: RFP DOCUMENT:

SELECTION OF EPC CONTRACTOR FOR DESIGN, ENGINEERING, PROCUREMENT, SUPPLY, CONSTRUCTION, COMMISSIONING ON TURNKEY BASIS AND COMPREHENSIVE OPERATION & MAINTENANCE FOR 10 (5+5) YEARS OF 50 MW GRID-CONNECTED SOLAR PHOTOVOLTAIC POWER PLANTS AT TTPS, LALPANIA, Dist. - BOKARO, JHARKHAND.



Tenughat Vidyut Nigam Limited,

Ranchi, Jharkhand

Phone No: 9572825552

Website: www.tvnl.in

TENUGHAT VIDYUT NIGAM LIMITED (TVNL)

JUPMI BUILDING PREMISES IN ABD AREA, RANCHI SMART CITY, P.O & P.S DHURWA, DIST: RANCHI, JHARKHAND -834004

Ref no. 101/2025-26 **Date: 24 April 2025**

NIT No. 02/Solar/EPC/TVNL/RAN/2025-26

Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance For 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist. - Bokaro, Jharkhand.

District: Bokaro | State: Jharkhand

Issued By:

TENUGHAT VIDYUT NIGAM LIMITED (TVNL)

Sub : Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand.

TENUGHAT VIDYUT NIGAM LIMITED (TVNL) invites interested parties to participate in this Request for Proposal (this "Tender") for the bidding and selection process for the appointment of Contractor for "Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand. (the 'Project').

Tender Documents may be downloaded from the Website https://jharkhandtenders.gov.in/nicgep/app. To view the download and any other updates regarding this Tender, kindly check https://jharkhandtenders.gov.in/nicgep/app. Tender Fee and EMD shall be paid along with online submission of Tender Documents shall be submitted before the due date along with the original documents. All the relevant documents of the Tender shall also be submitted physically by Courier services, Registered Post A.D., Speed Post, shall be addressed to: Electrical Superintending Engineer (Solar Projects), Tenughat Vidyut Nigam Limited, JUPMI Building Premises in ABD Area, Ranchi Smart City, P.O & P.S - Dhurwa, Dist. : Ranchi, Jharkhand, 834004, superscribing the envelope with Tender No. and Description.

Table 1: Important Dates

Sr.	Event		Date and Time
I.	Date of upload of this RFP	:	25th April 2025
II.	Last date and time of Online (e-tendering) Bid Submission (the "Bid Submission Deadline") **{This is mandatory}**	:	11th June 2025 up to 13:00 Hrs
III.	Last date and time of Physical receipt of all the relevant documents by Post, Courier, RPAD, Physical or Speed Post only **{This is mandatory}**	:	11th June 2025 up to 17:00 Hrs
IV.	Date of Pre-bid Meeting	:	14th May 2025 at 12:00 Hrs by Hybrid mode at TVNL, Ranchi office
V.	Bid Validity	:	Offers shall be valid for a period of One Hundred and Eighty (180) days from the date of opening of the Technical Bid
VI.	Opening of Technical Bid (Online)	:	12th June 2025 up to 16:00 Hrs
VII.	Opening of Technical Bid (Physical)	:	12th June 2025 up to 16:00 Hrs

VIII.	Tentative date of opening of online Financial Bid	:	To be decided
IX.	Target date for Commissioning of Project	:	On or before 300 days from date of Letter of Intent (LoI)/Work Order (WO)
X.	Tentative Date for Operational Acceptance Test	:	30 Days from the date of Commissioning
XI.	Estimated Cost (Excluding GST)	:	INR 240.94 Cr.
XII.	Performance Guarantee Testing Period & start of O&M Period	:	Performance Guarantee (PG) Test/ Operational Acceptance Test (OAT) Period shall start as under: A) If the Contractor successfully completes Operational Acceptance Test (OAT) in first attempt within 30 days from date of commissioning then PG Test Period and O&M Period will start from successful day of OAT. **(OR)** B) In case the Contractor fails the OAT in the first (1st) attempt, the Contractor shall be allowed maximum 30 days for corrective actions and further next OAT shall start on completion of 30 days period or earlier as desired by the Contractor. The PG Test and the O&M period shall start from the date when of second (2nd) OAT is successful. In case the Contractor fails in the second attempt as well, a penalty will be imposed at 1% of EPC Contract Price (including taxes and duties). In this case, irrespective of the result (whether pass or fail) of the OAT, the PG Test and O&M Period shall start from dy of 2nd OAT. The start of O&M and first (1st) year operation shall be considered after successful completion of operational acceptance test or deduction of 1% penalty for unsuccessful OAT,

			whichever is earlier. Further all the guarantees related to NEEGG shall also be applicable **(OR)** C) However, in case of failure of the second (2nd) OAT, if the Contractor needs more time to further take corrective action at its own discretion, then the same may be allowed by TVNL without imposing any further penalty on the Contractor towards such subsequent OATs. However, if the Contractor is successful in third (3rd) attempt then the penalty deducted at the time of unsuccessful 2nd attempt of OAT shall be returned but if the Contractor fails in third (3rd) attempt of OAT then penalty charged at the time of second unsuccessful attempt of OAT shall not be returned to the Contractor.
XIII.	Operation and Maintenance (O&M) Period	:	Upon start of PG Test Period as per Clause No. XII above for a period of five (5) years and further extended to a period of Five (05) years based on the performance of the vendor.
XIV.	EMD Validity	:	One Hundred and Eighty (180) days from the date of opening of the Technical Bid.
XV.	Bank Guarantee Against PV Module Warranty (if applicable)	:	90 days beyond the 25 Years from the date of Commissioning of the entire Project
XVI.	Bank Guarantee for shortfall in Generation at the time of PG test (if applicable)	:	4 Years from the completion of PG Test

Table 2: Important Amounts

Sr.	**Head**		**Amount and Validity**
I.	Tender Fees (non-refundable)	:	Rs. 17,700/- (INR Seventeen Thousand seven hundred Only) (including GST)
II.	Earnest Money Deposit (EMD) (Refundable/ adjustable)	:	Rs. 4,82,00,000/- (INR Four Crore Eighty-Two Lacs Only)

III.	Security Deposit cum Performance Bank Guarantee (PBG) for EPC Contractor	:	The EPC Contractor shall furnish 10% of the EPC Contract Value to TVNL within Thirty (30) days from the date of issue of Letter of Intent (LoI)/ Work order (WO), an unconditional and irrevocable bank guarantee for SD cum Performance Guarantee, as per Performa given.
IV.	O&M Bank Guarantee (O&M BG)	:	5% of the Total O&M Contract Price for 05 (Five) years, to be submitted two months before the expiry of Performance BG, valid up to an aggregate period of Five (05) years from the initiation of the O&M period.
V.	Bank Guarantee for shortfall at the time of PG test (To whomsoever it is applicable)	:	1.5 times of current tariff of TVNL billing rate as per JSERC
VI.	Bank Guarantee Against PV Module Warranty	:	In case the bidder is not able to provide Insurance for Solar PV Modules towards performance guarantee, then bidder shall submit a performance Bank guarantee of Rs. 20 Lakhs (rupees twenty lakhs) per MWp of Solar PV Module quantity ordered valid for 25 years on completion of supply and before expiry of 10% Contract PBG/SD

Important Note to Bidders:

Timely Submission of an offer to TVNL: In addition to the bid submitted online, all the relevant documents as per requirement of the Tender shall also be submitted physically along with the proof of Tender Fee and EMD in sealed cover so that the same is received in this office on or before the due date and time. Tenders without Tender Fee and Earnest Money shall not be considered. Please note that the Price Bid is not to be submitted in physical form.

No tender shall be accepted in any case after the due date and time of receipt of the Tender, irrespective of delay due to postal services or any other reasons, and TVNL does not assume any responsibility for late receipt of the Tender.

1. All interested parties are requested to understand this Tender in detail to comply with TVNL's requirements, including but not limited to the fees and deadlines, selection criteria, selection methodology, scope of work, and minimum technical standards. They shall strictly abide by ALL terms prescribed in this Tender and provide accurate information to the best of their knowledge without misleading the Company to be considered for participation in this Project.
2. It is mandatory for all the bidders to submit their Financial Bid ONLINE only via e- tendering portal.

3. Technical Bid (techno-commercial bid) to be submitted both in physical as well as soft copy (online). It is mandatory for all the bidders to submit their technical bid (Techno-commercial bid) documents in both forms, i.e., online (e-tendering) as well as in hard copy, in the scheduled time. Technical bids in any one (1) form, i.e., either in soft copy (online) or in hard copy (physical form), shall not be considered. In case of any discrepancies the interpretation and clarification of the technical bid submitted, shall only be through the uploaded soft copy of the technical bid proposal.
4. Technical Bid (Techno-commercial bid) in TWO (2) copies (1 Original+ 1 Copies) shall be sent in Sealed Envelopes containing copies of the Technical bid only (Techno-commercial bid).
5. Technical bid (Techno-commercial bid) envelope shall be super scribed as: "NIT No.: 02/Solar/EPC/TVNL/RAN/2025-26" Technical Bid (Techno-commercial bid) for "Design, Engineering, Procurement and Supply, Construction, Commissioning and Comprehensive Operation and Maintenance for ten (5+5) years of 50 MW (AC) Solar Photovoltaic Grid Connected Power Plants using PV technology at Tenughat Thermal Power Station, Lalpania, District: Bokaro in the State of Jharkhand" (the "Project").
6. All the envelopes should be addressed to the Electrical Superintending Engineer (Solar Projects), Tenughat Vidyut Nigam Limited, JUPMI Building Premises in ABD Area, Ranchi Smart City, P.O & P.S - Dhurwa, Dist. : Ranchi, Jharkhand, 834004. The complete postal address of the bidder should appear on all the envelopes so that it is possible to find out whose bid it is without opening the envelope.
7. Tender Fee and EMD shall be submitted in separate envelopes.
8. The cost of tender document (tender fee) shall be deposited well before the submission deadline through online payment (https://jharkhandtenders.gov.in/nicgep/app/) mode only. Tenders submitted without a tender fee will not be accepted.
9. Bidder(s) have to pay a total EMD of **Rs. 482 Lakhs** will be accepted Online payment through TVNL website (https://jharkhandtenders.gov.in/nicgep/app/) or Bank Guarantee in required format from any Indian Nationalized Bank/ Scheduled Commercial Bank in favour of “TENUGHAT VIDYUT NIGAM LIMITED” payable at Ranchi. DD/Cheques are not acceptable.
10. **It is mandatory for all bidders to submit their PRICE-BID (APPENDIX 14) only through online mode (e-tendering).** Price bid submitted in physical form will not be considered for its opening, and only online submitted price bids will be considered for evaluation. Bidders to note that the Price Bid (APPENDIX 14) of those bidders shall be opened (Online/ e-tendering) who is found technically qualified and is found responsive to TVNL's tender terms and conditions and Scope of Works**. The quoted EBV value (financial bid) submitted on the tender portal and the EBV Value mentioned on the PDF copy to be uploaded (Detail calculation in Excel sheet should also be uploaded in zip format) along with the financial bid should be the same. In case the number at either place differs, then the bid will be considered invalid.**
11. All the Bidders shall fulfil the pre-qualification criteria as stipulated in Clause No. 3.1.
12. Any technical/commercial query pertaining to this Tender should be referred to rk.prasad@tvnl.in, prince.ranjan@tvnl.in.

13. For quoting the bids, Bidders need to have the Digital Signature Certificates from either of the following agencies. (DSC as per Category- II).

14. Tender Documents (PDF Format) can be downloaded from the website: https://jharkhandtenders.gov.in/nicgep/app,

15. TVNL reserves the right to accept/reject any or all tenders without assigning any reasons thereof. Bidders are requested to be in touch with the above-mentioned websites till the opening of the price bid to know the latest status.

Yours faithfully,

For and on behalf of

Sd/-

Electrical Superintending Engineer (Solar Project)

TVNL, Ranchi

Document Checklist

[Note: Document Checklist shall be attached with Appendix]

Sr. No.	Document	Complied /Attached / Yes/No	For Official Use
1.	Complete sets of Bids (2 copies one original and one copy) as prescribed in Section 4.3.		
2.	Signed Tender Document(s) in Cover-I as described in Section 4.3.3.		
3.	Enclosures of the Bid, including the Covering Letter, as per the format prescribed in Letter in Cover-II.		
4.	EMD in the form of Bank Guarantee as per the format prescribed in Appendix 1: Format of Bank Guarantee in Cover III.		
5.	Details of the Bidder as per format prescribed in Appendix 3: Format of Details of Bidder		
6.	Attested copy of Goods and Service Tax Registration Certificate of Bidder.		
7.	Attested copy of PAN Card for Bidder.		
8.	Attested Certificate of Commencement of Business issued by the Registrar of Companies for the Bidder.		
9.	Attested copy of Provident Fund Code of Bidder.		
10.	Details of similar technical experience of the Bidder as per the format prescribed in Appendix 4: Format of Details of Similar Technical Experience.		
11.	Curriculum Vitae of all qualified technical staff indicated in Appendix 5: Format of Details of Qualified Technical Staff.		
12.	Details of proposed PV technologies as per the format prescribed in Appendix 6: Format of Disclosure of PV Technology Proposed		
13.	Project execution plan as mentioned in Appendix 7: Format of Project Execution Plan		
14.	Declaration of Compliance as per format prescribed in Appendix 8: Format of Declaration of Compliance.		
15.	No Deviation Certificate as per the format prescribed in Appendix 9: Format of No Deviation Certificate.		
16.	Declaration of Bidder's relation to Directors of TVNL as per the format prescribed in Appendix 10: Format of Declaration on Bidder's Relation to Directors.		
17.	Power of Attorney by the Bidder authorizing the signatory as per the format prescribed in Appendix 11: Format of Power of Attorney as Authorized Signatory		
18.	Format of Summary of Audited Financial Statements as per format prescribed in Appendix 12: Format of summary of Audited Financial Statements.		

19.	(If applicable) Authorization of use of financial capability by Parent as per the format prescribed in Appendix 13: Format of Authorization by Parent Company the necessary financial statements and summary required from the Bidder.		
20.	**a. Only the final EBV value should be submitted on the tender portal.** **b. Detail calculation in Excel sheet should also be uploaded in zip format** **c. PDF copy of the excel sheet calculations should be taken and duly signed , stamped and uploaded.** **d. the EBV Value, the pdf copy and the zip format shall be uploaded in financial bid only in online mode.**		
21.	Project implementation till PG test Operation and Maintenance (O&M) Schedule with resource planning in the form of Gantt/ Pert Charts		
22.	Bill of Quantities with Specifications / Make, etc., as per RFP		
23.	Copy of this RFP with the sign and official seal on every page.		

