthing mode & type	
33	Monitoring Device type & description	
34	Applicable IEC for Monitoring Device	

35	Max. operating output current	
36	Max. number of cables per output port	
37	Communication protocol	
38	Dimensions: W x H x D in mm	
39	Weight in kg.	
40	Warranty (years)	
41	Are insured? (please furnish details)	
	Credentials	
42	Year established	
43	Manufacturing facility address	
44	Capacity in MW of solar projects to whom the above mentioned String Combiner Box & Monitoring system is supplied till date	
45	Applicable IEC certificates	

TRANSFORMER

Sr. No.	DESCRIPTION	Inveretr Transformer	Power Transformer
1.	Service		
2.	Make		
3.	Rating		
4.	Rated frequency		
5.	No. of Phase HV Side LV Side Neutral		
6.	Rated Voltage HV winding kV LV winding kV		
7.	Vector group		
8.	Type of cooling		
9.	Tapping Range No. of steps In steps of		
10.	Tap changer type		
11.	% Impedance (+10% Tolerance as per IS)		
12.	Temperature rise above Ambient of 50Deg. C Oil Deg. C Winding Deg. C		
13.	Terminal Details HV Side LV Side		
14.	Insulation level a) Impulse withstand voltage i) HV kV peak b) Power frequency withstand voltage for oneminute (dry) ii) HV neutral kV rms iii) LV neutral		
15	Minimum specific creepage Distance (mm/kV)		
16	Winding conductor material HV LV		

17	Losses (at 75° Deg. C and principal Tapping) a) No load loss at rated Voltage and Frequency kW b) Load loss at rated Current(ONAN) kW Total loss at maximum Rated power kW		
18	Efficiency at 75° C and 0.9 PF at full load (ONAN) % at 75% load(ONAN) % at 50% load (ONAN) %		
19	Hot spot temp. in winding limited to C		
20	Overall dimensions (L x B x H) (mm)		
21	Shipping dimensions a).Height m b). Breadth m c). Length m		
22	Weight kg Core Core & windings Tank & Fittings Oil weight Overall weight		
23	Painting		
24	Maximum flux density		
25	Quantity of oil (liters)		
26	Details of Instruments and protection provided with the transformer (Make &Type)		
27	150% voltage withstand capacity in time/cycle		
28	Name and address of the manufacturer		
29	Total MW of grid connect SPV projects where the manufacturer has supplied		
30	Name and address of the project of minimum 10MW useful for eligibility criteria on		

***33kV Indoor VCB panel**

GURANTEED TECHNICAL PARTICULARS

1.	**General :**	
	Name of the Company	
	Office address	
	Factory address	
	Fax No.	
	Telephone No.	
2.	**Panel**	
	Type & Designation	
	Application Standard	
	Rated Voltage (KV)	
	Highest Voltage (KV)	
	Normal Current (Amps.)	
	Frequency (Hz)	
	STC for 3 Sec. (KA/ 3 Sec)	
	Breaking Capacity (KA)	
	Making Capacity (KAp)	
	Power frequency withstand voltage (KV rms)	
	Impulse withstand voltage (KVp)	
	Degree of protection	

	Material of enclosure			
	Sheet thickness of load bearing members			
	Sheet thickness of doors & covers			
	Position of Mechanical & Electrical Emergency Trip Arrangement			
	Power cable termination height			
	Position of Power Cable Entry			
	Position of Control Cable Entry			
	Separate Bus Section Panel at the side of Bus Coupler			
	Separate Panel for both Bus PT as per Drawing			
	Degree of protection of HV compartment			
	Degree of protection of LV compartment			
	Dimension in mm (H x W x D)	Height	Width	Depth
3.	**Bus Bar**			
	Material			
	Shape			
	Size			
	a) Main Bus			
	b) Earth Bus			
	Cross sectional area (Sq. mm)			
	Type of plating			
	Normal Current currying capacity (Amps)			
	STC for 3 Sec. (KA/3 Sec)			
	Temp. Rise over ambient at normal current			

	Current density (Amps/ sq. mm)	
	Phase to Phase clearance (mm)	
	Phase to ground clearance (mm)	
	Type of insulation	
4.	**Bus support insulator**	
	Material	
	Dry Power frequency Withstand Voltage for one minute	
	Wet Power frequency Withstand Voltage for one minute	
	Impulse Withstand voltage	
	Creepage distance	

5.	**Vacuum Circuit Breaker**	
	Make	
	Type	
	Reference Standard	
	Arc quenching medium	
	Number of break per phase	
	Rated voltage	
	Highest voltage	
	Frequency	
	Normal Current	
	Breaking capacity	
	Making capacity	
	STC for 3 Sec.	
	Insulation level	

	Temp. Rise over ambient at normal current	
	Operating duty cycle	
	Single Phase Capacitor Breaking capacity	
	Three Phase Capacitor Breaking capacity	
	Line Charging Breaking capacity	
	Cable Charging Breaking capacity	
	Minimum phase to phase clearance	
	Minimum phase to ground clearance	
	Type of operating mechanism	
	Closing time	
	Opening time	
	Mechanical Endurance capacity	
	Electrical Endurance capacity	
	Operating mechanism	
	Type of isolation	
	Details of mechanical interlock provided	
	Interchangeability between I/C, Feeder & B/C (Yes/No)	
	No. contacts in Aux. Switch (NO &NC)	
	No. contacts in Limit Switch (NO &NC)	
6.	**Vacuum Bottle**	
	Make	
	Rated voltage	
	Type and model no.	
	Normal current	
	Breaking capacity	

	Making capacity	
	STC for 3 Sec.	
	Maximum contact separation length	
	Minimum Mechanical life in no. of operation	
	Minimum Electrical Life in no. of operation at rated normal current	
	Minimum Electrical Life in no. of operation at rated full short circuit current	
	Power frequency withstand voltage (dry)	
	Impulse withstand voltage	
	Contact material	
	Type of plating	
	Contact pressure	
7.	**Current Transformer**	
	Make	
	Reference Standard	
	Type	
	Rated voltage	
	Rated frequency	
	Insulation level	
	Continuous over load in %	
	Class of insulation	
	Ratio	Incomer : Transformer: Outgoing :
	Class of accuracy	Incomer : Transformer: Outgoing :
	Burden	Incomer : Transformer : Outgoing :
	STC for 1 Sec.	