----------End of Section----------

Table of Contents

NOTICE INVITING E-TENDER ..... ERROR! BOOKMARK NOT DEFINED.
DOCUMENT CHECKLIST 9

1 DEFINITION, INTERPRETATIONS, AND INTRODUCTION ON TVNL 15

1.1 DEFINITIONS 15
1.2 INTERPRETATIONS 18

2 ABOUT 21

2.1 ABOUT TVNL 21

3 INSTRUCTION TO BIDDERS 22

3.1 GENERAL INSTRUCTIONS 22
PRE-QUALIFYING REQUIREMENTS (PQRS)/ELIGIBILITY CONDITIONS 23
3.2 LOCAL CONDITIONS 25
3.3 LOCAL REGULATORY FRAMEWORK 26
3.4 CLARIFICATIONS OF TENDER DOCUMENT 26
3.5 AMENDMENTS TO TENDER DOCUMENT 26
3.6 ACCEPTANCE OF BIDS 26
3.7 WITHDRAWAL OF INVITATION TO BID 26
3.8 REPRESENTATIVE/AGENT OF BIDDER 26
3.9 FINANCIAL PROPOSAL AND CURRENCIES 26
3.10 BANK GUARANTEES AND EMD 27
3.11 PROJECT MANAGEMENT CONSULTANT AND THIRD-PARTY INSPECTION AGENCY 31
3.12 RIGHT TO ACCEPT OR REJECT ANY OR ALL BIDS 31
3.13 NET ELECTRICAL ENERGY GENERATION GUARANTEE (NEEGG) 32

4 SUBMISSION OF BID 34

4.1 GENERAL TERMS 34
4.2 FORMAT AND SIGNING OF BID 34
4.3 SEALING AND MARKING OF BID 34
4.4 ENCLOSURES OF THE BID 35
4.5 BID DUE DATE 37
4.6 LATE BIDS 37
4.7 CONFIDENTIALITY 38
4.8 CORRESPONDENCE WITH THE BIDDER 38
4.9 BID OPENING AND EVALUATION 38
4.10 TESTS OF RESPONSIVENESS 38
4.11 MODIFICATION AND WITHDRAWAL OF BIDS 39
4.12 EVALUATION OF BID AND SELECTION OF BIDDERS 39
4.13 CONTACTS DURING BID EVALUATION 40
4.14 EMPLOYMENT OF OFFICIALS/EX-OFFICIAL OF TVNL 40
4.15 DECLARATION ON BIDDER'S RELATION TO DIRECTOR'S 40
4.16 LETTER OF INTENT (LOI)/ WORK ORDER (WO) AND NOTIFICATION TO PROCEED 40

4.17 SD-Cum Performance Guarantee 40
4.18 Fraudulent Practices 40

5 SCOPE OF WORK **42**

5.1 General Scope of Work 42
5.2 DETAILED ELECTRICAL WORK: 53
5.3 DETAILED CIVIL AND OTHER NON-ELECTRICAL WORK 117

6 GENERAL TERMS AND CONDITIONS **137**

6.1 Use of Contract Documents and Information: 137
6.2 Patent Rights: 137
6.3 Materials and Workmanship: 137
6.4 Inter-Changeability: 137
6.5 Packing and Marking: 138
6.6 Negligence 138
6.7 Statutory Responsibility: 138
6.8 Insolvency and breach of contract: 139
6.9 Timeline: 139
6.10 Delay in Execution or Failure to Supply: 140
6.11 Liquidated damages for Delay and Underperformance 141
6.12 Penalty of loss of Generation during O&M 142
6.13 Defect Liability 142
6.14 Termination of Default 144
6.15 Breach and Cancellation of the Contract 145
6.16 Force Majeure 145
6.17 Progress Report of Work: 146
6.18 Insurance: 146
6.19 Statutory Acts, rules, and Standards 147
6.20 Tools and Tackles 147
6.21 Safety Measures 147
6.22 Hazardous Material 147
6.23 Stoppage of Work 148
6.24 Hindrance Register 148
6.25 Responsibility of the Contractor 148
6.26 Right of the Company to make Change(s) in Design 148
6.27 Manuals 148
6.28 Governing Language 148
6.29 Order Amendments 148
6.30 Assignments or Subletting of Contract 148
6.31 Subcontracts 149
6.32 Inspection and Testing 149
6.33 Authorized Test Centres 151
6.34 Delivery of Equipment 151
6.35 Liabilities during Transit 151
6.36 Deduction from Contact Price 151
6.37 Terms of Payment 151

6.38 PAYMENTS 154
6.39 WARRANTY/GUARANTEE 154
6.40 ARBITRATION: 156
6.41 COURT OF COMPETENT JURISDICTION: 156
6.42 LAW AND PROCEDURE: 156
6.43 CONSTRUCTION OF CONTRACT: 156
6.44 NOTICES 156
6.45 FINAL BILL: 157
6.46 DEGRADATION OF SOLAR MODULES 158
6.47 RISK PURCHASE 158
6.48 CONFIDENTIAL INFORMATION: 158
6.49 WARRANTIES 159

7 SPECIAL TERMS AND CONDITIONS 161

7.1 DEFINITION 161
7.2 OBJECTIVES OF THE PROJECT 161
7.3 COMPLIANCE WITH JUSNL/TVNL/CEIG GUIDELINES 161
7.4 PROJECT SITE 161
7.5 SCOPE OF SERVICE 161
7.6 TRAINING OF TVNL'S PERSONNEL 161
7.7 MODE OF EXECUTION 161
7.8 PROGRAMME OF WORK 162
7.9 STARTING OF WORK 162
7.10 COMPLETION SCHEDULE 162
7.11 SITE INSPECTION AND BASIS OF BID 162
7.12 PRICE ESCALATION 162
7.13 TAXES AND DUTIES 162
7.14 PROCUREMENT OF MATERIALS 163
7.15 SAMPLES 164
7.16 NOTICE OF OPERATION 164
7.17 REJECTION OF MATERIALS 164
7.18 WATER AND POWER SUPPLY DURING CONSTRUCTION 164
7.19 LABOUR ENGAGEMENT 164
7.20 HANDING OVER-TAKING OVER 165
7.21 TERMINATION ON THE DEATH OF CONTRACTOR 165
7.22 RETIRED GOVERNMENT SERVANT TAKING TO CONTRACT 165
7.23 EPF 165
7.24 MISCELLANEOUS: 166
7.25 WORKS, GOODS, SERVICES AND INCIDENTALS 166

APPENDIX 1: FORMAT FOR BANK GUARANTEE 167

APPENDIX 2: FORMAT FOR COVERING LETTER 170

APPENDIX 3: FORMAT OF DETAILS FOR BIDDER 172

APPENDIX 4: FORMAT OF DETAILS OF SIMILAR TECHNICAL EXPERIENCE 173

APPENDIX 5: FORMAT OF DETAILS OF QUALIFIED TECHNICAL STAFF 174
APPENDIX 6: FORMAT OF DISCLOSURE OF PV TECHNOLOGY USED 175
APPENDIX 7: FORMAT OF PROJECT EXECUTION PLAN 176
APPENDIX 8: FORMAT OF DECLARATION OF COMPLIANCE 178
APPENDIX 9: FORMAT OF NO DEVIATION CERTIFICATE 179
APPENDIX 10: FORMAT OF DECLARATION ON BIDDER'S RELATION TO DIRECTORS 180
APPENDIX 11: FORMAT OF POWER OF ATTORNEY AS AUTHORIZED SIGNATORY 181
APPENDIX 12: FORMAT OF SUMMARY OF AUDITED FINANCIAL STATEMENTS 183
APPENDIX 13: FORMAT OF AUTHORIZATION BY PARENT COMPANY 185
APPENDIX 14: FORMAT OF FINANCIAL PROPOSAL 187
APPENDIX 15: BID EVALUATION CRITERIA (BEC) 192
APPENDIX 16: PROCEDURE FOR PERFORMANCE TESTING 195
APPENDIX 17: LIST OF BANK (FOR BANK GUARANTEE) 199
APPENDIX 18: FORMAT OF SD CUM PERFORMANCE BANK GUARANTEE 200
APPENDIX 19: FORMAT FOR O&M BANK GUARANTEE 202
APPENDIX 20: FORMAT OF AGREEMENT BETWEEN TVNL AND THE CONTRACTOR 205
APPENDIX 21: SOLVENCY CERTIFICATE 208
ANNEXURE 1: DETAILS OF PLANT LOCATION 209
ANNEXURE 2: MANDATORY SPARES 210
ANNEXURE 3: APPROVED MAKES 215
ANNEXURE 4: OPERATION & MAINTENANCE OF 50 MW (AC) SPV PLANT 223
DISCLAIMER 228
NOTES. 230

1 Definition, Interpretations, and Introduction on TVNL

1.1 Definitions

1.1.1 The following words and expressions shall have the meanings hereby assigned to them:

1.1.2 "**Actual Delivered Energy**" means the net energy in kilo-watt hour (kWh) from the 50 MW (AC) Solar PV plant as measured at the Metering Point. The metering point shall be at the Substation/ EHV line at the main bus-bar of the TVNL substation for interconnection.

1.1.3 "**Adjudicator**" means the person, the Managing Director of TVNL, to act as the adjudicator to make a decision on or to settle any dispute or difference between TVNL and the Contractor referred to it by the parties pursuant to Tender (Adjudicator) hereof.

1.1.4 "**Applicable Law**" means any statute, law, regulation, ordinance, notification, rule, regulation, judgment, order, decree, bye-law, approval, directive, guideline, policy, requirement or other governmental restriction or any similar form of decision of, or determination by, or any interpretation or administration having the force of law in the Republic of India and the State Government, by any Government Authority or instrumentality thereof, whether in effect as of the date of this Contract or thereafter.

1.1.5 "**Base NEEGG**" for a year is calculated by using the Net Electrical Energy Generation Guarantee (NEEGG) quoted in the Bid offer by the Contractor, adjusted with a correction factor to take into account the actual average global solar radiation measured by the calibrated pyranometer for that year.

1.1.6 "**Bid**" shall mean the bid submitted by the Bidder in response to this "Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand. ", Ref. NIT No. 02/Solar/EPC/TVNL/RAN/2025-26, dated 24/04/2025, issued by TVNL.

1.1.7 "**Bidder**"-Any reference to the Bidder includes Bidding Company including its successors, executors, and permitted assignee severally, as the context may require.

1.1.8 "**Capacity Utilization Factor (CUF)**" shall have the same meaning as provided in CERC (Terms and Conditions for Tariff Determination from Renewable Energy Sources) Regulations, 2009, as amended from time to time.

1.1.9 "**Chartered Accountant**" shall mean a person practicing in India or a firm whereof all the partners practicing in India as a Chartered Accountant(s) within the meaning of the Chartered Accountants Act, 1949.

1.1.10 "**Commissioning**" means the satisfactory, continuous, and uninterrupted operation of the equipment/system as specified after all necessary statutory approvals, initial tests, checks, and adjustments for a period of at least 3 days to the satisfaction of TVNL and necessary certificates are issued by all concerned/ nodal agencies appointed by JREDA/JUSNL/CEIG.

1.1.11 "**Company**" means Tenughat Vidyut Nigam Limited, which includes the legal successors or permitted assigns of the Company.

1.1.12 "**Completion of the Facilities**" means that the Facilities (or a specific part thereof where specific parts are specified in the Scope of Work) have been completed operationally and

structurally and put in a tight and clean condition and that all work in respect of Commissioning of the Facilities or such specific part thereof has been completed as per the Scope of Work.

1.1.13 "**Consultant**" shall mean any consultant hired by TVNL or the company for the purpose of this project.

1.1.14 "**Contract**" or "**Contract Agreement**" means the Contract signed between TVNL and the Contractor to execute the entire Scope of Work as given in the Appendix 20: Format of Agreement between TVNL and the Contractor.

1.1.15 "**Contract Documents**" means the documents listed in Appendix 20: Format of Agreement between TVNL and the Contractor.

1.1.16 "**Contractor**" means the Successful Bidder with whom the contract is signed by TVNL, including the legal successors, or permitted assignee of the Contractor.

1.1.17 "**Contractor's Equipment**" means all plant, facilities, equipment, machinery, tools, apparatus, appliances, or things of every kind required in or for installation, completion, and maintenance of Facilities that are to be provided by the Contractor but do not include Plant and Equipment, or other things intended to form or forming part of the Facilities.

1.1.18 "**Day**" means calendar day of the Gregorian calendar.

1.1.19 "**Delivery Point**" shall be the interconnection point at which the solar power developer (SPD) shall deliver the power to the TVNL Bus-Bar or Sub-station. The metering shall be done at this point of interconnection.

1.1.20 "**Defect Liability Period**" means the period of validity of the warranties given by the Contractor, during which the Contractor is responsible for defects with respect to the Facilities (or the relevant part thereof) as provided in Clause No. 6.13 (Defect Liability) hereof.

1.1.21 "**Effective Date**" for this Contract shall mean the date of issuance of Letter of Intent by TVNL.

1.1.22 "**DoE (GOJ)"** means Department of Energy.

1.1.23 "**Engineer-in-Charge**" shall mean the engineer appointed at the Project site and headquarters by TVNL.

1.1.24 "**Facilities**" means the Plant and Equipment to be supplied and installed, as well as all the Installation Services to be carried out by the Contractor under the Contract for enabling the installation, construction, testing, and commissioning of the Solar Power System(s).

1.1.25 "**Financial Bid**" or "**Financial Proposal**" means the proposal submitted by the Bidder online as a part of the Bid, including the EPC Contract Price, O&M Contract Price, and Guaranteed Generation as per the format prescribed in Appendix 14.

1.1.26 "**Guaranteed CUF**" means the CUF calculated as per Clause No. 1.1.8 Considering NEEGG quoted by the Bidder in the Tender document at the time of submission of Bid.

1.1.27 "**Government Authority**" means the Government of India, any state government or any governmental department, commission, board, body, bureau, agency, authority, undertaking, or administrative body or any sub-division or instrumentality thereof, central, state, or local, having jurisdiction over the Contractor, the Facility, or the performance of all or any of the services, obligations or covenants of Contractor under or pursuant to this Contract or any portion thereof.

1.1.28 "**Guarantee Test(s)**" means the Performance and Guarantee Test(s) specified in this Tender to be carried out to ascertain whether the Facilities or a specified part thereof is able to attain the Functional Guarantees.

1.1.29 "**JREDA**" shall mean Jharkhand Renewable Energy Development Agency.

1.1.30 "**JSERC**" shall mean the Jharkhand State Electricity Regulatory Commission constituted under section 82 of the Electricity Act 2003 or its successors.

1.1.31 "**TVNL**" means Tenughat Vidyut Nigam Limited (TVNL) and includes the legal successors or permitted assigns.

1.1.32 **"TTPS"** shall mean Tenughat Thermal Power Station and includes the legal successors or permitted assigns

1.1.33 "**Installation Services**" means all those services ancillary to the supply of the Plant and Equipment for the Facilities to be provided by the Contractor under the Contract, e.g., transportation and provision of marine or other similar insurance, inspection, expediting, Site preparation works (including the provision and use of Contractor's Equipment and the supply of all civil, structural and construction materials required), installation, Commissioning, carrying out guarantee tests, operations, maintenance, the provision of operations and maintenance manuals, training of TVNL's personnel etc.

1.1.34 "**JNNSM**" means the Jawaharlal Nehru National Solar Mission.

1.1.35 "**Metering Point**" for purposes of recording of Delivered Energy at the Delivery Point.

1.1.36 "**Month**" means calendar month of the Gregorian calendar.

1.1.37 "**MNRE**" means Ministry of New and Renewable Energy, Government of India.

1.1.38 "**O&M**" means Operations and Maintenance.

1.1.39 "**Owner(s)**" means TVNL and includes the legal successors or permitted assigns.

1.1.40 "**Price Bid**" means the same as per Clause No. 1.1.25.

1.1.41 "**Party**" or "**Parties**" means individually any one of the Bidder, Contractor, or TVNL; or collectively any or all of the Bidder, Contractor, or TVNL; respectively.

1.1.42 "**Plant**" means the Grid-Connected Solar Photovoltaic Power Plant of 50 MW proposed at Tenughat Thermal Power Station (TTPS), Lalpania, District: Bokaro, as per the provisions in this Tender.

1.1.43 "**Plant Capacity**" is defined as the function of cumulative rated DC capacity of all solar PV modules under STC conditions as defined and measured in adhering to the guidelines of the latest version of applicable IEC standards for crystalline silicon PV module technologies as well as cumulative rated AC capacity of the grid-connected inverters, utility interface, performance measurement, and safety norms in accordance the relevant guidelines of MNRE/ JREDA / any other Jharkhand State Agencies as well as the requirements stipulated by TVNL; the plant shall be complete in all respect and shall be capable of generating, export and send energy accounting locally and data over the remote server at locations specified by the respective company.

1.1.44 "**Projects**" means the 50 MW (AC) Grid-Connected Solar Photovoltaic Power Plant proposed at Tenughat Thermal Power Station (TTPS), Lalpania, District: Bokaro, as per the provisions in

this Tender, including but not limited to its design, engineering, procurement and supply, construction, commissioning, compressive operation, and maintenance.

1.1.45 "**Project Manager**" means the person appointed by TVNL in the manner provided in the Tender hereof and named to perform the duties delegated by TVNL.

1.1.46 "**Prudent Utility Practices**" means those practices, methods, techniques, and standards that are generally accepted for use in electric utility industries, taking into account conditions in India, and commonly used in prudent electric utility engineering and operations to design, engineer, construct, test, operate and maintain equipment lawfully, safely, efficiently and economically as applicable to power stations of the size, service, and type of the Project, and that generally conform to the manufacturer's operation and maintenance guidelines.

1.1.47 "**Site**" means the land and other places upon which the Facilities are to be installed and such other land or places as may be specified in the Contract as forming part of the Site.

1.1.48 "**Solar Power System(s)**" means the solar photovoltaic grid-connected power system(s) to be established at the site specified in the Tender.

1.1.49 "**Subcontractor**", including vendors, means any person to whom the execution of any part of the Facilities, including preparation of any design or supply of any Plant and Equipment, is sub-contracted directly or indirectly by the Contractor, and includes its legal successors or permitted assigns.