	ALF of Protection core	
	ISF of Metering Core at lower ratio	
	Core identification	
8.	**Potential Transformer**	
	Make	
	Reference Standard	
	Whether withdrawable Type (Yes/No)	
	Insulation level	
	Type of insulation	
	Winding connection	
	Rated voltage	
	Class of insulation	
	Ratio	
	Class of accuracy	
	Burden per Phase	
	Core identification	
	Over Voltage Factor	
	Installation Position	
	Primary Fuse rating	
9.	**Terminal connector**	
	Make	
	Type	
	Size	

10.	**Trip & Close coils**	
	Voltage & Wattage of Closing coil	

	Voltage & Wattage of Tripping coil			
11	**Control wire**			
	Make			
	Voltage Grade			
	Size			
	i) CT Circuit			
	ii) PT Circuit			
	iii) Other Circuit			
	Colour			
12.	**Earth Bus**			
	Material			
	Shape			
	Size			
	Current rating			
	Current density			
	Type of plating			
13.	Adaptor cable box arrangement for 33 KV Power Cable to Station Service Transformer.			
14.	Painting Details			
	Surface cleaning process			
	Paint thickness			
	Paint shed			
15.	**Shipping dimension of equipment (mm)**	Height	Width	Depth
16.	**Lifting Hooks provided (Yes/No)**			
17.	**Accessories**			
	Spring Charging Handle (no.)			
	VCB Operating Handle (no.)			
18.	Guarantee of the complete equipment (in years)			

*Only to be submitted by the bidder if indoor VCB panel is used.

DC CABLES			
Name of the vendor:			
Cable Description : XC x XX **mm²** Annealed Tinned flexible Copper Conductor, EBXL XLPO **120**°C Insulated & Sheathed Solar Cable			
	Parameters	**Unit**	**Values**
1.0	Cable Size	Sq.mm	
2 0	No. of Cores	Nos.	
3.0	Specification		
4.0	Voltage Rating	kV	
5.0	**CONDUCTOR**		
5.1	Material		
5.2	Cross sectional Area	Sq.mm	
5.3	Type of Conductor		
5.4	Wire Dia. – Max	mm	
5.5	Max DC Conductor Resistance at 20°C	07km	
6.0	**INSULATION**		
6.1	Material		
6.2	Nominal Thickness of Insulation	mm	
6.3	Insulation Resistance (Min)	Q Cm	
6.4	Insulation Color		
7.0	**OUTER SHEATH**		
7.1	Material		
7.2	Nom. Thickness of Outer Sheath	mm	
7.3	Nominal Overall Diameter of Cable	mm	
7.4	Approx. Cable Weight	Kg/ Km	
7.5	Marking on the Cable		
8.0	**ELECTRICAL DATA**		
8.1	Current Rating - Single cable free in air	Amps	
8.2	Max. Continuous Working Temp	°C	
8.3	Max. conductor temp at termination of short circuit	°C	
9.0	Weathering / UV resistance		
9 1	Test under fire conditions		
9.2	Halogen constant		
10. 0	Packing Length	Mtr	
10. 1	Type of Packing		
10. 2	Warranty		
10. 3	Rodent resistivity		
Credentials			
1	Year established		
2	Manufacturing facility address		
3	Up till Capacity in MW of solar project to whom the above mentioned PV DC cable is supplied.		
4	Do you have in house Electron beam cross linking facility?		

5	Do you have IEC certification ?	
Documents required		
Documents regarding the supply of cables to 150MW capacity projects. (reference list along with invoices)		
IEC certificates		
Documents regarding the in-house electron beam cross linking facility		

DC CABLES (String Combiner Box To Inverter)

Name of the vendor:			
Cable Description: XC x XX mm2 Annealed tinned flexible aluminum conductor EBXL, XLP			
Sr. No	Parameters	Unit	Values
1.0	Cable Size	Sq.mm	
2 0	No. of Cores	Nos.	
3.0	Specification		
4.0	Voltage Rating	kV	
5.0	CONDUCTOR		
5.1	Material		
5.2	Cross sectional Area	Sq.mm	
5.3	Type of Conductor		
5.4	Wire Dia. – Max	mm	
5.5	Max DC Conductor Resistance at 20°C	07km	
6.0	INSULATION		
6.1	Material		
6.2	Nominal Thickness of Insulation	mm	
6.3	Insulation Resistance (Min)	Q Cm	
6.4	Insulation Colour		
7.0	OUTER SHEATH		
7.1	Material		
7.2	Nom. Thickness of Outer Sheath	mm	
7.3	Nominal Overall Diameter of Cable	mm	
7.4	Approx Cable Weiqht	Kg/Km	
7.5	Marking on the Cable		
8.0	ELECTRICAL DATA		
8.1	Current Rating - Single cable free in air	Amps	
8.2	Max. Continuous Working Temp	°C	
8.3	Max. conductor temp at termination of short circuit	°C	
9.0	Weathering / UV resistance		
9 1	Test under fire conditions		
9.2	Halogen constant		
10.0	Packing Length	Mtr	
10.1	Type of Packing		
10.2	Warranty		
10.3	Rodent resistivity		

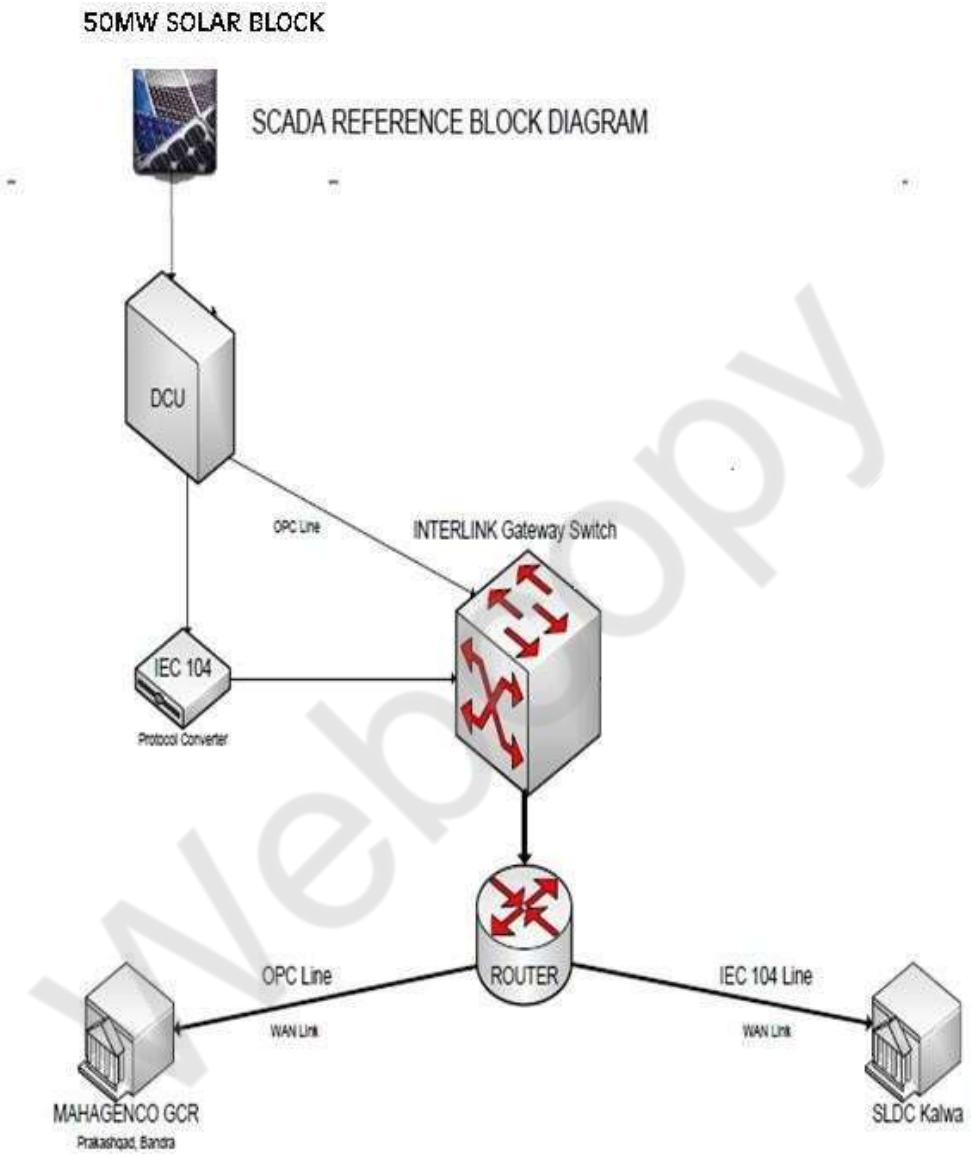
	Credentials		
1	Year established		
2	Manufacturing facility address		
3	Up till Capacity in MW of solar project		
4	Do you have in house Electron beam		
5	Do you have IEC certification?		
	Documents required		
1.	Documents regarding the supply of		
2.	IEC certificates		
3.	Documents regarding the in-house		