1.1.50 "**Successful Bidder**" means the Bidder who is financially and technically eligible and qualified and evaluated as the Lowest Evaluated Bidder as per the provisions in this Tender and to whom the contract is awarded.

1.1.51 "**Tender**" or "**Tender Document(s)**" shall mean this "Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand. " Ref. NIT No. 02/Solar/EPC/TVNL/RAN/2025-26 dated 24/04/2025 issued by TVNL, including its annexure, appendices, attachments, amendments, and any other documents as added or modified by TVNL as per the provisions in this Tender.

1.1.52 "**Tender Issuing Authority**" means the office of Electrical Superintending Engineer (Solar Projects), Tenughat Vidyut Nigam Limited, JUPMI Building Premises in ABD Area, Ranchi Smart City, P.O & P.S - Dhurwa, Dist. : Ranchi, Jharkhand, 834004.

1.1.53 "**Tender for Completion**" shall be the date on or before which Completion of the Facility has to be achieved to the satisfaction of TVNL, and such date is specified in NIT.

1.2 Interpretations

1.2.1 Language: Unless otherwise agreed by the parties in writing, the parties shall use the English language and the Contract and the other Bid documents, all correspondence, and communications to be given, and all other documentation to be prepared and supplied under the Contract shall be written in English, and the Contract shall be construed and interpreted in accordance with that language. If any of the Contract Documents, correspondence, or communications are prepared in any language other than English, the English translation of

such documents, correspondence, or communications shall prevail in matters of interpretation.

1.2.2 References: All Clauses, Sections, Chapters, Appendices, Annexure, or any other objects mentioned in this Tender shall refer to the same in this Tender unless specified otherwise.

1.2.3 Singular and Plural: The singular shall include the plural and the plural the singular, except where the context otherwise requires.

1.2.4 Headings: The headings and marginal notes in the General Conditions of Contract are included for ease of reference and shall neither constitute a part of the Contract nor affect its interpretation.

1.2.5 Persons: Words importing persons or parties shall include firms, corporations, and government entities.

1.2.6 Men: The word 'Men' in this Tender shall mean all genders, i.e., male, female, and others.

1.2.7 Entire Agreement: The Contract constitutes the entire agreement between TVNL and Contractor with respect to the subject matter of the Contract and supersedes all communications, negotiations, and agreements (whether written or oral) of parties with respect thereto made prior to the date of Contract. The various documents forming the Contract are to be taken as mutually explanatory. Should there be any discrepancy, inconsistency, error, or omission in the Contract documents, the matter may be referred to the Adjudicator, and the Contractor shall carry out work in accordance with the decision of the Adjudicator.

1.2.8 Amendment: No amendment or other variation of the Contract shall be effective unless it is in writing, is dated, expressly refers to the Contract, and is signed by a duly authorized representative of each party hereto.

1.2.9 Time: Any time, unless mentioned otherwise, shall be as per Indian Standard Time (IST).

1.2.10 Currency: All amounts mentioned as Rupees, Rs. or INR shall be interpreted as Indian Rupees.

1.2.11 Independent Contractor: Subject to the provisions of the Contract, the Contractor shall be solely responsible for the manner in which the Contract is performed.

a. All employees, representatives, or subcontractors engaged by the Contractor in connection with the performance of the Contract shall be under the complete control of the Contractor and shall not be deemed to be employees of TVNL, and nothing contained in the Contract or in any sub-contract awarded by the Contractor shall be construed to create any contractual relationship between any such employees, representatives, or Subcontractors and TVNL.

b. Not in any case the sub-contractor shall claim or shall put any binding to TVNL, and the sub-contractor must be handled by the Contractor and TVNL shall not be responsible for any claims at any time by the Contractor in relation to the sub-contractor.

1.2.12 Non-Waiver:

a. Subject to Clause1.2.12 (b) below, no relaxation, forbearance, delay, or indulgence by either party in enforcing any of the terms and conditions of the Contract or the granting of time by either party to the other shall prejudice, affect, or restrict the rights of that

party under the Contract, nor shall any waiver by either party of any breach of Contract operate as a waiver of any subsequent or continuing breach of Contract.

b. Any waiver of a party's rights, powers, or remedies under the Contract must be in writing, must be dated and signed by an authorized representative of the party granting such waiver, and must specify the right and the extent to which it is being waived.

1.2.13 Severability: If any provision or condition of the Contract is prohibited or rendered invalid or unenforceable, such prohibition, invalidity, or unenforceability shall not affect the validity or enforceability of any other provisions and conditions of the Contract.

1.2.14 Country of Origin: "Origin" means the place where the materials, equipment, and other supplies for the facilities are mined, grown, produced, or manufactured, as the case may be, and from which the services are provided.

---End of Section---

2 About

2.1 About TVNL

Tenughat Vidyut Nigam Limited (A Govt. of Jharkhand Undertaking) is a power generating company incorporated on 26.11.1987 under the Companies Act, 1956, Head Quarter at Ranchi.

The project known as Tenughat Thermal Power Station (TTPS) is located at village Lalpania in the District of Bokaro (Jharkhand), 829149. It is situated on the left bank of Tenughat reservoir. The nearest railway station is Gomia (GMIA), which is at a distance of 20 KM (approx.) by road. The project is also connected by merry-go-round rail route from Dumri Bihar (DMBR) railway station in Barkakana Jn-NSCB Gomoh Rail route. The project site is developed with all modern infrastructure like school, hospital, bank, post office, marketing complex etc.

The total installed capacity of Tenughat Thermal Power Station is 2X210 MW. The first unit was put in commercial operation in September 1996 and second unit in September 1997. Existing units are performing well above the national standards.

The daily requirement of coal for full load generation for its 2X210 MW is approximately 7000 MT, which is being fulfilled by road/ rail transport from its nearby collieries.

The organization is run by a dedicated and competent team of employees.

---End of Section---

3 Instruction to Bidders

3.1 General Instructions

3.1.1 The current document is the Tender, which is issued to all the potential Bidders, requesting a Bid for implementation of the Project on a fixed price basis. A Contractor would be selected through a competitive bidding process for execution of the Project.

3.1.2 Before submitting tenders, the instructions may be read carefully regarding the submission of the tender. If any bidder finds discrepancies or omissions in the Tender documents or is in doubt as to the true meaning of any part, he shall clarify the same from the Tender issuing office in writing before the pre-bid meeting. After the Pre-bid meeting, no query shall be considered.

3.1.3 Unless exempted specifically, tenders not accompanied with the prescribed EMD, Tender Fees shall be rejected. EMD / Tender Fees shall be in the prescribed mode of payment as asked in the NIT; otherwise, the tender shall be liable to be rejected.

3.1.4 The validity of the Tender/offer shall be for **180 days** from the date of opening of the Technical Bid.

3.1.5 The details of NIT, along with Tender Documents, can be seen and downloaded from the TVNL website - https://jharkhandtenders.gov.in/nicgep/app

3.1.6 The committee nominated by TVNL shall evaluate all the bids received against NIT on the parameter indicated under the heading Pre-Qualifying Requirement (PQRs)/ Eligibility conditions in Clause 3.2 and other relevant clauses of the Tender. The decision of the committee shall be final.

3.1.7 Issuance of Tender Documents to any party shall not construe that such party is considered to be qualified.

3.1.8 In case the due dates of sale/receipt/opening of the Tender happen to be a holiday in TVNL, the needful will be done on the next working day.

3.1.9 The bidders/contractors shall observe the highest standards of ethics during the submission of tender, procurement, and execution of the contract. In case of evidence of cartel formation by the Bidder(s), EMD is liable to be forfeited.

3.1.10 The bidder shall bear all costs, including bank charges if any, associated with the preparation and submission of his bid, and the purchaser will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

3.1.11 Tender Issuing Authority reserves the right to cancel the NIT or to change the qualifying requirement or to reject any or all the tenders so received without assigning any reason.

3.1.12 The Site for the work is either available or it shall be made available in the parts in a manner so as not to hamper the progress of the work.

3.1.13 The Bidder whose Bid is accepted will be required to furnish by way of Performance Bank Guarantee the amount as prescribed in the NIT for the due fulfilment of his Contract.

3.1.14 Canvassing in connection with tenders is strictly prohibited, and the tenders submitted by the Bidders who resort to canvassing will be liable to rejection straight away.

3.1.15 All rates shall be quoted on the proper form, i.e., price bid supplied as part of the Tender documents on the e-tender portal by the Department.

3.1.16 On acceptance of the Tender, the name of the authorized representative(s) of the Successful bidder, who would be responsible for taking instructions from the Engineer-in-Charge, shall be communicated to the Engineer-in-Charge immediately after the allotment/start of work.

3.1.17 The TVNL does not bind itself to accept the lowest tender and reserves to itself the right to accept the whole or any part of the Tender, and the Bidder shall be bound to perform the same at the rate quoted in this Tender.

3.1.18 No contractor is permitted to tender for the works if any of his near relatives is posted to deal with day-to-day duties in the passing of bills, etc., and who is working in any capacity requiring him to give instructions/advice and in particular any office/official of the Company including the member of the Board. Any breach of this condition by anyone shall render him liable to be removed from the list of contractors for the TVNL, and the work entrusted to him may be terminated.

***Note:**

1. The terms near relatives meant wife/ husband, parents and grandparents, children and Grandchildren, brothers and sisters, uncles and cousins, and their corresponding in-laws.
2. The bidder shall attach the list of officers and employees of TVNL related to him with this tender.

Pre-Qualifying Requirements (PQRs)/Eligibility Conditions

3.1.1 TECHNICAL QUALIFICATION REQUIREMENTS:

i. The Bidder shall be an ISO Certified body incorporated in India under the Companies Act, 1956 or 2013 including any amendment thereto/LLP (Limited Liability Partnership) registered under 58(4)(b) of the LLP act./ CPSU/ SPSU. A copy of certificate of incorporation shall be furnished along with the bid in support of above.

ii. The Bidder shall have an experience of design, supply, installation and commissioning and Operational & Maintenance of Solar Power Plants of project size of minimum 20 MW for one single project size execution and cumulative successful completion certificates of at least 50 MW or above, which have been successfully commissioned after 01 October 2016 and in operation for at least one (1) year as on the Deadline for Submission of Bid.

iii. The Bidder shall have an experience of

   a. Three similar completed works costing not less than the amount equal to 40(forty) percent (INR 96.38 Cr.) of the estimated EPC cost excluding GST; or
   b. Two similar completed works costing not less than the amount equal to 50 (fifty) percent (INR 120.47 Cr.) of the estimated EPC cost excluding GST; or
   c. One similar completed work costing not less than the amount equal to 80 (eighty) percent (INR 192.75 Cr.) of the estimated EPC cost excluding GST.

   Bidders shall have to submit Work Order along with successful completion certificates and Charging Certificate for above project for a project size of minimum 20 MW or above.

iv. Bidder shall have to submit, in support of the above, the list of projects commissioned along with their work order and the commissioning certificates along with the certificate of plant being in operation. In case the bidder wants to meet the eligibility criterion through its own power plant, then a certificate from Chartered Accountant to that effect will be required to be submitted.

3.1.2 FINANCIAL QUALIFICATION REQUIREMENTS

i. Average Turnover of the Bidder for last three (3) financial years will be at least 1.5 times of the estimated cost (i.e. Rs 361.5 Crores).

ii. The Net Worth of the Bidder during the last Financial Year shall be at least 10% of the estimated project value (i.e. Rs 24.1 Crores), wherein the Net Worth shall be calculated as follows:

Net Worth = (Equity + Reserves) – (Revaluation reserves + intangible assets + miscellaneous expenses to the extent not written off + carried forward losses).

The Bidder shall provide a copy of each audited annual report to ascertain their turnover and net-worth.

iii. The Bidder shall submit audited annual reports of FYs 2021-22, FY 2022-23 & FY 2023-24.

iv. Bidder may also submit a solvency certificate as per Appendix 21.

3.1.3 OTHER

i. The Tender of only those bidders will be considered who will produce documentary proofs, self-attested to meet the following requirements: The Bidders to have valid Proof of Permanent EPF account no., ESI registration no., and Goods and Service Tax no.

ii. The agency should have a valid license under contract labour regulation and abolition Act-1970 from the labour department Jharkhand or should give an undertaking that he will get himself registered within one month if work is allotted to him.

iii. A self-attested certificate from the Bidder to the effect that the Bidder is not blacklisted from any Public Sector undertakings of Central Govt. / State Govt. /SEBs / Corporations/ TVNL/ any other reputed Thermal Plant etc.

3.2 Local Conditions

3.2.1 The Bidder is advised to visit and examine the Project Site conditions, traffic, location, surroundings, climate, availability of power, water and other utilities for construction, access to the site, handling and storage of materials, weather data, applicable laws and regulations, and obtain for itself on its own responsibility all information that may be necessary for preparing the Bid and entering into the Contract Agreement. The costs of visiting the Project Sites shall be at Bidder's own expense.

3.2.2 The Bidder and any of its personnel or agents shall be granted permission by TVNL to enter its premises and lands for the purpose of such inspection, but only upon the express condition that the Bidder, its personnel or agents, shall release and indemnify TVNL and its personnel and agents from and against all liability in respect thereof and shall be responsible for personal injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expenses however caused, which, but for the exercise of such permission would not have arisen.

3.2.3 Failure to visit the Project Sites or failure to study the Tender Document shall in no way relieve the Successful Bidder from furnishing any material or performing any work by the Tender Document.

3.2.4 In no case, the Target Date for Completion of Projects shall be extended due to the failure of the Bidder to visit the Project Sites. The Bidder must conduct its own inspection of the Project Sites and access to the Project Sites and surroundings at its own cost in order to make a proper estimate of the works to be performed under consideration of site-specific constraints. This applies in particular to the transportation of equipment to the Project Sites and the scope of Project Sites works. The Bidder shall also inspect the Project Sites and the access to Project Sites from the point of manufacture to make sure that its equipment is suitable for the available access and the site terrain.

3.2.5 It shall be deemed that by submitting a Bid, the Bidder has:

i. made a complete and careful examination of the Tender Document;

ii. received all relevant information requested from TVNL;

iii. acknowledged and accepted the risk of inadequacy, error, or mistake in the information provided in the Tender Documents or furnished by or on behalf of TVNL relating to any of the matters referred to in this Tender;

iv. satisfied itself about all matters, things, and information, including matters referred to in the Tender Document, necessary and required for submitting an informed Bid, execution of the Projects in accordance with the Tender Document, and performance of all of its obligations there under;

v. acknowledged and agreed that inadequacy, lack of completeness, or incorrectness of the information provided in the Tender Document or ignorance of any of the matters referred to in the Tender herein shall not be a basis for any claim for compensation, damages, the extension of time for performance of its obligations, loss of profits, etc. from the TVNL, or a ground for termination of the Contract Agreement; and

vi. Agreed to be bound by the undertakings provided by it under and in terms hereof.

3.2.6 TVNL shall not be liable for any omission, mistake or error on the part of the Bidder in respect of any of the above or on account of any matter or thing arising out of or concerning or relating to the Tender Document or the Bidding Process, including any error or mistake therein or in any information or data given by TVNL.

3.3 Local Regulatory Framework

3.3.1 It shall be imperative for each Bidder to fully inform itself of all local conditions, laws, and factors that may have any effect on the execution of the Contract as described in the Bidding Documents. TVNL shall not entertain any request for clarification from the Bidder, regarding such local conditions.

3.3.2 It is the responsibility of the Bidder that such factors have properly been investigated and considered while submitting the Bid proposals and that no claim whatsoever, including those for financial adjustment to the Contract awarded under this Tender, shall be entertained by TVNL and that neither any change in the time schedule of the Contract nor any financial adjustments arising thereof shall be permitted by TVNL.

3.4 Clarifications of Tender Document

3.4.1 A Bidder requiring any clarification of the Tender documents may notify TVNL in writing or by facsimile or by e-mail to TVNL's contact: rk.prasad@tvnl.in, prince.ranjan@tvnl.in

3.5 Amendments to Tender Document

3.5.1 TVNL may, for any reason, whether at his own initiative or in response to a clarification requested by a prospective Bidder, modify the Tender Documents.

3.5.2 The amendments will be notified on the website as mentioned in the Notice Inviting e-tender of this Tender.

3.5.3 In order to allow the prospective Bidder(s) a reasonable time in which to take the amendment into account in preparing their Bids, TVNL, at its discretion, may extend the deadline for the submission of Bids.

3.6 Acceptance of Bids

3.6.1 TVNL neither binds itself to accept the lowest or any nor to assign any reason for the rejection of any Bid. It is also not binding on TVNL to disclose any analysis report.

3.7 Withdrawal of Invitation to Bid

3.7.1 While TVNL has floated this Tender and has requested Bidders to submit their proposals, TVNL shall always be at liberty to withdraw this invitation to bid at any time before the acceptance of the bid offer.

3.8 Representative/Agent of Bidder

3.8.1 All the Bidders are requested to mention the name of their authorized representative/ agent, if any, with full address in the Bid. In case the representative is changed during the bidding process, such changes shall be notified by the Bidder, failing which TVNL shall not accept any responsibility.

3.9 Financial Proposal and Currencies

3.9.1 The Bidders shall quote the price for the Project Site inclusive of all the taxes while also providing the breakup of taxes as mentioned in Appendix 14. A similar format will be present in the e-tender for online submission. The Bidder shall indicate the price in the Financial Proposal in Indian National Rupee only.

3.10 Bank Guarantees and EMD

3.10.1 The validity of EMD shall be as per mentioned in NIT.

3.10.2 The EMD shall specifically bind the Bidder to keep its Bid valid for acceptance and to abide by all the conditions of the Tender Documents in the event of TVNL desiring to award the work to the said Bidder. TVNL shall have an unqualified discretion to forfeit the EMD in the event: (i) Bidder fails to keep the Bid valid up to the date specified/ required, or (ii) refuses to unconditionally accept the Letter of Intent and carry out the work in accordance with the Bid in the event such Bidder is chosen as the Successful Bidder.

3.10.3 The Company shall, however, arrange to release the EMD in respect of unsuccessful Bidders, without any interest, only after the issue of LOA to the Successful Bidder and their acknowledgment of the same.

3.10.4 The EMD in respect of the Successful Bidder shall be converted into the Security Deposit, which will be valid up to faithful execution of work, including the O&M period.

3.10.5 The EMD shall be forfeited and appropriated by TVNL as per the discretion of TVNL as genuine, pre-estimated compensation and damages payable to TVNL for, inter alia, time, cost, and effort of TVNL without prejudice to any other right or remedy that may be available to TVNL hereunder or otherwise, under the following conditions:

i. If a Bidder submits a non-responsive Bid;

ii. If a Bidder engages in a corrupt practice, fraudulent practice, coercive practice, or restrictive practice;

iii. In the case of Successful Bidder, if it fails within 30 days from the issue of LoI /WO – (a) to sign the Contract Agreement and/or (b) to furnish the Performance Bank Guarantee within the period prescribed.

iv. In case the Successful Bidder, having signed the Contract Agreement, commits any breach thereof prior to furnishing the Performance Bank Guarantee.

3.10.6 The Successful Bidder shall furnish the following Bank Guarantees:

i. **Security Deposit (SD) cum Performance Bank Guarantee** as per the format given in Appendix 18: Format of SD cum Performance Bank Guarantee, shall be furnished in favour of "Tenughat Vidyut Nigam Limited". The Contractor shall submit a Performance Bank Guarantee of 5% of the EPC Contract Price within Thirty Days (30) days from the date of issue of the Letter of Intent (LoI)/ WO, initially valid for a period of Twenty-Two (22) months from the date of issue of LoI/WO, whereas remaining 5% shall be deducted from RA Bills. However, in case of delay in the demonstration of the PG test, the same will have to be extended up to 5 months beyond the due date for completion of the PG test. The period for the Performance Guarantee (PG) Test shall begin from the date mentioned in the NIT of this Tender and shall continue till next one year. Performance Bank Guarantee shall be returned only after successful Performance Guarantee Test/ Final Acceptance Test.

ii. **O&M Bank Guarantee**: The Contractor shall undertake comprehensive operation and maintenance (O&M) activities for a period of Five (05) years and further extended to a period of Five (05) years based on the performance of the vendor from the date mentioned in NIT of this Tender. The Contractor shall submit the O&M Bank Guarantee to TVNL within 30 days from the date of the start of the O&M period as specified in the NIT of this Tender in favour of "Tenughat Vidyut Nigam Limited". The format of the O&M Bank Guarantee is given in Appendix 19: Format of O&M Bank Guarantee.

   a. Due to the extended nature of the O&M Bank Guarantee, the Contractor is allowed to provide O&M Bank Guarantees of not less than Two (2) years and renew the same each year. However, the Contractor shall renew the O&M Bank Guarantee at least one month before the expiry of the validity, failing which TVNL will be at liberty to encash the same. In case the O&M Bank Guarantee is encashed due to any penalty, then the Contractor has to replenish within 20 days the O&M Bank Guarantee for the remaining period.
   b. Any lapse in the timely renewal of the O&M Bank Guarantee shall entitle TVNL to encash it without assigning any further reason thereof.
   c. The O&M Bank Guarantee for 2 years should be valid up to 45 days beyond the due date of completion of the 2nd O&M year. For subsequent O&M years, the Bank Guarantee should be extended/renewed in such a manner that the same remains valid up to 45 days beyond the date of completion of each subsequent O&M year.

iii. **Bank Guarantee for shortfall at the time of PG Test:** In case the Contractor fails to achieve the NEEGG at the PG test then the Contractor shall, within a period of thirty (30) days, provide a Bank Guarantee of the amount equal to "Rs (1.5 times of current tariff of TVNL billing rate ae per JSERC) x No. of shortfall units" valid for a period of 4 (four) years. In case the Contractor achieves the NEEGG in the 5th year then the Bank Guarantee shall be returned to the Contractor at the end of 5th year of O&M Period. However, if the Contractor fails to achieve the NEEGG during the 5th year then Rs. (1.5 times of current tariff of TVNL billing rate as per JSERC)/ kWh shall be charged for the shortfall that has occurred in the 5th year with a maximum amount limited to the Bank Guarantee value. For example, during the PG Test, if the Contractor has a shortfall of 100 kWh, then the Contractor shall submit a Bank Guarantee of Rs. 100 x 1.5 billing rate valid for 4 (four) years. Further, at the end of 5th year, if the shortfall is of 100 kWh then maximum penalty of Rs. 100 x 1.5 TVNL billing rate shall be encashed from this Bank Guarantee. However, if the shortfall is of 80 kWh then Rs. 80 x 1.5 TVNL billing rate shall be encashed from the Bank Guarantee and the remaining amount of the Bank Guarantee shall be released to the Contractor. It is further clarified that the year-on-year shortfalls in achieving the NEEGG during the 1st to 5th year of O&M Period shall be charged as per Clause No 6.12.2 of this Tender Document, which shall be over and above the provision of this current Clause.

iv. **INSURANCE OR BANK GUARANTEE AGAINST PV MODULE WARRANTY**

A) Bank Guarantee against PV Module Warranty: The Successful Bidder who is not able to provide insurance of PV modules as mentioned below (B) shall provide security in the form of Bank Guarantee for an amount Rs. 20 Lakh per each megawatt of PV modules (i.e. DC capacity) shall be issued by Solar PV Module manufacturer/ EPC vendor in favour of TVNL, which shall be valid for a period of twenty five (25) years and 90 days. The minimum validity of the Bank guarantee shall be five (5) years and shall be renewed subsequently every five (5) years prior to thirty (30) days of its expiry. The BG shall be submitted on completion of supply and before expiry of 10% Contract PBG/SD prior to the return of PBG. In case the PV module fails to provide power output as per its performance warranty, and if the Contractor fails to rectify, replace or repair the PV module, then the Owner shall carry out the necessary rectification, repair or replacement at its own discretion at the risk and cost of the Contractor. The cost of such rectification, repair or replacement shall be encashed from the Bank Guarantee against PV Module Warranty. The same shall be replenished by the Contractor within thirty (30) day, failing which the entire Bank Guarantee amount shall be encashed and all pending payment shall be withheld by the Owner till such amount is replenished by the Contractor. In another instance, if the Contractor becomes bankrupt or insolvent, then the Owner shall immediately encash the entire amount of the Bank Guarantee against PV Module Warranty.

OR

B) Insurance: The PV module power output warranty as per the technical specification shall be insured and backed up through an insurance policy of 10% of the total order value of the supplies by a reputed insurance company which will cover against the PV module power output warranty in case of insolvency or bankruptcy of the PV module manufacturer.

The module should be insured in compliance with the following clauses

1) To be insured from one of the companies:
    a. Munich RE
    b. Ariel RE
    c. Power Guard
    d. Swiss RE
    e. Any Reputed Indian Insurance Company
    Through their Indian authorized companies
2) In case of insolvency of the Contractor, the Owner under the terms of the insurance policy against Module Performance and Warranty shall be entitled to raise a claim against the Module Warranty Insurance Policy and in order to benefit from the coverage provided by the aforementioned policy. The Contractor shall be responsible for maintaining the coverage provided under the Module Warranty Insurance Policy at all times, at its cost and expense.
3) Further, the Contractor to note that Owner requires the following to be complied while covering the Warranty/Guarantee/Performance of the supplied goods under the insurance:
    a. Single Insurance Policy for Product Warranty/Guarantee and performance before dispatch of the first lot of PV Modules.
    b. The Insurance Policy shall be kept valid for the period for which output peak watt capacity is warranted (as a minimum), from the date of receipt of last batch/lot of equipment at site.
    c. The premium charges, recurring charges, any other expenditure under the Insurance Policy shall be covered by the Contractor.
    d. The insurer must continue to compensate end users for warranty claims for the product quality and/or performance even if Contractor ceases to exist as an independent operating company.
    e. The insurance shall be non-cancellable by the insurer and shall provide third party bankruptcy rights.
    f. Coverage under the insurance policy shall be immediate, without any waiting period.
4) The PV module power output warranty as per the technical specification shall be insured and backed up through an insurance policy by a reputed

insurance company which will cover against the PV module power output warranty in case of insolvency or bankruptcy of the PV module manufacturer. The Bidder shall submit a suitable insurance from Third Party. TVNL reserves right to accept or reject Insurance company based on its credential, market feedback etc.

3.11 Project Management Consultant and Third-Party Inspection Agency

3.11.1 A Project Management Consultancy (PMC) or Third-Party Inspection agency (TPI) may be appointed by TVNL, at its sole discretion, to conduct any kind of inspection/ joint inspection regarding procurement, fabrication, installation, hook-up, quality, execution, commissioning, operation and maintenance during the span of the Project. The Contractor shall provide necessary access and coordination to conduct such inspections. The Contractor shall provide all necessary access and cooperation for inspection by National or State agencies.

3.12 Right to Accept or Reject any or all bids

3.12.1 Notwithstanding anything contained in this Tender, TVNL reserves the right to accept or reject any Bid and to annul the bidding process and reject all Bids at any time without any liability or any obligation for such acceptance, rejection, or annulment, and without assigning any reasons thereof.

3.12.2 TVNL reserves the right to reject any Bid and appropriate the EMD if:

i. After reviewing the Bid, there is doubt that the offered works, materials, or equipment are not state of the art and/ or not suitable for the site operating conditions;

ii. At any time, a material misrepresentation is made or uncovered, or

iii. The Bidder does not provide, within the time specified by the TVNL, the supplemental information sought by TVNL for evaluation of the Bid.

3.12.3 Such misrepresentation/ improper response shall lead to the disqualification of the Bidder. If such disqualification/ rejection occurs after the Bids have been opened and the Successful Bidder gets disqualified/rejected, then TVNL reserves the right to:

a) Select the next Bidder with the Lowest Evaluated Bid Value as the Successful Bidder or

b) Take any such measure as may be deemed fit in the sole discretion of TVNL, including annulment of the bidding process.

3.12.4 In case it is found during the evaluation or at any time before signing of the Contract or after its execution and during the period of subsistence thereof that one or more of the pre-qualification conditions have not been met by the Bidder or the Bidder has made material misrepresentation or has given any materially incorrect or false information, the Bidder shall be disqualified forthwith, if not yet appointed as the Contractor either by issue of the LoI or entering into of the Contract Agreement, and if the Successful Bidder has already been issued the LoI or has entered into the Contract Agreement, as the case may be, the same shall, notwithstanding anything to the contrary contained therein or in this Tender, be liable to be terminated, by a communication in writing by TVNL to the Contractor, without TVNL being liable in any manner whatsoever to the Bidder or Contractor, as the case may be. In such an event, TVNL shall forfeit and appropriate the bank guarantees without prejudice to any other right or remedy that may be available to TVNL.

3.12.5 TVNL reserves the right to verify all statements, information, and documents submitted by the Bidder in response to the Tender Documents. Failure of TVNL to undertake such verification shall not relieve the Bidder of its obligations or liabilities hereunder, nor will it affect any rights of TVNL thereunder.

3.13 Net Electrical Energy Generation Guarantee (NEEGG)

3.13.1 The Bidder shall be required to quote the Net Electrical Energy Generation Guarantee (NEEGG) for a ten (10) year period. The Bidder shall give NEEGG per annum after considering the proposed configuration and all local conditions, solar insulation, wind speed, air temperature and relative humidity, barometric pressure, rainfall, sunshine duration, and all other factors and losses due to near shading, incidence angle modifier, irradiance level, temperature loss, array loss, module quality loss, module array mismatch loss, soiling loss, and various inverter losses, etc. To assess/ verify the feasibility of quoted NEEGG, Bidders are required to provide computation documents along with considered factors based on which NEEGG has been computed.

3.13.2 Bidders are expected to undertake their own study of the solar profile and other related parameters of the area and make sound commercial judgments about power output, i.e., Net Electrical Energy Guaranteed Generation. The site information and solar data provided in this Tender, except for the reference radiation for the twelve months, are only for preliminary information purposes. No claim or compensation shall be entertained on account of this information. It shall be the responsibility of the Bidder to access the corresponding solar insulation values and related factors of the solar plant, along with expected grid availability. The Bidder should access all related factors about the selected Project Site for the Project and quote the NEEGG for the proposed Project Site.

3.13.3 The Contractor shall be responsible for achieving NEEGG. For any shortfall in NEEGG corresponding to the offer, the compensation shall be recovered from the Contractor. The Contractor shall maintain the Plant equipment, including its repair, replacement, overhauling, etc., so as to give the agreed NEEGG per year, for which TVNL shall pay the agreed O&M Contract Price and the applicable taxes.

3.13.4 The Bids with NEEGG of less than or equal to 88,653 MWh for the first year shall be summarily rejected.

3.13.5 The NEEGG quoted for each consecutive year should have a maximum 0.5% annual degradation factor in NEEGG. If the bidder anticipates any degradation of the modules during the first year, it shall be taken care of to provide additional capacity of solar PV modules to meet guaranteed generation at the end of the first year to avoid liquidated damages/compensation on account of Performance Guaranteed Generation. The NEEGG of a consecutive year should not be more than the previous year's NEEGG. Bids not following these conditions shall be summarily rejected.

3.13.6 This NEEGG shall be used for the evaluation of the Bids as specified in Appendix 14.

----End of Section----

4 Submission of Bid

4.1 General Terms

4.1.1 A Bidder is eligible to submit the Bid for the Projects. Any form of Consortium is not allowed.

4.1.2 Along with the electronic submission of the Bid, the bid has to be also submitted in post as indicated in Clause 4.3 for Technical Bid.

4.1.3 Notwithstanding anything to the contrary contained in this Tender, the detailed terms specified in the draft Contract Agreement shall have an overriding effect, provided, however, that any conditions or obligations imposed on the Bidder hereunder shall continue to have effect in addition to its obligations under the Contract Agreement.

4.1.4 The Bid should be furnished in the formats mentioned in the Tender Document, which shall be duly signed by the Bidder's authorized signatory, provided that the Financial Proposal (priced) shall be submitted through online mode only as a signed and stamped pdf file and the Excel sheet shall also be uploaded in zip file through online mode.

4.1.5 The Bidder should submit a power of attorney as per the format given in "Appendix 11: Power of Attorney for the signing of Bid" authorizing the signatory of the Bidder to commit to the Bid.

4.1.6 Any condition or qualification or any other stipulation contained in the Bid other than those already existing in the Tender Document shall render the Bid liable to rejection as a non-responsive Bid. The complete Bid shall be without alterations, interlineations, or erasures, except those to accord with instructions issued by TVNL or as necessary to correct errors made by the Bidder, in which case such corrections shall be initiated by the person or persons signing the Bid.

4.1.7 The Tender Documents, Bid Documents, and all attached documents are and shall remain the property of TVNL and are transmitted to the Bidders solely for the purpose of preparation and the submission of a Bid in accordance herewith. Bidders are to treat all information as strictly confidential and shall not use it for any purpose other than for the preparation and submission of their Bid. TVNL will not return any Bid or any information provided along therewith.