AC Cables:

Name of the vendor:			
Cable Description: 1500 V AC, PVC insulated confirming IEC 60189/ IS 1554 & IEC 60502-1 with Aluminum conductor according to IEC 60228. AC cables of size 4mm^2 and below shall be electrolyte tinned copper conductor type confirming the relevant IS/IEC.			
S. No	Parameters	Unit	Values
1.0	Cable Size	Sq.mm	
2 0	No. of Cores	Nos.	
3.0	Specification		
4.0	Voltage Rating	kV	
5.0	CONDUCTOR		
5.1	Material		
5.2	Cross sectional Area	Sq.mm	
5.3	Type of Conductor		
5.4	Wire Dia. – Max	mm	
5.5	Max DC Conductor Resistance at 20°C		
6.0	INSULATION		
6.1	Material		
6.2	Nominal Thickness of Insulation	mm	
6.3	Insulation Resistance (Min)	Q Cm	
6.4	Insulation Colour		
7.0	OUTER SHEATH		
7.1	Material		
7.2	Nom. Thickness of Outer Sheath	mm	
7.3	Nominal Overall Diameter of Cable	mm	
7.4	Approx. Cable Weight	Kg/Km	
7.5	Marking on the Cable		
8.0	ELECTRICAL DATA		
8.1	Current Rating - Single cable free in	Amps	
8.2	Max. Continuous Working Temp	°C	
8.3	Max. conductor temp at termination of short circuit	°C	
9.0	Weathering / UV resistance		
9 1	Test under fire conditions		
9.2	Halogen constant		
10.0	Packing Length	Mtr	
10.1	Type of Packing		

10.2	Warranty		
10.3	Rodent resistivity		
	Credentials		
1	Year established		
2	Manufacturing facility address		
3	Up till Capacity in MW of solar project		
4	Do you have in house Electron beam		
5	Do you have IEC certification?		
	Documents required		
1.	Documents regarding the supply of cables to 250MW capacity projects. (reference list along with invoices)		
2.	IEC certificates		
3.	Documents regarding the in-house electron beam cross linking facility		

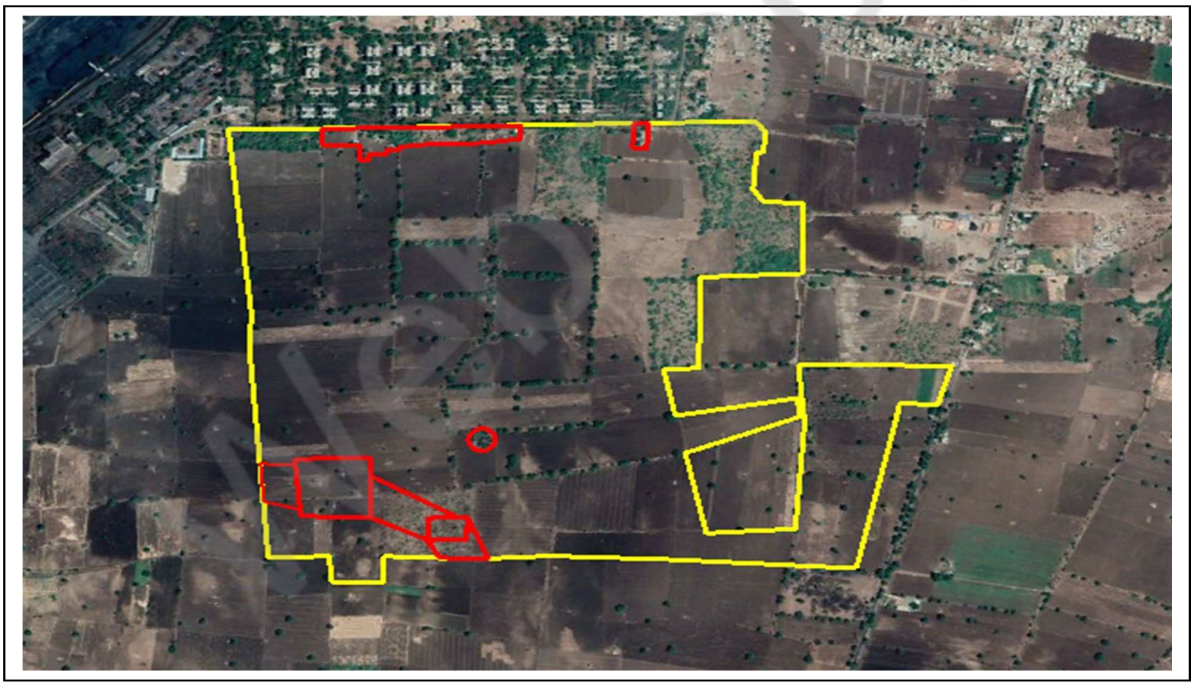
Annexure- 18 :- Typical SCADA network diagram
(For reference, only)



Annexure- 19 :- Proposed Location and Capacity

A) Ground Mounted Solar - 62 MW (AC) Site Location

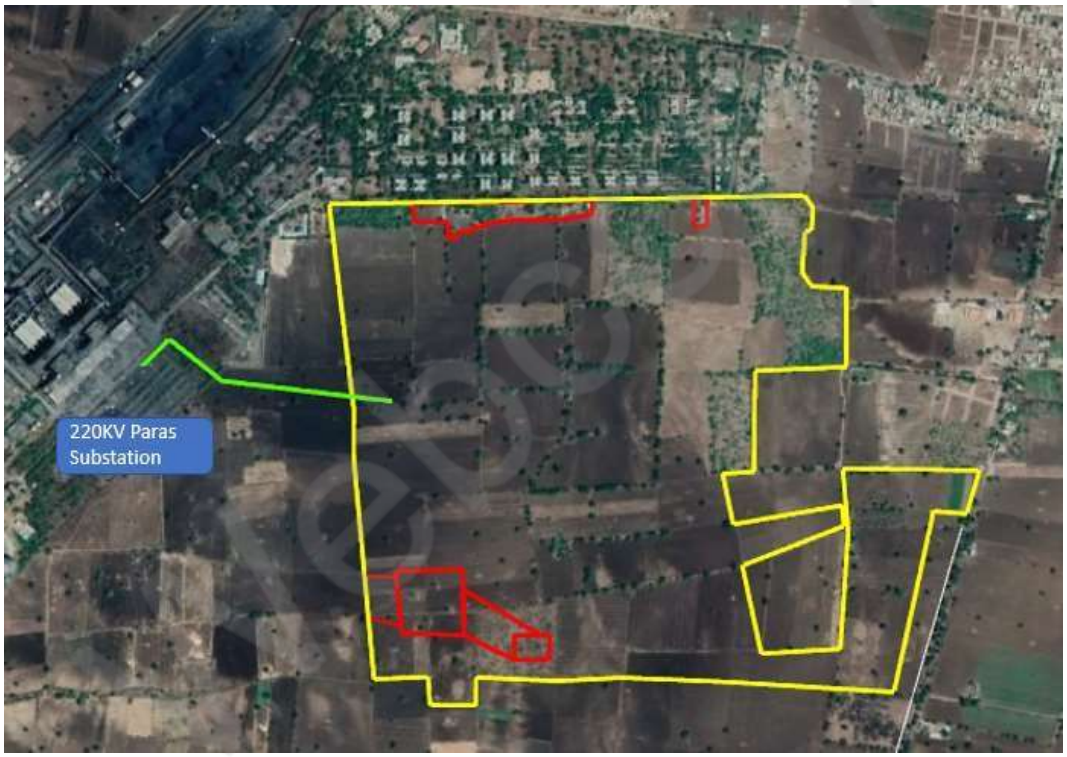
Sr. No.	Particulars	Details
1	Name of Land Parcel	Paras Thermal Plant
2	Latitude and Longitude	Latitude:20.71 Longitude: 76.80
3	Area Available	110.92 Hectares
4	Net Area	103 Hectares
5	Location	Village: Paras, Taluka: Balapur, District: Akola
6	Solar Capacity Proposed	62 MW (AC)



Satellite view of Proposed Site Location (indicative)

B) Evacuation Substation Details:

General Details		
Sr. No.	**Particulars**	**Details**
1	Name of the Substation	220/33 kV Paras Substation
2	Latitude and Longitude	Latitude:20.71; Longitude: 76.79
3	Taluka	Balapur
4	District	Akola
5	State	Maharashtra



Satellite view of Substation

Annexure- 20 :- List of Banks

1. SCHEDULED COMMERCIAL BANKS	2.OTHER PUBLIC SECTOR BANKS
SBI AND ASSOCIATES	IDBI Bank Ltd.
1. State Bank of India	**3.FOREIGN BANKS**
2. State Bank of Bikaner & Jaipur	1. Bank of America NA
3. State Bank of Hyderabad	2. Bank of Tokyo Mitsubishi UFJ
4. State Bank of Indore	3. BNP Paribas
5. State Bank of Mysore	4. Calyon Bank
6. State Bank of Patiala	5. Citi Bank N.A.
7. State Bank of Travancore	6. Deutsche Bank A.G
NATIONALISED BANKS	7. The HongKong and Shanghai Banking Corpn. Ltd.
1. Allahabad Bank	8. Standard Chartered Bank
2. Andhra Bank	9. Societe Generale
3. Bank of India	10. Barclays Bank
4. Bank of Maharashtra	11. Royal Bank of Scotland
5. Canara Bank	12. Bank of Nova Scotia
6. Central Bank of India	13. Development Bank of Singapore (DBS, Bank Ltd.)
7. Corporation Bank	14. Crédit Agricole Corporate and Investment Bank
8. Dena Bank	**4. SCHEDULED PRIVATE**
9. Indian Bank	1. Federal Bank Ltd.
10. Indian Overseas Bank	2. ING Vysya Bank Ltd.
11. Oriental Bank of Commerce	3. Axis Bank Ltd.
12. Punjab National Bank	4. ICICI Bank Ltd.
13. Punjab & Sind Bank	5. HDFC Bank Ltd.
14. Syndicate Bank	6. Yes Bank Ltd.
15. Union Bank of India	7. Kotak Mahindra Bank
16. United Bank of India	8. IndusInd Bank Ltd.
17. UCO Bank	9. Karur Vysya Bank
18. Vijaya Bank	
19. Bank of Baroda	

Annexure -21 :- PG Test Procedure

Part A: Requirements/Readiness before commencement of PG Test

1 SCADA

1.0 Provision for monitoring of solar radiation data from weather monitoring station & energy generation data from 62 MW_{AC} solar power plant shall be made available at OWNERS Headquarter. For this Purpose, Contractor shall install web link at OWNERS Headquarter. The remote view facility OWNERS Headquarter will be for monitoring. For PG test all the governing data will be controlled and referred at site only.

1.1 Contractor shall submit calibration details along with any correction factors if required to consider for the all interconnected Pyranometer to SCADA and shall be verified. Any changes in these factors shall not be allowed after commencement of PG Test.

1.2 For entire 62MW solar power plant capacity single Weather Monitoring System (WMS) be referred. If any correction, modifications, alterations or maintenance of SCADA required, it will be carried out in presence of OWNER representative and shall be noted separately in a logbook.

1.3 OWNER shall confirm the proper operation of SCADA before Commencement of PG Test. It is confirmed that, radiation & energy generation data is being recorded at SCADA for minimum 1 minute interval.

1.4 Calibration details of energy meters (ABT) installed at point of interconnection of 62MW solar power plant shall be made available

2 WEATHER MONITORING STATION

2.0 WMS shall be under CCTV coverage for 24hrs and recording of the same shall be made available to OWNER as and when required. WMS shall be installed with proper guarding to prevent unauthorized access and Contractor shall be solely responsible for security and safety of WMS..

2.1 Calibration of WMS at site shall be carried out as per contract specification. However Contractor shall calibrate all the installed pyranometer as per IEC standard by TUV or (an Accredited lab), at site.

2.2 Each weather monitoring station must have pyranometer installed at horizontal as well at tilted plane at an angle of solar module.