4.1.8 Bidder shall note that Price Bid of only those Bidders shall be opened who are found technically qualified and responsive to TVNL's Tender terms and conditions, including but not limited to the Scope of Work.

4.2 Format and Signing of Bid

4.2.1 The Bidder shall provide all the information sought under this Tender. TVNL will evaluate only those Bids that are received in the required formats and complete in all respects.

4.2.2 The Bid shall be typed or written in indelible ink and signed by the authorized signatory of the Bidder, who shall also initial each page in blue ink. All the alterations, omissions, additions, or any other amendments made to the Bid shall be initialled by the person(s) signing the Bid.

4.3 Sealing and Marking of Bid

4.3.1 The Bid of the Bidder shall be contained in one (1) single "Main" Envelope.

4.3.2 The Main Envelope shall contain two (02) Envelopes as follows:

1) "Original" Envelope
2) "Copy" Envelope

4.3.3 The "Original and "Copy" Envelopes shall contain the following Envelopes:

a) Cover-I: Signed Copy of the Tender Document(s)
b) Cover-II: Enclosures of the Bid
c) Cover-III: Proof of EMD and Tender Fee

4.3.4 All original attested Tender Documents, Bid Enclosures, EMD and Tender Fee shall be contained in the "Original" Envelope.

4.3.5 Envelopes shall be clearly marked as "Original" and "Copy".

4.3.6 The content of documents uploaded on the https://jharkhandtenders.gov.in/nicgep/app and hard copies submitted should be the same, and in case of any discrepancy, all documents uploaded on the https://jharkhandtenders.gov.in/nicgep/app portal shall stay valid.

4.4 Enclosures of the Bid

4.4.1 Cover-I shall be duly marked as a "Signed copy of the Tender Document(s)" and shall include the duly signed and sealed Tender Document, including its annexure, appendices, attachments, amendments, and any other documents as added or modified by TVNL as per the provisions in this Tender.

4.4.2 The documents accompanying the Bid other than the attested Tender Document(s) and Proof of Tender Fee and EMD shall be placed in Cover-II and marked as "Enclosures of the Bid". These documents shall include:

a) The Covering Letter as per the format prescribed in Appendix 2: Format for Covering Letter.
b) Details of the Bidder as per format prescribed in Appendix 3: Format of Details of Bidder
c) Attested copy of Goods and Services Tax (GST) Registration Certificate of Bidder
d) Attested copy of PAN Card of Bidder.
e) Attested Certificate of Commencement of Business issued by the Registrar of Companies for the Bidder.
f) Attested copy of Provident Fund Code of Bidder.
g) Details of similar technical experience of the Bidder as per the format prescribed in Appendix 4: Format of Details of Similar Technical Experience.
h) Details of qualified technical staff as per format prescribed in Appendix 5: Format of Details of Qualified Technical Staff.
i) Curriculum Vitae of all qualified technical staff indicated in Appendix 5: Format of Details of Qualified Technical Staff.
j) List of proposed PV technologies as per format prescribed in Appendix 6: Format of Disclosure of PV Technology Proposed.
k) Project execution plan as mentioned in Appendix 7: Format of Project Execution Plan.

l) Declaration of Compliance as per format prescribed in Appendix 8: Format of Declaration of Compliance.

m) No Deviation Certificate as per the format prescribed in Appendix 9: Format of No Deviation Certificate.

n) Declaration of Bidder's relation to Directors of TVNL as per the format prescribed in Appendix 10: Format of Declaration on Bidder's Relation to Directors.

o) Power of Attorney by the Bidder authorizing the signatory as per the format prescribed in Appendix 11.

p) Format of Summary of Audited Financial Statements as per format prescribed in Appendix 12: Format of Summary of Audited Financial Statements.

q) (If applicable) Authorization of use of financial capability by Parent as per the format prescribed in Appendix 13: Format of Authorization by Parent with the necessary financial statements and summary required from the Bidder.

4.4.3 Cover–III shall be duly marked as a "copy of Proof of EMD and Tender Fee" and shall contain a copy of proof of Tender Fee and EMD.

4.4.4 All Bid documents (except the financial bid) shall be placed in hard binding, and the pages shall be numbered serially. Each page thereof shall be initialled in blue ink by the authorized signatory.

4.4.5 All envelopes in the Bid Documents shall be sealed. The outer envelope shall clearly bear the following identification:

Outer Envelope

"NIT no - 02/Solar/EPC/TVNL/RAN/2025-26, Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand.

Cover-I shall bear the following identification:

"Cover-I: Signed Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand. "

Cover -II shall bear the following identification:

"Cover-II: Enclosures of Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand. "

Cover -III shall bear the following identification:

"Cover-III: Proof of EMD and fee for Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand. ".

4.4.6 Each of the envelopes shall clearly indicate the name and address of the Bidder. In addition, the Bid Due Date should be indicated on the right-hand top corner of each of the Envelopes. Each of the envelopes shall be addressed to:

ATTN.:

Electrical Superintending Engineer (Solar Project)

Tenughat Vidyut Nigam Limited,

JUPMI Building Premises in ABD Area,

Ranchi Smart City, P.O & P.S - Dhurwa, Dist. : Ranchi, Jharkhand, 834004 - INDIA

4.4.7 If the envelopes are not sealed and marked as instructed above, the Company assumes no responsibility for the misplacement or premature opening of the contents of the Bid submitted.

4.4.8 Bids submitted by fax, telex, telegram, or e-mail shall not be entertained and shall be rejected.

4.5 Bid Due Date

4.5.1 Bids should be submitted before the Deadline for Submission of Bid as specified in NIT.

4.5.2 TVNL may, in its sole discretion, extend the Bid due date by issuing an Amendment/Addendum in accordance with Clause No.3.6 uniformly for all Bidders.

4.6 Late Bids

4.6.1 Bids received by TVNL after the specified time on the Bid due date shall not be eligible for consideration and shall be summarily rejected. In case it happens to be a holiday on the prescribed closing/opening day of the Bid, the next working day shall be treated as the scheduled prescribed day of closing/opening of the Bid.

4.7 Confidentiality

4.7.1 Information relating to the examination, clarification, evaluation, and recommendation for the Bidders shall not be disclosed to any person who is not officially concerned with the process or is not a retained professional advisor/ consultant advising TVNL in relation to or matters arising out of or concerning the bidding process. TVNL will treat all information submitted as part of the Bid in confidence and will require all those who have access to such material to treat the same in confidence. TVNL may not divulge any such information unless it is directed to do so by any statutory entity that has the power under law to require its disclosure or is to enforce or assert any right or privilege of the statutory entity and/ or TVNL.

4.8 Correspondence with the Bidder

4.8.1 The Company shall not entertain any correspondence with any Bidder in relation to the acceptance or rejection of any Bid.

4.9 Bid Opening and Evaluation

4.9.1 The Company shall open, examine, and evaluate the Bids in accordance with the provisions set out in this Tender.

4.9.2 To facilitate the evaluation of Bids, the Company may, at its sole discretion, seek clarifications in writing from any Bidder regarding its Bid.

4.9.3 After the receipt of Bids, the Company may, at its discretion, send a team of engineers and other staff, if necessary, to inspect the engineering facilities to ensure suitability and satisfactory working conditions at the Bidder's work(s)/yard(s) and equipment listed to be used by the Bidder for the work. The Bidder shall ensure that the aforesaid team shall at all times have access to visit and inspect works, equipment, etc.

4.10 Tests of Responsiveness

4.10.1 Prior to the evaluation of Bids, the Company shall determine whether each Bid is responsive to the requirements of the Tender. A Bid shall be considered responsive only if:

i. The minimum Performance Guaranteed of the Power Plant for one year is provided by the Bidder.
ii. It is received by the Bid due date, including any extension thereof;
iii. It is received in the manner prescribed in this Tender;
iv. It is accompanied by the requisite Tender Fee and EMD;
v. It is received with all the Enclosures of the Bid as prescribed in Clause 4.4;
vi. Its enclosures are received as per the formats specified in the Appendices as well as the Tender;
vii. It contains all the information (complete in all respects) as requested in this Tender (in the same formats as specified);
viii. It complies with all the terms, conditions, and provisions specified in this Tender, and it does not contain any conditions or deviations;

4.10.2 TVNL reserves the right to reject any Bid that is non-responsive, and no request for alteration, modification, substitution, or withdrawal shall be entertained by TVNL in respect of such Bid.

4.11 Modification and withdrawal of Bids

4.11.1 In case any clarifications are sought by TVNL after the opening of Bids, then the replies of the Bidder should be restricted to the clarifications sought. Any Bidder who modifies its Bid (including a modification which has the effect of altering the value of its Financial Proposal) after the opening of Bid without specific reference by TVNL shall render the Bid liable to be rejected without notice and without further reference to the Bidder and its EMD shall be forfeited.

4.11.2 Withdrawal or unsolicited modification of a Bid during this interval shall result in the Bidder's forfeiture of its EMD.

4.12 Evaluation of Bid and Selection of Bidders

4.12.1 TVNL will examine the Bid to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed and whether the Bid is generally in order.

4.12.2 Prior to the detailed evaluation, TVNL will determine the substantial responsiveness of each Bid. A substantially responsive Bid is one that conforms to all the terms and conditions of the Tender Documents without material deviations. Deviations from or objections or reservations to critical provisions such as those concerning EMD, Applicable Law, and Taxes and Duties will be deemed to be a material deviation. TVNL's determination of a Bid's responsiveness is to be based on the contents of the Bid itself without recourse to extrinsic evidence.

4.12.3 If the Bid is not substantially responsive, it will be rejected by TVNL and may not subsequently be made responsive by the Bidder by correction of the nonconformity.

4.12.4 TVNL will evaluate and compare Bids that have been determined to be substantially responsive.

4.12.5 Following factors shall be required for the evaluation of the Bid:

a) The Evaluated Bid Value (EBV) shall be calculated using the following parameters:
   i. Quoted Engineering Procurement Commissioning (EPC) Contract Price;
   ii. Quoted Net Present Value (NPV) of O&M Price of ten (10) years;
   iii. Quoted Net Electrical Energy Generation Guarantee; and
   iv. Constant parameters as indicated in the Tender on page 192.

b) The Bid with the Lowest Evaluated Bid Value (Rs. Per kWh) for Project shall be considered as L-1 as the Successful Bidder for Project. The Bid with the next highest value shall be considered as L-2, and so on. For more understanding, please refer to Appendix 15: Bid Evaluation Criteria (BEC). An example has also been done for Bidder's comprehension.

4.12.6 In no case, a Bidder shall have the right to claim to be the Successful Bidder for its Bid.

4.13 Contacts during Bid Evaluation

4.13.1 Bids shall be deemed to be under consideration immediately after they are opened and until such time TVNL makes official intimation of award/ rejection to the Bidders. While the Bids are under consideration, Bidders and/ or their representatives or other interested parties are advised to refrain from contacting, by any means, TVNL and/ or their employees/ representatives on matters related to the Bids under consideration.

4.14 Employment of Officials/Ex-official of TVNL

4.14.1 Bidders are advised not to employ serving TVNL employees. It is also advised not to employ ex-personnel of TVNL within the initial two-year period after their retirement/ resignation/ severance from the service without specific permission of TVNL. TVNL may decide not to deal with such firm(s) who fails to comply with this provision.

4.15 Declaration on Bidder's relation to director's

4.15.1 The Bidders are required to certify, in the prescribed format Appendix 10, whether he/they is/are related to any of the Directors/Senior Personnel of TVNL in any of the ways mentioned in the Certificate. It is clarified that any such affirmative certificate shall not, by itself, prejudice the consideration of the Bid. This certificate must accompany the Bid.

4.16 Letter of Intent (LOI)/ Work Order (WO) and Notification to proceed

4.16.1 After the selection of the Successful Bidder, a Letter of Intent (the "LoI")/ Work Order (the "WO") shall be issued, in duplicate, to the Successful Bidder. The Successful Bidder shall not be entitled to seek any deviation from the Contract as may have been amended by TVNL prior to the bid submission date.

4.16.2 On the issue of the LoI by the Company, the Authorized representative of the Successful Bidder shall sign the Contract Agreement within thirty (30) days and submit the Bank Guarantee within the stipulated time. The authorized representative of the Successful Bidder shall sign the Contract Agreement.

4.17 SD-Cum Performance Guarantee

4.17.1 The Successful Bidder shall, within thirty (30) days of the issue of the LoI/WO, submit the Performance Bank Guarantee as per the format prescribed in Appendix 18: Format of SD cum Performance Bank Guarantee and sign the Contract Agreement within the stipulated time.

4.17.2 The bank guarantee by the Contractor will be given from the nationalized bank. BG of any other Bank will not be treated as valid BG.

4.18 Fraudulent Practices

4.18.1 The Bidders may please note that TVNL shall not entertain any correspondence or queries on the status of the Bids received against this Tender. Bidders are advised not to depute any of their personnel or agents to visit TVNL's office to make such inquiries.

4.18.2 Any effort by a Bidder to influence TVNL on the Bid evaluation, Bid comparison, or Contract award decision may result in the rejection of the Bidder's Bid.

----End of Section---

5 Scope of Work

5.1 General Scope of Work

The bids are invited for the 50 MW (AC) Solar PV project at TTPS located at Lalpania, Bokaro.

5.1.1 The general scope of work for the 50 MW(AC) Solar PV power plant involves Design Engineering, Procurement and Supply and Construction (EPC), Commissioning and Operation, and Maintenance for 10 years (5 Years + 5 Years Extendable based on the performance of the vendor) of the grid-connected solar photovoltaic power plant, and evacuation of power into 220 KV Substation. The scope of work includes the Solar PV Technology Grid Interactive Solar PV Power Plant with associated HT and EHV overhead transmission line/underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV substation at TTPS, Lalpania, Bokaro, Jharkhand, including 10 (5+5) years' Operation and Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection.

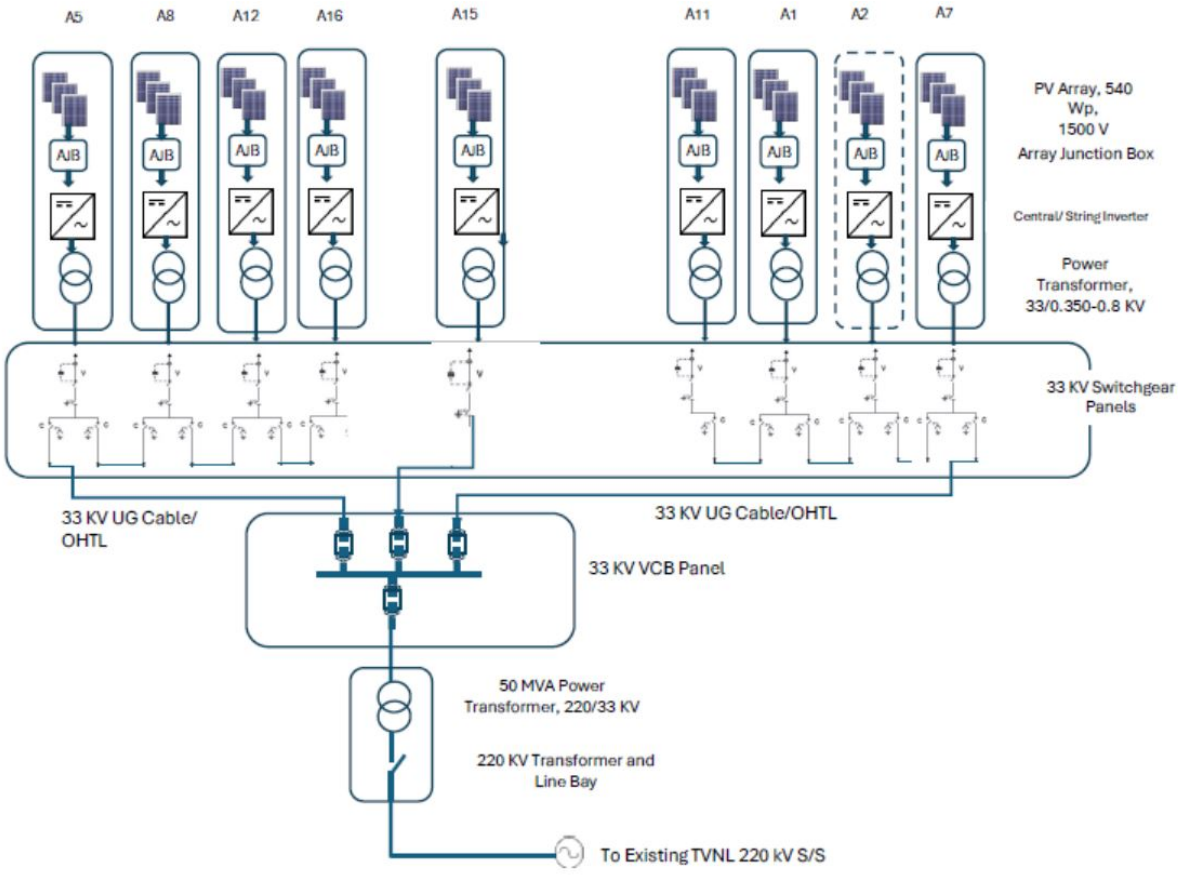
5.1.2 Evacuation of Power and Metering Point:

The evacuation of the generated solar PV power is proposed at 220 kV TTPS sub-station. Power shall be stepped up from each of the plots to 33kV using a Step-up transformer of suitable rating. As the plots are scattered, a ring main system of 33kV shall be used as per the requirement. Power from different plots shall be connected to the respective ring in 33 KV LILO (Line-In-Line-Out). Power of these rings shall be brought to a 2-IN-1-OUT 33kV HT Panel/ RMU, and the combined power shall be then stepped up to 220 kV using a 33/220 kV step-up transformer which shall be evacuated to 220kV Sabo sub-station with the help of protection Bay. The voltage variation in various power supply systems shall be considered as ±10%. Max. 25 MW can be evacuated in a single circuit at 33 KV level.

The Bidder shall be responsible for the supply, erection, and commissioning of a spare 33 kV VCB and TVM meter near Plot 12A for power distribution in the TTPS colony. Necessary arrangements must be made to ensure power supply in the event of a power failure in the colony area. Metering shall be provided at the HT panel through the TVM meter, which shall be accounted for in the guaranteed generation calculation.

The Bidder has to do the power evacuation and integration it to the 220 kV TTPS Lalpania substation via an overhead line with the double pole structure / underground cable at 220 kV grid voltage with all necessary infrastructure such as protection switchgear and metering systems as per the requirement of Discom/ Transco/ any other statutory authority.

Tentative Power Block Diagram



5.1.3 Details of Project SITE

50 MW (AC) Solar PV Project Site is situated at TTPS, Lalpania, Dist. Bokaro, Jharkhand, India. The feasible land is 188.11 acres, at Latitude of 23.727743N and Longitude 85.765547E. The land is in possession of TVNL. Ten (10) unutilized areas have been selected for the solar photovoltaic power plant at TTPS Lalpania, with a total of 188.11 acres of land identified as feasible for solar plant installation according to the land details. Below are details of selected plots for Solar Plant installation.

Sl. No.	Plot name	Plot area (Acre)	Details of the Land Location	Inside ** / Outside*	Remarks
1.	A-1	10.11	Opp. Main Gate up to ETP	Inside	
2.	A-2	4.42	Opp. ETP and Canteen	Inside	
3.	A-5	10.70	Area beside 400KV Switchyard	Inside	
4.	A-7	7.00	CW Intake and 220 KV Switchyard South	Inside	
5.	A-8	16.45	Track Hopper and Extension phase CHP	Inside	
6.	A-11	10.58	Area between Coal Yard and Fire Tender House	Inside	
7.	A-12 (b)	15.00	Land behind CISF Barrack along the drain canal up to Railway line & F-Type	Outside	Ash Filled Area
8.	A-15 (a)	69	Land between D Type to E Type up to Tilaya displaced Basti alongside the Ramgarh Road	Outside	
9.	A-15 (b)	4.85			
10.	A-16	40.00	Land along the other side of Ramgarh Road Market up to Sarna College Boundary	Outside	Partial Ash-Filled Area
Total Area (Acre)		**188.11**			

** Inside- means inside plant boundary.

* Outside- means outside plant boundary area but acquired land of Tenughat Thermal Power Station (TTPS) Lalpania adjacent to TTPS.

Bidders are requested to visit the site for actual assessment before quoting the bid. The scope of work includes Design, Engineering, Supply, Erection, Testing and Commissioning of 50 MW(AC) Grid Interactive Solar PV Power Plant with associated HT/EHV overhead transmission line / underground cable along with all required electrical equipment, construction of bays up to the point of interconnection at 220kV bays at TTPS Substation including 10 (5+5) years' Operation and Maintenance of Solar Power Plant and Evacuation System up to the point of interconnection at Bokaro, Lalpania, Jharkhand, India- 829149.

5.1.4 Operation and Maintenance (O&M)

The scope of work includes Operation and Maintenance (O&M) of the plant for ten (10) years (5 Years + 5 Years extendable based on the performance of the vendor), wherein the plant shall

generate at least equivalent to the guaranteed Performance of the Plant. Extension of the O&M period for 5 years is purely at TVNL's discretion. The Bidder shall submit in the Bid a comprehensive project execution schedule as well as an Operation and Maintenance (O&M) schedule with resource planning in the form of a Gantt chart and shall be liable for abiding by the schedule. It is the responsibility of the Contractor to perform the necessary maintenance/ timely replacement of all Civil /Mechanical/Electrical components of the project during this O&M period such that the guaranteed performance of the plant is not compromised. Any damage to Civil/Electrical/Mechanical components of the plant is to be reworked/ replaced/ supplied without any extra cost and time by the Contractor during the complete O&M period. The Operation and Maintenance shall be comprehensive. The maintenance service provided shall ensure the project functioning of the Solar PV system as a whole and the Power Evacuation System to the extent covered in the Contract. All preventive/ routine maintenance and breakdown/ corrective maintenance required for ensuring maximum uptime shall have to be provided. Accordingly, the Comprehensive Operation and Maintenance shall have two distinct components as described below:

a) Preventive / Routine Maintenance: This shall be done by the Contractor regularly and shall include activities such as cleaning and checking the health of the Plant, cleaning of module surface, tightening of all electrical connections, and any other activity that may be required for proper functioning of the Plant as a whole. Necessary maintenance activities, preventive and routine for Transformers and associated switchgear also shall be included. The schedule for maintenance activities shall be furnished by Bidder.
b) 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 of the fault, failing which the Contractor will be penalized as per terms and conditions of this Tender.
c) Predictive Maintenance: The Contractor shall carry out predictive maintenance using special diagnostic techniques and equipment to determine any possible major/minor deterioration and faults in the near future in the equipment used in the solar power plant.
d) The date of the Comprehensive Operation and Maintenance Contract period of the Plant shall begin on the date as defined in the NIT of this Tender. Detailed scope of comprehensive operation and maintenance has been described in Chapter 5 of this document. However, operation of the Power Plant means the operation of the system as per the bidding schedule and workmanship in order to keep the project trouble-free, covering the guarantee period.

5.1.5 Electrical Network:

Consisting of installation of solar PV modules, Array Junction boxes/string combiner boxes, and Fuse boxes/circuit breakers of approved make. Power Conditioning Units (PCU) of String/ Central shall be utilized in 50 MW (AC) with Crystalline Solar PV Technology. The total number of PCUs shall be as per the inverter capacity used. The 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 be in accordance with the AC output of the Inverter, the secondary voltage will be 33kV, and the Associated Switchgear of approved make shall be utilized. The Power transformer inside the switchyard should be of adequate capacity and Protection system. Total number of transformers shall be as per the designed numbers of units according to the inverter capacity. The Bidder has to do the power evacuation and integrate it to 220 kV Sabo substation via overhead line with the double pole structure/ underground cable at 220 kV grid voltage with all necessary infrastructure such as protection switchgear and metering systems as per the requirement of the TVNL/JSERC/CEIG. LT/HT Power and Control Cables, including end terminations and other required accessories for both AC and DC power. 415 TPN Distribution Board for catering to the lighting of the power station, including power plug, etc. Lighting fixtures, switches, receptacles, and necessary wiring for control room building and area lighting (yard LED lighting). Earthing system for PV Array, DC power system, lightning protection system, AC power system for both LT and HT, equipment, etc. for control room building, yard area, PCU, transformers and HT switch gear and lighting system, automatic weather station, SCADA and remote web-based communication and monitoring hardware, software, etc.; plant and human safety and protection equipment including danger signs etc. All statutory approval should be done by the Contractor at their own cost, like electrical, fire safety, and CEIG approval. Civil foundation work of transformers, switchgear, PV module mounting work, etc. The bidder has to construct a required capacity of switchyard inside the solar land parcel. Fabrication, supply and erection of cable trays, support, brackets, and accessories in case of site fabrication of cable tray. Supply of galvanized steel rigid/flexible conduits and accessories, home pipes, ferrules, lugs, glands, terminal blocks, galvanized sheet steel junction boxes, cable fixing clamps, nuts and bolts etc., as required. Supply of necessary steel materials for field fabrication of cable trays, supports, brackets, grounding system, etc. Construction of pathways inside the array and main approach road, entry gate, as required. Outdoor cable installation shall be trenched or underground as per the site requirement and site conditions, and the method for trenching and undergrounding cable shall comply with applicable IS standards. EPC Contractor shall arrange the water required for module cleaning, provision for project shall be made by Contractor to cater water requirement for module cleaning and other purpose. All relevant drawings, data sheets, technical catalogues on each piece of equipment/ devices and type test certificates shall be submitted. Materials and accessories that are necessary or usual for satisfactory and trouble-free operation and maintenance of the above equipment. Furniture for office use as per requirement. The contractor has to make the required power supply arrangement for the construction purpose from self/TVNL and should bear the nominal power charges for utilization of power for his construction work if power is supplied by TVNL. Adequate air Conditioner system along with required accessories shall be provided for each main control room. Air cooling system by employing ducting for each inverter and blower/suction fan along with required ventilation shall be provided as per requirement.

5.1.6 Civil and Other Non-Electrical Work

i. **Module Mounting Structures (MMS):** Successful Contractor shall design, fabricate, supply, and install module mounting structures with all required accessories like clamps, nuts, bolts, cable ties, etc. Fixed type OR single-axis seasonal type structures are acceptable.

ii. **Foundations:** Successful Contractor shall design and construct appropriate civil foundations for MMS, prefabricated structures, transformers, switchyard equipment, feeder bay, etc.

iii. **Prefabricated Structures:** The following prefabricated structures are to be planned and constructed by the Contractor for the projects.
   a. Main Control Room (MCR) including Invertors and office room with pantry and toilet unit: 2 number (Genets – 1 & Ladies – 1)
   b. Security Cabin near Plant Main Gate: 1 number.
   c. Necessary Approach Road and Drainage System shall be considered.

iv. **Solar PV Module Cleaning System:** The Contractor shall plan for one wash of all solar PV modules on a fortnightly basis. For this, the contractor shall create and operate a min. 1,00,000 -litre capacity Sintex water storage tank [FRP or HDPE (3 to 4 layers) water storage tank are also accepted] with the GI pipeline network, High Pressure pump & accessories, flexible hose pipe, etc. The contractor has to design and construct a water supply network as per the requirement of water for cleaning of PV modules (at least once every two weeks), Vegetation/ Gardening, and for daily uses.

v. **Boundary Wall for plots A-12, A-15 & A-16:** The Contractor shall provide a Pre-cast boundary or Fly Ash brick chipping boundary wall of a minimum 2-meter height with concertina coil above the wall of the designated A-12 (b), A-15(a), A-15 (b) & A-16 plot of the entire plant boundary with a gate of structural steel material.

vi. **Chain-Link Fencing:** The Contract or shall provide chain-link fencing for all the internal plots.

vii. **Cable Trenches**: Construction of RCC cable trenches with cable trays and chequered plate covers in control rooms, earthen excavated cable trench with alternate layers of sand and brick as per relevant IS from PV arrays to control room to 33 KV Evacuation and up to Take over point provide by TTPS shall be provided by the Contractor.

5.1.7 **Site levelling:** The Contractor shall level the site, as required, so as to compact the plant in the minimum possible area and also minimize shading losses because of other objects and solar PV module structures.

5.1.8 **Communication:** The Contractor shall provide complete plant SCADA with a SCADA server having string-level monitoring capabilities over a remote server. The contractor shall lay the Fiber optic cable in the appropriate cable trench, connect it with suitable connectors, and terminate it to the SCADA server inside the control room. The Contractor shall also provide the necessary internet connection through GPRS enabled modem along with LAN connectivity / Broadband for data communication over a remote server and shall bear the cost of the same during the Contract period, including O&M. The Contractor shall provide the necessary provision of RTU for communication with SLDC. The Contractor shall submit the below-mentioned Technical Data Sheet for String RTU, TCP String, and Central RTU in the prescribed format.

Type Code
Power Entry Characteristics
AC input voltage range (V ac, min V ac, max)
Nominal AC input voltage (V ac,n)
Rated frequency (fr)
DC Input Voltage Range (V dc,min..V dc,max)
Nominal DC input voltage (Vdc,n)
RS485 Section
Serial interface type
Baud rate
Protocol
Number of devices
Line biasing resistor (wherever necessary)
Termination resistor
RS485 MODBUS section
Serial interface type
Baud rate
Protocol
Number of devices
Line biasing resistor (wherever necessary)
Termination resistor
Physical and Environmental
Environmental protection rating
Ambien temperature range
Relative humidity
Compliance
Isolation
Marking
Safety and EMC standard

An essential list of I/O and equipment is given herewith, but the scope is not limited to the Essential List. The contractor is fully responsible for providing a complete SCADA System that can be extensible/communicable with an additional/future solar plant.

Sr.	Equipment to be monitored	Data to Be Monitor (Real Time)	Type of IO
1	String Junction Box Monitoring / Array Monitoring	Each PV string Junction Box needs to be monitored	Through Communication with SJB PLC/Card
2	String Junction Box / Array Junction Box (SJB = AJB)	SJB internal temperature and SJB Bus Voltage and Current	Through Communication with SJB PLC/Card
3	Inverter	All Electrical Parameters of the Inverter, along with Scanning, Records, Error communication	Through Communication with SJB PLC/Card
4	Inverter Transformer	Oil and Winding Temp Monitoring	Analog Input
5	33 KV VCB Panel	ON/OFF and Trip position of Each Breaker and Energy Meter communication	Through DI and Communication and RS-485/MODBUS for Energy Measurement
6	Weather Monitoring Station	Two no. of Class I Pyranometer (one for GHI, one at PV plane collector angle), Two numbers of contact type temperature sensors, one at module front and the other at backside of the module. Ambient temperature sensor, Wind velocity and speed sensor.	Through Communication
7	Main and Check Meter	All electrical parameters recorded by an energy meter	Through RS-485/ MODBUS communication
8	220/33 KV Switchyard	All Electrical components of the switchyard	Through DI and DO Communication and RS-485/MODBUS for Energy Measurement

5.1.9 Plant Safety Equipment

The Contractor shall provide appropriate numbers of foam-type fire extinguishers / CO2 extinguishers, sand buckets, and transformer discharge rods at the Inverter Rooms, Control Room, Security Cabin, and Switchyard/Substation. Further, all high voltage places are to be provided with danger sign boards with appropriate size and material to last for 25 years.

5.1.10 Statutory Requirements

All construction, operation and maintenance procedures shall be carried out through appropriate, relevant standards and regulations laid by TVNL / CEIG / MNRE and/or any other agency as and when applicable. Further, this shall comply with the applicable labour laws. The Bidder shall make themselves aware of such requirements and shall not solely depend on the Company to avail full information.