2.3 **Special Equipment, Instrumentation tools and tackles** : Contractor shall ensure availability of necessary equipment for trouble shooting at site. Equipment required:- Solar Kit (make Seaward/or equivalent for measurement of Instant Irradiance), Multimeter/Clampon meter – FLUKE/or equivalent, thermal image camera. NB:- Contractor shall submit the calibration Certificate of these equipments for Reference.

Part B: PG Test Measurements

1.0 Recording of Energy Generation:

Energy generated by 62 MW (AC) Solar Power Plant shall be recorded from energy meter (ABT) installed at the point of interconnection on monthly basis by Contractor as per prescribed format and shall be duly signed by Site-in Charge of Contractor and verified by OWNER officials or Consultant .

Refer Table 1.

Table-1

				Date		
Sr. No	ABT Meter No.	Previous reading (Net Export) (KWH)	Current ABT reading (Net Export) (KWH)	Differ (KWH)	MF	Net Energy Generation KWH (Export)
		(i)	(ii)	(iii)	(iv)	(v)=(iii)x(iv)
1					xxx	

Notes:-

- All readings shall be recorded from ABT Meters.
- Also, recording of ABT meter shall be logged & recorded with the help of data logger for verification on monthly basis.
- All readings shall be recorded at fixed time.

2.0 Recording of Radiation Data:

2.1 Solar Radiation data i.e. Irradiance in Watt/m2 at tilted plane shall be recorded at weather monitoring station as per the format attached below on daily basis by Contractor and submitted to OWNER for verification.

i. Cleaning of solar both Pyranometer radiation sensors will be carried out daily basis at least 30 minutes prior to sunrise by Contractor. While cleaning it shall be insured that the Tilt angle of Pyranometer shall not be disturbed. Before starting the PG test recording of Pyranometer positions will be noted and sealed with permanent color marking & photograph of the same shall be submitted to OWNER.

ii. Total daily solar Radiation computed with time resolution of 1minute interval.

2.2 Calculation of the Energy loss due to the Grid Failure/Outage

Solar Radiation data i.e. Irradiance in kWh/m2 at tilted plane as per below prescribed format shall be send to OWNER on Monthly basis by Contractor for verification. **Refer Table 2.**

Table-2

Sr. No.	day	Time at which the grid failure in	Time at which Value after inverter is in Sleep Mode	Total time of grid outage/ Failure in Minutess	Average Solar Radiation (Tilted Plane)- kWh/m2 at time of grid failure	Energy Loss due to the Grid failure ** In Kwh
		T1	T2	T=T2-T1	ASR	EL
1	1st					
2	2nd					
30	30th					
31	31st					
Average						

- Radiation data from the WMS shall be retrieved on every Monday at 7PM & proper sealing of data port shall be carried out data port after the reading.

- Value of cumulative solar irradiance to compute the value of Energy generation can be calculated as following.

** Energy loss will be calculated by considering the **Performance Ratio (P.R.) of previous day for the subsequent period** for the grid failure time period (T) as under:

Energy loss (EL) in (kwh) = [P.R. x Average Solar Radiation (Tilted Plane) kWh/m2 x Active area of the PV module (m2) x PV module efficiency]

i.e. EL = [P.R. x ASR x Active area of the PV module (m2) x PV module efficiency]

TABLE FOR CALCULATION OF ARRIVING IN SHORT FALL IN ENERGY

Total short fall in energy generation has been done as given in below. Refer **Table 4.**

Month	Quoted Generation Units by the Contractor (Kwh) (A)	Net Energy Generation in Kwh (Table-1 col-v) (B)	Shortfall in energy(Kwh) during the PG test (SF) = (A)-(B)
Jan			
Feb			
March			
April			
May			
June			
July			
Aug			
Sept			
Oct			
Nov			
Dec			
TOTAL			

Table-4

Shortfall in energy (MUs) during the PG test = SF- EL

"Shortfall in Generation will be levied @ applicable tariff X shortfall Generation." GST is applicable on penalty as per GST Law. If penalty is applicable, it shall be recovered from any due OR payment to the EPC Contractor.

OWNER have right to modify the PG Test protocol considering the ground realities and practical difficulties arrived during PG test. All terms and conditions of contract are also applicable along with this PG test protocol.

Annexure- 22:- Performa for Advance payment Bank Guarantee

Performa for Advance payment Bank Guarantee

(To be submitted by Bidder on a Non-Judicial Stamp Paper of Appropriate Value) Address of guarantor

bank:
……
…….
Address of beneficiary (contracting agency):
…….
……..

On ..... you concluded with ..... ("Contractor")
a contract for.....(project, object of contract) at a price
of..... In accordance with the provisions of the contract the
Contractor receives an advance payment in the amount of....., which represents
…… % of the order value.

We, the undersigned.....(Guarantor), waiving all objections and defenses
under the aforementioned contract, hereby irrevocably and independently guarantee to pay on your first
written demand any amount advanced to the Contractor up to a total of
..... (in words:
.....) against your written declaration that the
Contractor has failed to duly perform the aforementioned contract.

This guarantee shall come into force and effect as soon as the advance payment has been credited to the account of the Contractor.

In the event of any claim under this guarantee, payment shall be effected to
Canara Bank, Account No. 1903201010135. Branch Prime Corporate Branch, Fort, Mumbai Bank Code No: CNRBH 0001903,
for account of
..... (contracting agency/project-executing agency).

This guarantee shall expire no later than …….
By this date we must have received any claims for payment by letter or encoded telecommunication.

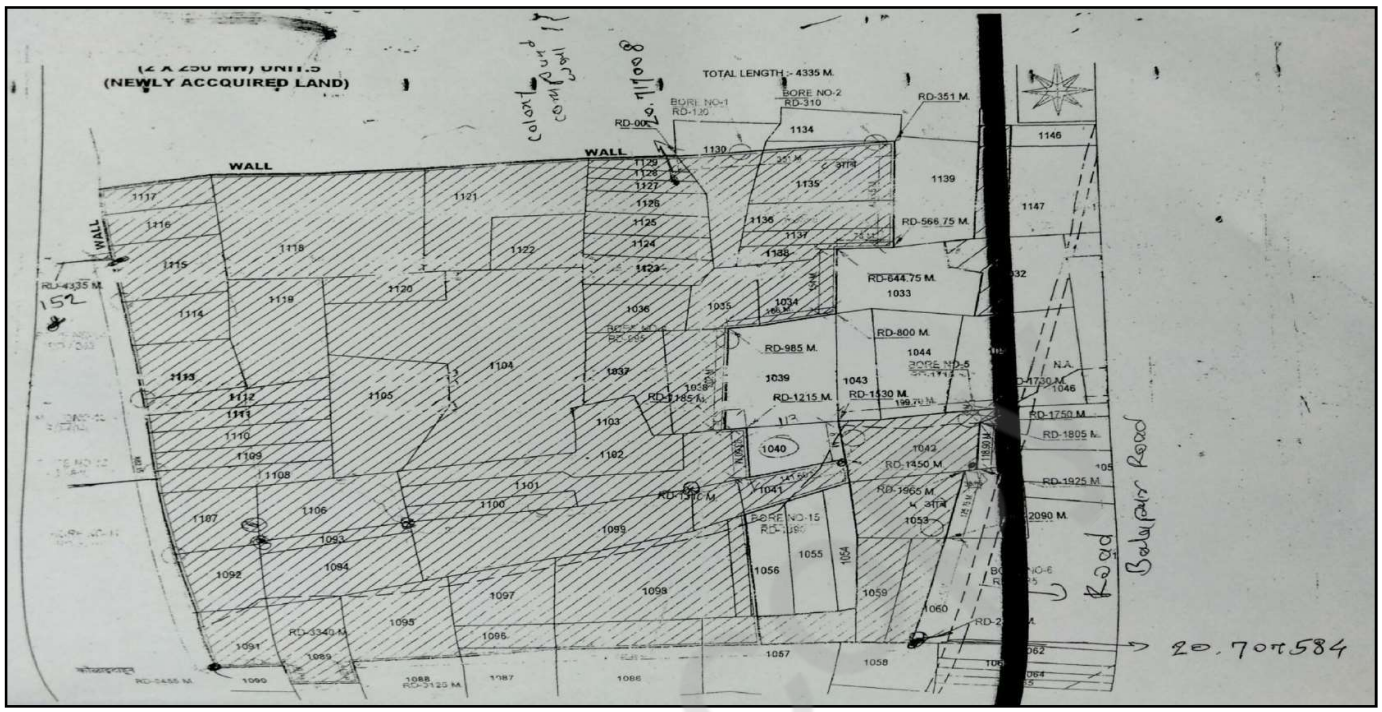
It is understood that you will return this guarantee to us on expiry or after payment of the total amount to be claimed hereunder.

This guarantee is governed by the laws of …….