5.1.11 Planning and Designing

i. The Contractor shall plan and design for the electrical/mechanical/civil requirements, including but not limited to plant configuration, space optimization, the distance between rows of modules, sufficient passage for vehicle and man-power movement in the plant, mounting structures, location of Control room, cable routing, selection of equipment and items, procurement plan etc. to enhance plant output.

ii. The Contractor has to carry out the complete soil investigation of the site, through Government approved laboratory before designing various civil structures. The design of all civil foundations, R.C.C. structures, buildings etc. will be carried out considering the appropriate seismic zone of the area. All appropriate loads, wind velocity, seismic factors etc. will be considered as per the relevant IS Specifications while designing any Civil/Mechanical/Electrical structure. Also, the environmental conditions, soil characteristics, atmospheric effect, groundwater table level, rainwater data, land profile, etc. will be considered as per site condition and accordingly appropriate precautions, preventive measures such as applications of the Epoxy to Underground concrete structure and application of sufficient galvanization to steel structure will be taken while designing the structures. RCC of the appropriate grade will be adopted considering the surrounding weather and soil effect of the site and as per the relevant I.S. standard specifications. The concrete mix design of required strength shall be carried out in Govt. approved laboratory and shall be submitted to the client for approval.

iii. The Contractor shall take into consideration all parameters like wind speed, seismic zone, safety factor, and safe Soil Bearing Capacity (SBC) etc., for the purpose of design and construction of civil foundations for all civil work as per relevant IS codes.

iv. The Contractor shall carry out Shadow Analysis at the site and accordingly design strings and arrays layout considering optimal usage of space, material and labour.

v. All designs and drawings shall be developed based on the governing standards and requirements of the project and also keeping in mind basic design specifications. The company may approve minor deviations or suggest required modifications that are meant to increase plant performance without sacrificing quality/workmanship norms.

vi. All designs, specifications, reports, etc., submitted or used by the Contractor at any point in time shall first be approved by the Company /Consultant and revised by the Company /Consultant, if required, prior to execution.

vii. The technology offered shall be commercially established technology, and at least one Project based on this technology shall be satisfactorily operational for at least one year in India. Details of the Project with location and the successful operational period of the Project utilizing this technology shall also be mentioned before the submission of the first set of drawings for approvals.

viii. The Company reserves the right to modify the specifications at any state as per local site conditions/requirements and the EPC contractor shall comply with modification without any extra cost and time.

5.1.12 Approval of Design/Drawings:

i. The following procedure must be followed for the assessment and approval of designs, specifications, and drawings during the course of the project: The Contractor shall submit to the Company/Consultant the documents in hard copy and soft copy both with proper reference and drawing numbers. Three sets of drawings to be submitted in hard copy. The respective documents for the selection, supply, installation, erection, and commissioning of equipment/ structures have to be submitted at least 20 days in advance of the planned start of the activity as per the Contractor's project schedule. The Contractor shall submit documents as required for this project according to his design and specifications. The Company / Consultant (on behalf of the Company) will assess and approve the documents within 7 Working days of submission of documents, and only after the approval the Contractor shall release the documents for site execution. The documents shall be revised by the Contractor as per instructions /comments given by the Company / Consultant (on behalf of the Company), if required, prior to execution. Subsequent revisions and the final version of the documents shall also be submitted in hard and soft copy to the Company and the Consultant. The Contractor has to take into account the above-mentioned process of revisions (if required) and adjust the preparation and delivery of the documents such that the overall planned project schedule is not affected.

ii. The Contractor has to submit all drawings that are related to the plant for approval, and the Contractor shall not claim any drawing as their intellectual property. The drawing which is developed for the project will be the intellectual property of the Company.

iii. The Contractor shall submit a comprehensive project management schedule in the form of a Gantt chart CPM/PERT chart and shall be liable for abiding by the schedule.

iv. The Bidder shall submit in the Bid basic engineering drawings of all civil work, including but not limited to the layout of the power plant indicating rows of photovoltaic modules, the layout of different buildings, basic MMS design, civil foundations, location of control panels, DC and AC Distribution Boxes and anchoring design/details, electrical SLD, shading analysis and generation estimation report etc.

v. The bidder shall submit in the Bid technical specifications/drawings/designs and datasheets for all electrical work, including but not limited to electrical components of the power plant,

including photovoltaic modules, cables, connectors, junction boxes, inverters, transformers, monitoring and auxiliary systems, etc.

vi. The Contractor shall submit a comprehensive maintenance schedule for the operation and maintenance of the photovoltaic power plant along with checklists before the commencement of work on-site and shall be liable for abiding by the schedule. All construction, operation and maintenance procedures shall be carried out through appropriate relevant standards, regulations and labour laws.

5.1.13 Final Commissioning

The commissioning procedure shall be as per TVNL/ Chief Electrical Inspector to Government (CEIG) requirements. The Contractor shall also ensure the following:

i. Obtaining a written certificate of commissioning of the facility and permission to connect to the grid from the office of the Chief Electrical Inspector of the state and any other authorized representative from the Government of India (GoI)/ GOJ/ TVNL / JUVNL.
ii. Inspection and successful electrical commissioning certificate from the Company.
iii. Satisfactory completion certificate towards completion of all other contractual obligations by the Contractor as stipulated by the Company.

5.1.14 Comprehensive Operation and Maintenance Contract:

The Bidder shall separately quote in Appendix 14 for the Operation and Maintenance of the power plant for Ten (10) Years (5 Years + 5 Years Extendable based on the performance of the vendor), wherein the plant should perform at a minimum annual NEEGG derated every year by not more than 0.5% referring to the installed AC capacity of the plant indicated by the Bidder. Any damage to the Civil/Electrical/Mechanical components of the plant is to be reworked/replaced/supplied without any extra cost and time by the Contractor during the maintenance period. This means after the completion of the O&M period, every component of the plant should be in good and working condition.

Disclaimer: Any civil/electrical/other work that is not mentioned or included in this Tender document but necessary for the construction and O&M of 50 MW (AC) Solar PV plants at Tenughat Thermal Power Station, Lalpania, District-Bokaro, shall be borne by the Contractor. The Contractor shall, unless specifically excluded in the Contract, perform all such works and /or supply all such items and materials not specifically mentioned in the Contract/ Tender Document but can be reasonably inferred from the Contract as being required for attaining completion, commissioning and performance of the facilities, delivering NEEGG and maintaining the plant and achieving NEEGG during O&M period of 50 MW (AC) Solar PV plant, as if such work and/or items and materials expressly mentioned in the Contract without any extra cost implication and liability to TVNL. All specifications mentioned in this Tender indicate a minimum technical requirement. The Contractor may propose alternate specifications or design, though the final acceptance of the same is subject to the Company's discretion.

5.2 DETAILED ELECTRICAL WORK:

5.2.1 Photovoltaic Modules

5.2.1.1 **Standards and Codes:** Photovoltaic Modules shall comply with the specified edition of the following standards and codes (IEC) or equivalent Indian Standards, wherever applicable

Standards Description	
IEC 61215/ IS 14286	Design Qualification and Type Approval for Crystalline Silicon Terrestrial Photovoltaic (PV) Modules
IEC 61701- As applicable	Salt Mist Corrosion Testing of Photovoltaic (PV) Modules
IEC 61853- Part 1/ IS 16170: Part 1	Photovoltaic (PV) module performance testing and energy rating –: Irradiance and temperature performance measurements and power rating
IEC/IS 61730-1,2	Photovoltaic (PV) Module Safety Qualification – Part 1: Requirements for Construction, Part 2: Requirements for Testing
IEC TS 62804-1	Photovoltaic (PV) modules - Test methods for the detection of potential-induced degradation (PID). IEC TS 62804-1: Part 1: Crystalline silicon (Mandatory for system voltage is more than 600 VDC and advisory for system voltage is less than 600 VDC)
IEC 62759-1	Photovoltaic (PV) modules – Transportation testing, Part 1: Transportation and shipping of module package units

5.2.1.2 **Technical Requirements:** The total solar PV array capacity (kWp) should not be less than the allocated capacity (kW)

Parameter	Specification
Cell/ Module Technology	Mono-crystalline (mono perc half-cut cell panel ≥ 540Wp configuration)
Module Efficiency	≥ **21.0**%
Rated power at STC	No negative tolerance is allowed.
Temperature co-efficient of power	better than -0.35%/°C
Application Class as per IEC 61730	Class A
Fill Factor (FF)	Greater than or equal to 80%

5.2.1.3 **Component Specifications:** The PV Modules glass panel shall be:

i. Monofacial or Bi-facial Mono-PERC PV modules of a minimum of 540 Wp shall be used in the project.
ii. For PV Modules with a back sheet, toughened low iron glass with a minimum thickness of 3.2 mm for mono-crystalline modules in case of mono facial modules.
iii. In the case of glass-glass PV Modules, glass thickness shall be a minimum of 2 mm on each side. It shall be laminated using a laminator with a symmetrical structure, i.e., heating plates on both sides. PV modules must be warranted with a linear degradation rate of power output.
iv. The glass used shall have a transmittance of above 90%.

v. The back sheet used in the PV modules shall be a three-layered structure with an outer (air side) layer having fluoropolymer or a material with superior UV stability properties. The back sheet shall have the following properties:

Parameter	Specification
Material thickness	≥ 300 microns
Water vapor transmission rate	< 2 g/m2 /day
Partial discharge test voltage	≥ 1500 V
Elongation at break	> 100%
Adhesion strength with encapsulant	> 40 N/cm
Interlayer adhesion strength	> 4 N/cm

The Client reserves the right to conduct a Pressure Cooker (PC) test/ Highly Accelerated Stress Test (HAST) to confirm the durability of the back sheet in accelerated conditions.

vi. The encapsulant used for the PV modules should be UV-resistant and PID-resistant in nature. No yellowing of the encapsulant with prolonged exposure shall occur.

vii. The sealant used for edge sealing of PV modules shall have excellent moisture ingress protection with good electrical insulation (Breakdown voltage >15 kV/mm) and good adhesion strength. Edge tapes for sealing are not allowed.

viii. The module frame shall be made of anodized Aluminium, which shall be electrically and chemically compatible with the structural material used for mounting the modules. It is required to have provision for Earthing to connect it to the Earthing grid. The anodization thickness shall not be less than 15 microns.

ix. The material used for the junction box shall be UV-resistant to avoid degradation during module life. The degree of protection of the junction box shall be at least IP 67. Minimum three bypass diodes and two IEC 62852/EN 50521 certified MC4 compatible connectors with an appropriate length of IEC 62930/EN 50618 certified 4 sq.mm copper cable shall be provided. The cable length shall be in accordance with the PV Module wiring strategy and adequate to ensure that the cable bending radius standard is not exceeded.

x. Protective devices against surges at the PV module shall be provided. Low voltage drop bypass diodes shall be provided.

xi. All materials used for manufacturing solar PV modules shall have a proven history of reliability and stable operation in external applications. It shall perform satisfactorily in relative humidity up to 85% with temperature between -40°C to +85°C and shall withstand adverse climatic conditions, such as high-speed wind, blow with dust, sand particles etc., for wind speed of 180 km/hr on the surface of the panel as per IEC 61730.

xii. Each PV Module shall be provided an RFID tag, which is embedded inside the module lamination and must be able to withstand harsh environmental conditions. The RFID database shall contain the following information. RFID scanner and database of all the modules containing the following information shall also be provided.
   a) Name of the manufacturer of the PV Module
   b) Name of the Manufacturer of Solar cells

c) Month and year of the manufacture (separately for solar cells and module)
d) Country of origin (separately for solar cells and module)
e) I-V curve for the module
f) Peak Wattage, Im, Vm and FF for the module
g) Unique Serial No. and Model No. of the module.
h) Date and year of obtaining IEC PV module qualification certificate
i) Name of the test lab issuing the IEC certificate

j) Other relevant information on the traceability of solar cells and modules as per ISO 9000 series.

5.2.1.4 **Warranty:**

i. PV modules must be warranted with a linear degradation rate of power output except for the first year (maximum 3% including LID) and shall guarantee 90% of the initial rated power output for the first 10 Years and 80% of the initial rated power output at the end of 25 years from the date of supply.
ii. The modules shall be warranted for a minimum of 10 years against all material/ manufacturing defects and workmanship from the date of supply.
iii. The above warranties shall be backed by the OEM of the module. OEM shall issue the above warrantee certificate directly in the name of TVNL.
iv. The manufacturer should warrant the output of Solar Module(s) If Module(s) fail(s) to exhibit such power output in the prescribed time span, the Contractor will either deliver additional PV Module(s) to replace the missing power output with no change in area used or repair or replace the PV Module(s).

5.2.1.5 **Manufacturing and Inspection:**

The sampling will be carried out at the factory in the presence of a TVNL representative. The ISO 2859 standard shall be followed for sampling and IEC Standards for sample testing and acceptance shall be followed to compare the test results. In the case where the tests show non-conformity to the tender document and/or have an impact on plant performance and guaranteed generation of the plant, the Contractor shall compensate by replacing or adding the module capacity at the sole discretion of TVNL. The cost of these tests shall be borne by the Contractor. The contractor should coordinate with the TVNL Authorized Representative for scheduling of inspection and testing. The Contractor shall inform the client of the module manufacturing schedule at least 7 (seven) working days before the start of the proposed schedule. The client or their representative shall perform a material inspection at the Manufacturer's factory before the start of the proposed manufacturing schedule. Proof of procurement of components as per the approved BOM mentioning manufacturer name, manufacturing date and relevant test certificate shall be submitted during material inspection for verification. The Manufacturing shall start only after the clearance by the TVNL or their representative after the material inspection. The cells used for module making shall be free from all defects like edge chipping, breakages, printing defects, discoloration of the

top surface etc. Only Class A solar cells shall be used. The modules shall be uniformly laminated without any lamination defects. The current binning of modules shall be employed to limit the current mismatch of modules. Different colour codes shall be provided on the modules as well as pallets for the identification of different bins. A maximum of three numbers of bins will be allowed for each module rating.

i. Determination of module efficiency under standard test conditions - A sample of Modules for 50 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.
ii. Determination of modules peak power rating on STC condition under PID test sample of modules for 50 MW (AC) shall be tested.
iii. Low insolation tests with 200, 300, 400, 500 and 800 w/sqm. - A sample of modules for 50 MW (AC) shall be tested.
iv. Determination of cell cracks snail trail and connection errors through electroluminescence testing and normative-actual value comparison of characteristic parameters. - A sample of modules for 50 MW (AC) shall be tested.
v. Determination of EVA cross-linking degree. - A sample of modules for 50 MW (AC) shall be tested.
vi. Wet leakage test - A sample of 1 module for 50 MW (AC) shall be tested.
vii. Mechanical load test - A sample of 1 module for 50 MW (AC) shall be tested (half of the modules from previous tests and half new).
viii. Dynamic load test - A sample of 1 module for 50 MW (AC) shall be tested (half of the modules from previous tests and half new).
ix. Peel test. - A sample of 1 module for 50 MW (AC) shall be tested (one of the modules from previous tests and one new).
x. The Contractor shall provide the necessary testing reports to the TVNL as and when required.
xi. Neither the waiving of inspection nor acceptance after inspection by TVNL shall, in any way, absolve the Contractor of the responsibility of supplying the plant and equipment strictly in accordance with specifications and drawings etc.

5.2.1.6 **On-Site Tests:**

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

i. Establishment of string capacity.
ii. A sample of 5 strings /MW shall be tested.
iii. Measurement temperature of the PV modules with a thermal image camera with respect to the neighbouring cells shall be carried out at the site a sample of 1/500 shall be tested. In case of a failure rate > 10%, the sample shall be increased to 1/100.

iv. Inspection of the MMS corrosion protection as per applicable IS/ASTM (Shall be carried out at the site by a 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.

5.2.1.7 **Pre-dispatch Inspection of PV Modules at Manufacturing Facility:**

The Contractor shall provide a pre-dispatch inspection call to TVNL/authorize 3rd party agency for inspection at manufacturer works for PV Modules, as per TVNL-approved drawings. Prior to inviting TVNL /authorize 3rd party agency for pre-dispatch inspection, the vendor shall submit a detailed quality assurance plan (QAP) for TVNL approval. QAP shall include type tests, routine tests, factory acceptance tests, sampling plans, applicable standards, etc. For all bought-out items, test certificates as per relevant standards shall be submitted along with factory acceptance test reports. After the inspection, a complete set of test reports shall be submitted for dispatch clearance. All the travel charges along with boarding and lodging for TVNL or authorized inspectors shall be borne by the EPC contractor.

5.2.1.8 **Insurance:**

The Contractor shall bear the responsibility to arrange PV module insurance for the entire contract period, encompassing all the probable risks associated with the PV Modules. The insurance should also cover the product warranty and performance warranty. All the expenses in relation to such insurance of the project will have to be borne by the Contractor. The insurance shall be in the name of TVNL, and the policy shall be submitted to TVNL. The performance warranty shall be specifically a warrant and indemnity insurance against excessive loss of output of the PV module. A draft of the insurance should be submitted to TVNL. The Contractor shall provide the electrical characteristics of a typical solar PV module that is a representative sample of proposed modules, including current-voltage (I-V) performance curves and temperature coefficients of power, voltage and current. Modules shall be provided with a junction box determined to make and length of cable and connectors, as prescribed in the IEC certification for the selected module. These shall be approved by TVNL.