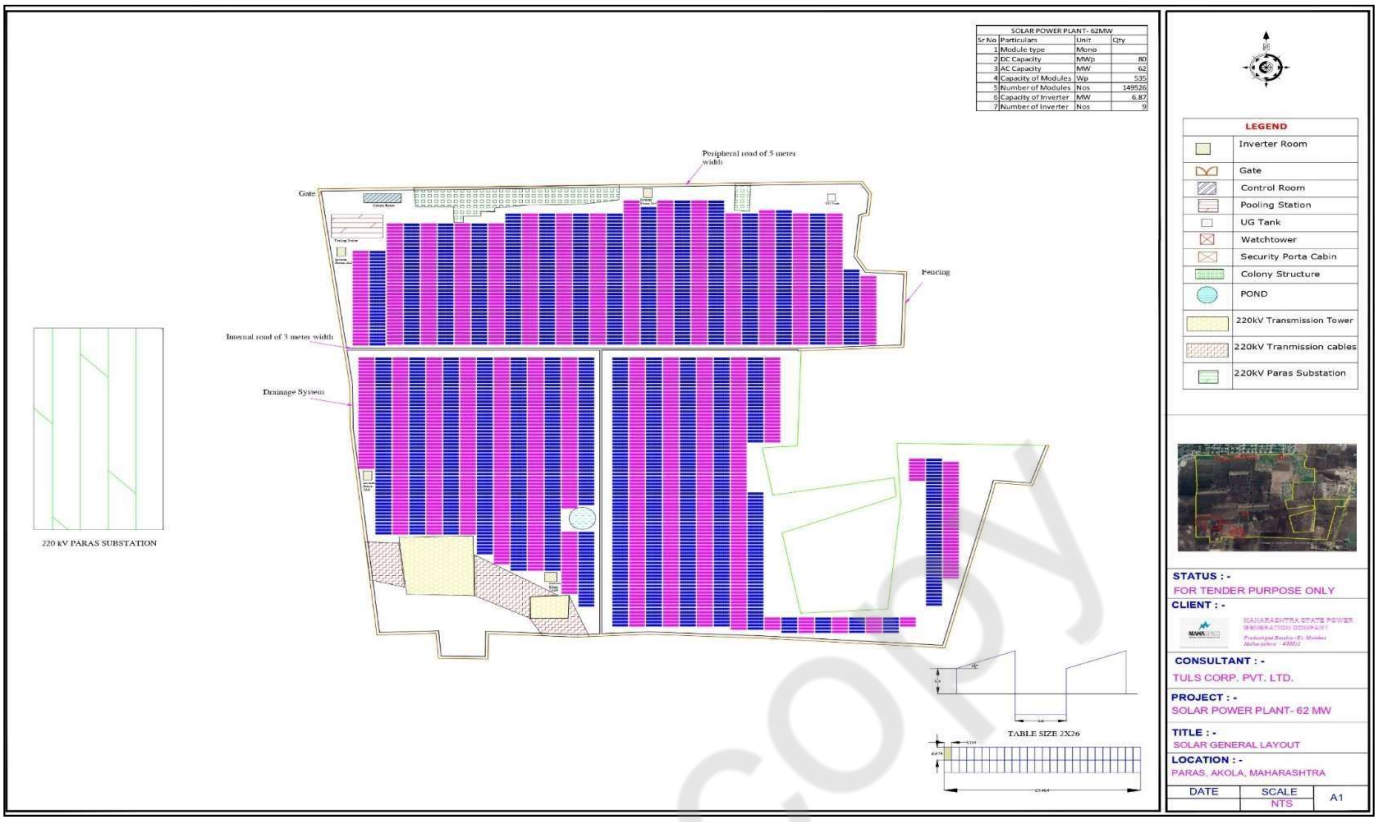
.... Place, date
Guarantor

Annexure- 23:- Tentative Drawings

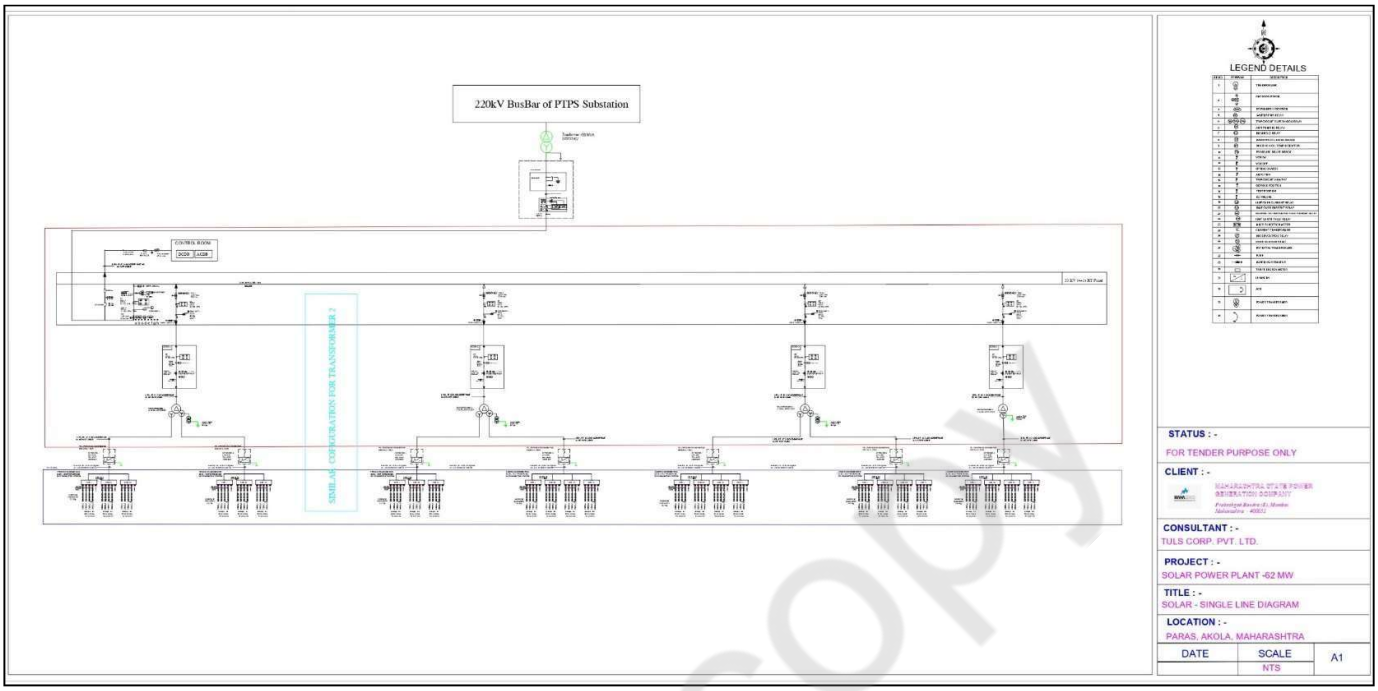
1. Land Map



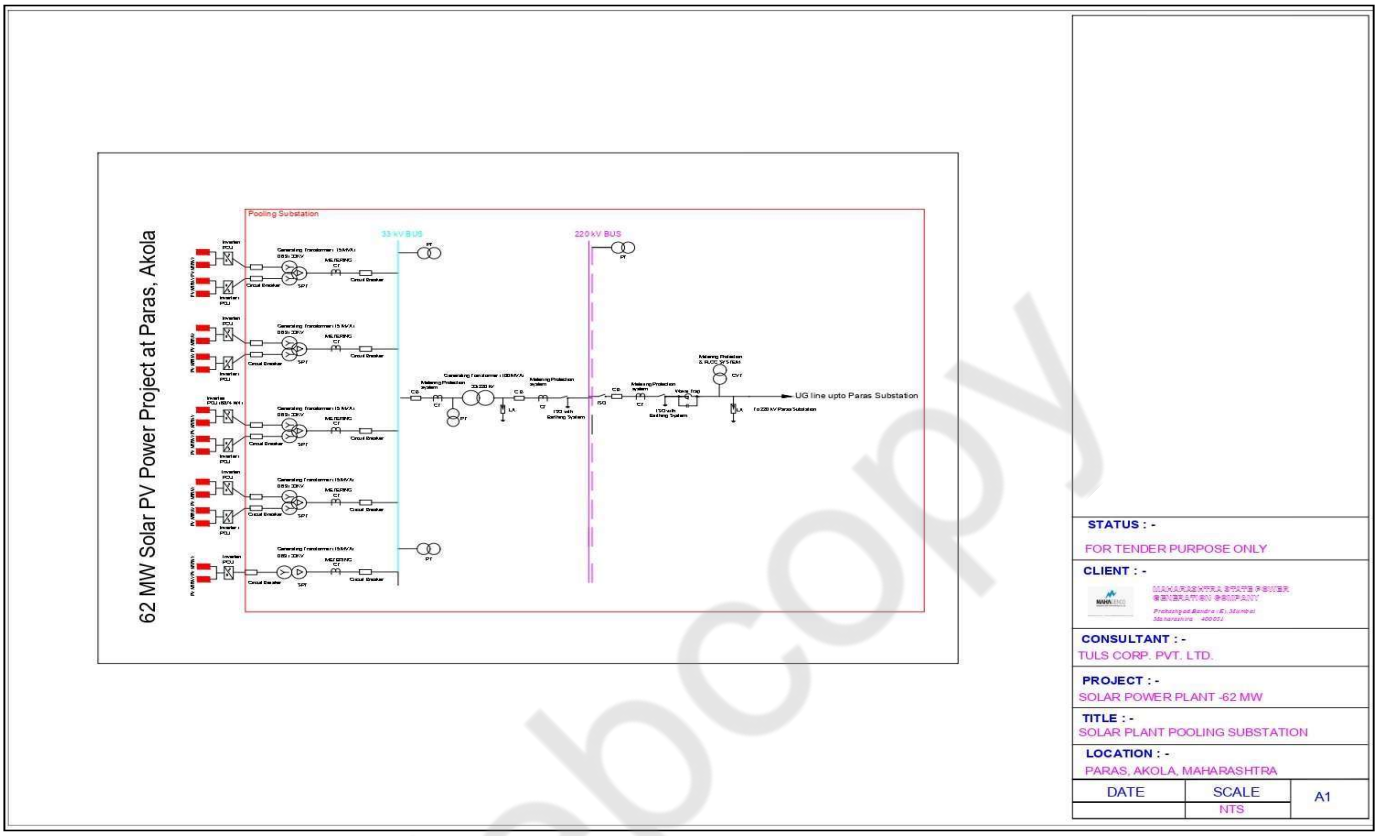
2. General Layout of Solar PV Plant



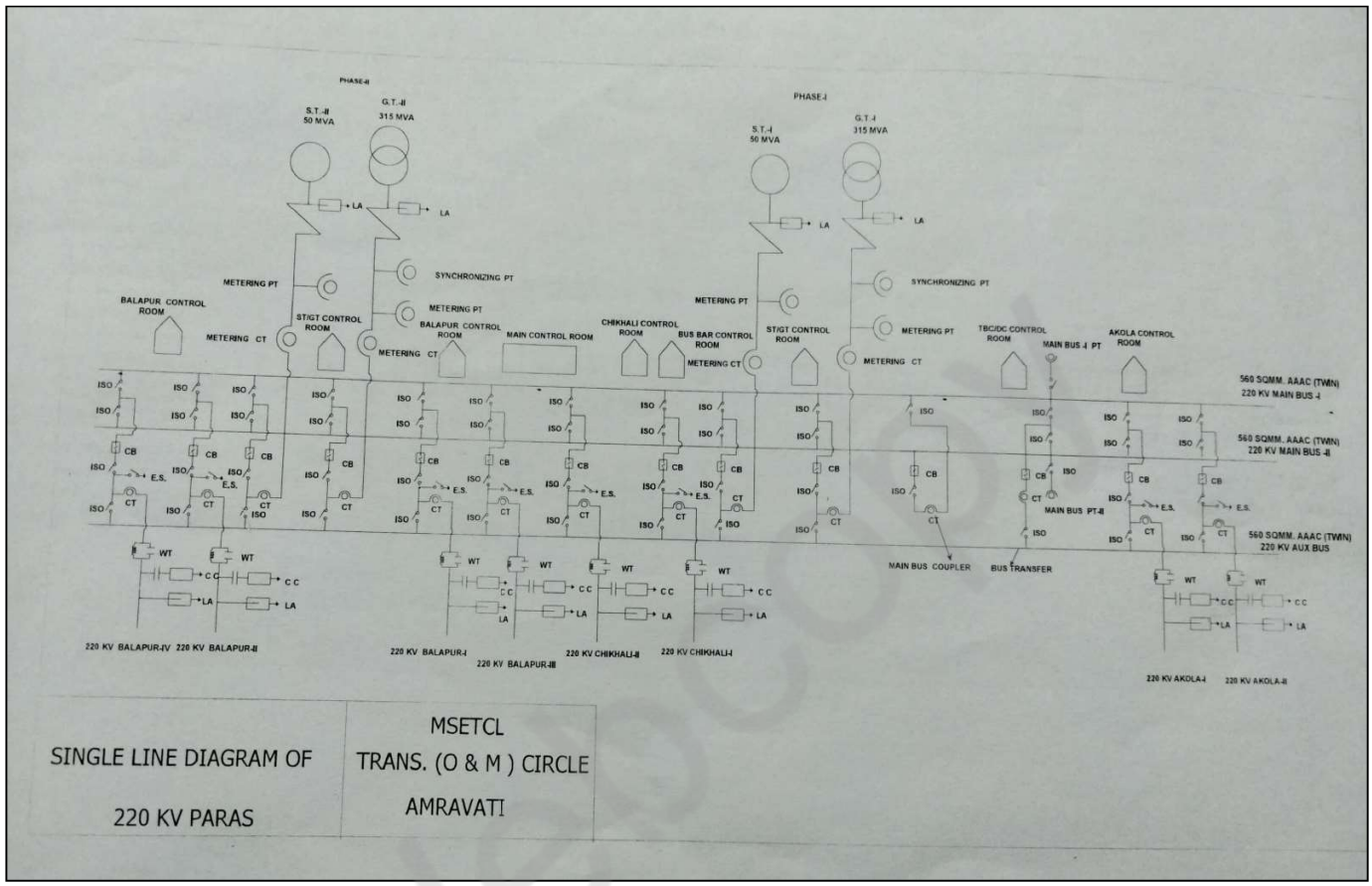
3. Single Line Diagram



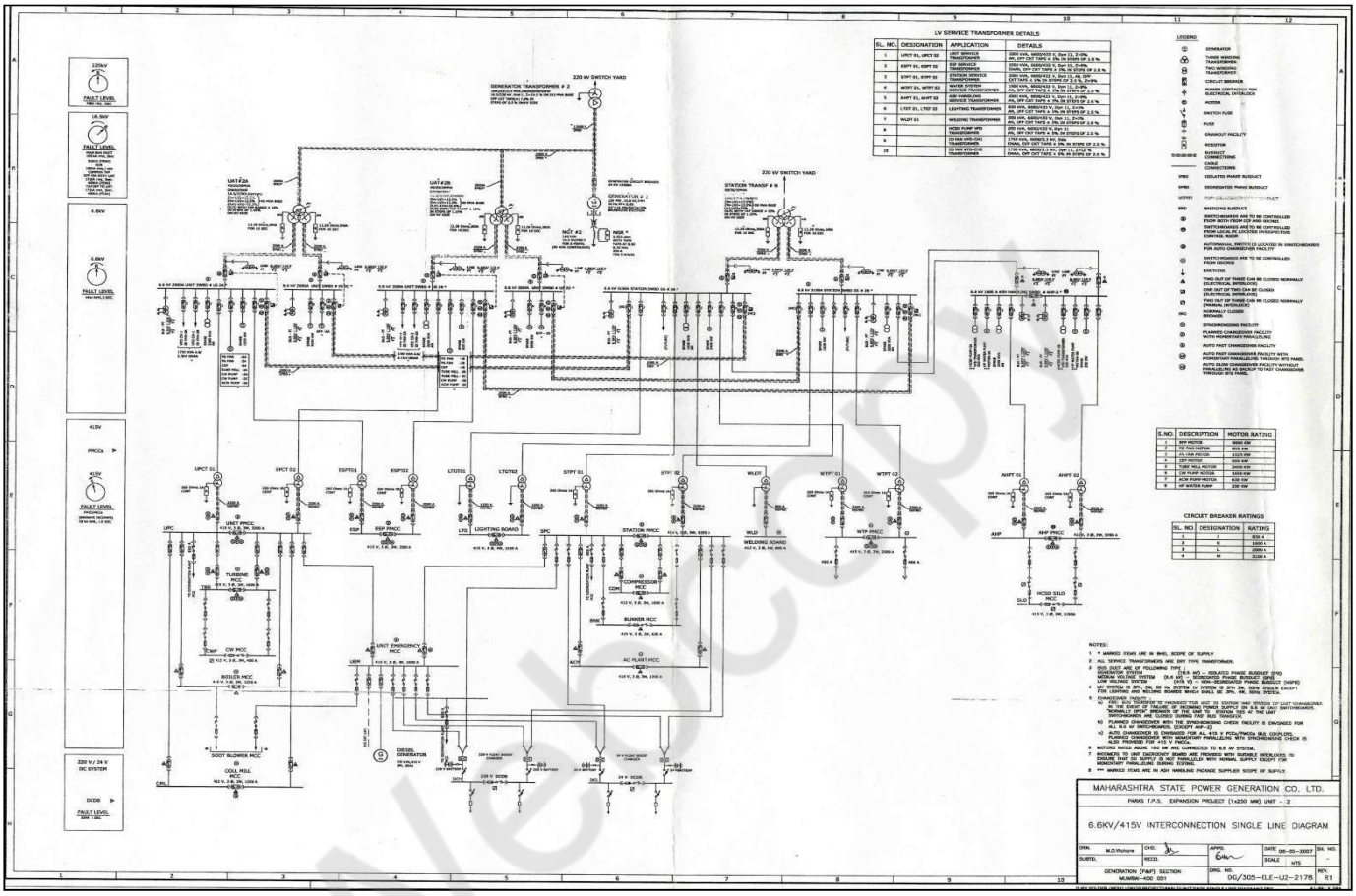
4. Main switchyard (Pooling Substation)



5. 220 kV Paras Substation SLD



6. PTPS SLD



7. Topography Map of Solar Land parcel