5.2.2 Junction Box/Combiner Box:

5.2.2.1 **Standards and Code:**

Standard/Code	Description
IEC 60529	Enclosure Ingress Protection
IEC 62262	Enclosure Impact Protection
IEC 60269	Fuse
IEC 61643-11	Surge Protection Device
IEC 62852 or EN 50521	Solar cable connector
IEC 60695-2-11	Fire hazard testing

5.2.2.2 **Construction:**

i. SCB The string combiner boxes shall be dust, vermin, waterproof and sunlight/ UV resistive as well as fire-retardant and must have minimum protection to IP 65, and mechanical impact resistance shall be at least IK08. Protection Class II. The terminals will

be connected to the 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.

ii. SCB shall be designed for ambient temperature in summer up to 60 degrees 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.

iii. SCB shall have designed Inputs of 8 /14/16 /24, with suitable current rating (Isc) and fuses holder as per applicable IS standard for each input. This rating (Isc) shall be finalized during the engineering and design review phase. In each SCB, 5% spare terminals along with cable glands and fuse rounded off to the next higher integer shall be provided to connect the PV strings.

iv. Every SCB input shall be provided with fuses on both positive and negative sides. In the case of a negative grounded system, fuse at the positive side only is acceptable. The rating of the fuses shall be selected such that it protects the modules from reverse current overload.

v. 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 IEC60269-1. String fuses should be so designed that it should protect the modules from reverse current overload. Fuses or Isolation Links shall be mounted in pull-out type fuse holders. Fuse holders shall be suitable for DIN rail mounting. PCB-mounted fuses are not acceptable. The fuse rating for single and combined input (limited to two) shall be 15 A and 30 A, respectively, suitable for 1000/1500 Volt for the crystalline module. The fuse rating shall be decided during detail engineering. In the case of a negative grounded system, the requirement of string fuses as well as inverter input fuses on the negative side shall be decided based on the recommendation of the Inverter (PCU) manufacturer.

vi. 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, a Surge Protection Device (SPD) shall be provided for the data /communication circuit.

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

viii. Output: 1500V DC, Solar Connectors: Push in Type no need to crimp the connections.

ix. SCB shall be finger-touch proof and have adequate safety labels of instructions.

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

xi. MC4 connector conforming to IEC 62852 or EN 50521 shall be provided at each SCB input. A cable gland (double compression metallic) of suitable size for DC cables shall be

provided at the SCB output. UV-resistant printed cable ferrules for solar cables and communication cables and punched/ embossed aluminium tags for DC cables shall be provided at cable termination points for identification.

xii. String-level monitoring shall be provided in the SCB, along with necessary surge protection in case of the central inverter. Monitoring of various parameters at dual string level with Y type of connector shall be made possible in the Main Control Room at the site by installing the suitable string monitoring system any fault at the string level could be recognizable by that system. Each of these input strings is to be monitored for string current.
   a) Monitoring Device: Shunt type as per IEC61010-1 and IEC 61326-1 Certified
   b) Output Total voltage and current to be monitored.
   c) The system shall be able to operate in error-free and trouble-free mode at the ambient 60-degree temperature (and internal combiner box temp of 70°C).
   d) Memory mapping of the communication devices shall be submitted for SCADA integration.
   e) Mounting arrangements, installation manual and operation and maintenance manual shall be shared.
   f) The contractor shall submit the GTP, QAP, TUV/UL/equivalent certifications, performance/experience certificate, detailed datasheet, and heat load calculations of the String Combiner Box and string monitoring system to TVNL for approval.

5.2.2.3 **Type Test:**

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

i. Temperature rise test on the complete assembled box as per the acceptable limit mentioned in the relevant clauses.
ii. Type test for the enclosure as per code and standard mentioned in the relevant clauses.
iii. Thermal ageing

5.2.2.4 **Warranty:**

The SCB unit shall be warranted against all material/ manufacturing defects and workmanship for a minimum of 2 (two) years from the date of supply. The warranty certificate shall be issued by OEM directly in the name of TVNL.

5.2.3 String Inverter /Power Conditioning Unit (PCU)

5.2.3.1 **Standards and Code:** The Power Conditioning Unit (PCU) /String Inverter shall comply with the specified edition of the following standards and codes.

Standard/Code	Description
IEC 61683 Ed. 1	Photovoltaic systems - Power conditioners - Procedure for measuring efficiency
IEC 62109-1 Ed. 1	Safety of power converters for use in photovoltaic power systems - Part 1: General requirements

IEC 62109-2 Ed. 1	Safety of power converters for use in photovoltaic power systems - Part 2: Particular requirements for inverters
IEC 61000-6-2 Ed. 2	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standards for industrial environments
IEC 62116 Ed. 2	Utility-interconnected photovoltaic inverters - Test the procedure of islanding prevention measures
IEC 60068-2-1:2007	Environmental testing - Part 2-1: Tests - Test A: Cold
IEC 60068-2-2:2007	Environmental testing - Part 2-2: Tests - Test B: Dry heat
IEC 60068-2-14:2009	Environmental testing - Part 2-14: Tests - Test N: Change of temperature
IEC 60068-2-30:2005	Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)
IEC 61727/ VDE 0126	Photovoltaic (PV) systems Characteristics of the utility interface Testing include Flicker, DC injection, Harmonics and waveform distortion, Power factor, Loss of utility voltage, Over/under voltage and frequency, Islanding protection and Response to utility recovery.
IEEE 519	Defines the voltage and current harmonics distortion criteria for the design of electrical systems
CEA Technical Standards for Connectivity to the Grid Regulations 2007 with 2013 and 2019 Amendment	
Inverters used in grid-connected solar power projects shall be registered with BIS and bear the Standard Mark as notified by the Bureau of Indian Standards.	

5.2.3.2 **Technical Requirements:**

Parameter	Specification
Rated AC power	As per design
Maximum input voltage	1500 V
Rated AC output voltage	As per design
Tolerance on rated AC output voltage	+/-10%
Rated frequency	50 Hz
Operating frequency range	47.5 Hz to 52 Hz
Power factor control range	0.9 lag to 0.9 lead
European efficiency	Minimum 98%
Maximum loss in Sleep Mode	0.05% of rated AC power
Total Harmonic Distortion	Less than 3% at rated capacity IEEE 519
Degree of protection	Central Inverter – IP 21 (Indoor), String Inverter – IP 65

i. The rated/nameplate AC capacity of the PCU shall be the AC power output of the PCU at 50°C.

ii. Maximum power point tracker (MPPT) shall be integrated with the PCU to maximize energy drawn from the Solar PV array. The MPPT voltage window shall be sufficient to

accommodate the output voltage of the PV array at extreme temperatures prevailing at the site.

iii. The PCU output shall always follow the grid in terms of voltage and frequency. The operating voltage and frequency range of the PCU shall be sufficient to accommodate the allowable grid voltage and frequency variations.

5.2.3.3 **Construction:**

i. Power Conditioning Unit (PCU) shall consist of an electronic three-phase string inverter along with associated control, protection, filtering, measurement and data-logging devices.
ii. Every DC input terminal of PCU shall be provided with fuse / MCB / MCCB of appropriate rating. The combined DC feeder shall have suitably rated isolators for safe start-up and shutdown of the system. One spare DC input terminal shall be provided for each PCU. String inverters without a DC fuse may be acceptable in case not more than two strings are connected to the same MPPT.
iii. Type-II surge protective device (SPD) conforming to IEC 61643-11 / IEC 61643-31 / EN 50539-11 shall be connected between positive/ negative bus and earth.
iv. In case an external auxiliary power supply is required, UPS shall be used to meet the auxiliary power requirement of PCU. It shall have a backup storage capacity of 2 hours.
v. Circuit Breaker or Relay of appropriate voltage and current rating shall be provided at the output to isolate the PCU from the grid in case of faults.
vi. The PCU shall be tropicalized, and the design shall be compatible with conditions prevailing at the site. A suitable number of exhaust fans with proper ducting shall be provided for cooling, keeping in mind the extreme climatic condition of the site as per the recommendations of OEM to achieve the desired performance and life expectancy.
vii. All the conducting parts of the PCU that are not intended to carry current shall be bonded together and connected to dedicated earth pits through protective conductors of appropriate size. DC negative terminal shall be grounded. In case DC negative grounding is not possible, an appropriate anti-PID device shall be provided.
viii. A dedicated communication interface shall be provided to monitor the PCU from SCADA.
ix. PCU front panel shall be provided with LCD/ LED to display all the relevant parameters related to PCU operation and fault conditions. It shall include, but not be limited to, the following parameters.
    a) DC input power
    b) DC input voltage
    c) DC input current (for each terminal)
    d) AC output power
    e) AC output voltage (all the 3 phases and line)
    f) AC output current (all the 3 phases and line)
    g) Frequency
    h) Power Factor
x. In the case of outdoor PCU, PCU without LCD display with provision for Data access over Bluetooth / Wi-Fi shall be acceptable.

xi. String inverter, if installed in the open, shall be placed inside a canopy shed with at least 15 cm in all directions. Alternatively, the Contractor may install the inverter on the column post of the Module Mounting Structure below the modules. In such a case, the canopy is not required, and the column and foundation shall be designed accordingly.

xii. AC combiner box for string inverter configuration shall comply with Clauses of the Technical Specifications with the exception of the following.

a) Rated System Voltage – Inverter Output Voltage
b) IP Rating – IP 5X (Indoor)
c) Metering System – Not required.

5.2.3.4 **Operating Modes:**

Operating modes of PCU shall include but are not limited to, the following modes. These operating modes and conditions for transition are indicative only. The Contractor shall provide a detailed flow chart indicating the various operating modes and conditions for transition during detailed engineering.

Standby Mode Operating:

a) The PCU shall continuously monitor the input DC voltage and remain on Standby Mode until it reaches the pre-set value.

MPPT Mode:

a) When the input DC voltage is above the pre-set value, and AC grid connection conditions are fulfilled, the PCU shall enter into MPPT mode.

Sleep Mode:

a) When the AC output power/DC input voltage decreases below the pre-set value for pre-set time delay, the PCU shall switch into Sleep Mode.

5.2.3.5 **Protection Features:**

The PCU shall include appropriate self-protective and self-diagnostic features to protect itself and the PV array from damage in the event of PCU component failure or from parameters beyond the PCU's safe operating range due to internal or external causes. The self-protective features shall not allow signals from the PCU front panel to cause the PCU to be operated in a manner that may be unsafe or damaging. Faults due to malfunctioning within the PCU, including commutation failure, shall be cleared by the PCU protective devices.

The PCU shall provide protection against the following types of faults, among others.

a) DC/AC over current
b) DC/AC overvoltage
c) DC reverse polarity
d) DC earth fault
e) AC under voltage

f) AC under frequency/over frequency
g) Islanding
h) Over Temperature
i) Lightning surges

5.2.3.6 **Grid Support Functions:**

i. Active power regulation

The PCU shall be able to limit the active power exported to the grid based on the set point provided through the PCU front control panel. The PCU shall also be able to automatically limit the active power after an increase in grid frequency above a pre-set value. The ramp rate shall be adjustable during operation and start-up after a fault. The applicability of the requirement shall be as per CEA regulation and compliance.

ii. Reactive power control

The PCU shall be able to inject /absorb reactive power to/ from the grid based on the set point provided through the PCU front control panel. The same shall be performed automatically with an adjustable ramp rate based on dynamic changes in grid voltage or reactive power reference.

iii. Voltage Ride Through

The PCU shall remain connected to the grid during a temporary dip or rise in grid voltage as per the LVRT and HVRT requirements of CEA Technical Standards for Connectivity to the Grid Regulations. The PCU shall also be able to inject reactive power during the period of voltage dip.

5.2.3.7 **Warranty:**

The complete Power Conditioning Unit shall be warranted against all material/ manufacturing defects and workmanship for a minimum of 5 (five) years from the date of supply. The warranty certificate shall be issued by OEM directly in the name of TVNL.

5.2.4 Cables and Conductors

5.2.4.1 **Standards and Codes: -**

Cable	From	To	Conductor	Insulation	Voltage Rating	Applicable Standard
Solar Cable*	Module	SCB	Tinned Copper	XLPO	1.9 kV DC	IEC 62930 / IS 17293/ EN 50618
DC Cable	SCB	PCU	Copper	XLPE	1.9 kV DC	IS 7098 Part I-II
AC LT Cable	PCU	IDT	Aluminium	/ XLPE	1.1 KV	IS 7098 Part I-II

AC HT Cable	IDT	Main Transformer	Aluminium	XLPE	33 KV	IS 7098 Part I-II-III
	*Cable used for module interconnection shall also be referred as solar cable.					

i. Solar DC cables shall be single core, tinned copper, Flame Retardant Low Smoke (FRLS), DC cable with positive polarity should have a marking of a red line on the black outer sheath and the negative polarity cable shall be with black colour. PVC outer sheath conforming to EN 50618. In addition to the manufacturer's identification of cables as per relevant standards, the following marking shall also be provided over the outer sheath.
   a) Cable size and voltage grade
   b) Word 'FRNC/ FRLS' (as applicable) at every metre
   c) Sequential marking of the length of the cable in meters at every meter
   d) Cables shall be sized based on the following considerations:
   e) Rated current of the module.

iv. In the case of central inverters, the average voltage drop in the cables (from PV Modules to PCU) shall be limited to a maximum of 1.5 % of the rated voltage. In the case of string Inverters, the average voltage drop (from PV module to string inverter) shall be limited to 0.5% of the rated voltage drop. The Contractor shall provide detailed voltage drop calculations in an Excel sheet.

v. Short circuit withstand capability has to be considered in the design.

vi. De-rating factors according to laying pattern and other factors as per the datasheet of the manufacturer have to be considered.

5.2.4.2 **Warranty:**

The cables (shall be warranted against all material/ manufacturing defects and workmanship for a minimum of 1 (one) year from the date of supply. The warranty certificate shall be issued by OEM directly in the name of TVNL.

5.2.4.3 **Standards and Code:**

Sr.	Item	Relevant IS	Relevant IEC
1	Conductors of Insulated Cables	IS: 8130 - 1984	IEC: 228
2	Impulse tests on cables and their accessories		IEC: 230
3	Extruded solid dielectric-insulated power cables for rated voltage from 1 KV up to 30 KV.		IEC: 502
4	Test methods for insulations and sheaths of electric cables and chords.		IEC: 540
5	Test on cable over a sheath, which has special protective functions and is applied by extrusion.		IEC: 229

6	Calculations of the continuous current rating of cables (100% load factor).		IEC: 287
7	Cross-linked polyethylene insulated PVC sheathed cable for voltage from 3.3 KV up to 33 KV.	IS: 7098 (Part II and III)	
8	PVC insulation and sheath of electrical cables.	IS: 5831 - 1984	
9	Mild steel wires formed wires and tapes for armouring of cables.	IS: 3975	
10	Electrical test methods for electric cables partial discharge test.		IEC: 885(2) - 1987 (Part II)
11	Methods of test for cables.	IS: 10810	
12	Common test methods for insulating and sheathing materials of electric cables.		IEC: 811
13	Impulse test on cables and other accessories		IEC: 230
14	Cable termination for gas-insulated switchgear.		IEC: 859

i. All AC cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions.

ii. Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted. However, cable joints may be allowed if the route length is more than the maximum available drum length, subject to Client approval.

iii. In addition to the manufacturer's identification of cables as per relevant standards, the following marking shall also be provided over the outer sheath.
   a) Cable size and voltage grade
   b) Word 'FRLS' at every meter
   c) Sequential marking of the length of the cable in meters at every meter
   d) Cables shall be sized based on the following considerations:
   e) Rated current equipment

In the case of Central inverters, the maximum voltage drop in LT cable (from PCU to inverter transformer) shall be limited to 0.5% of the rated voltage. In the case of String inverters, the maximum voltage drop (from string inverter to LT combiner panel and from LT combiner panel to Inverter duty transformer) shall be limited to 1.5%. For HT cables (from inverter transformer to plant take-off point), maximum voltage drop shall be limited to 0.5 % of the rated voltage. The Contractor shall provide voltage drop calculations in an Excel sheet.

i. Short circuit withstands capability as per design for 1s.

ii. De-rating factors according to laying patterns and other factors as per the datasheet of the manufacturer have to be considered.

Note: All the DC, LT, HT cable supplied for the construction of project shall be type tested, the type test report shall not be older than 5 years from the date of supply of material at site. The type tests should have been carried out at a Govt. laboratory or an independent Govt. authorised NABL accredited laboratory / test house.

The following routine tests are to be carried out by the Contractor in presence of Third Party Agency under intimation to TVNL at least 7 days in advance and TVNL at their discretion may depute their representative(s) to witness the said tests.

Routine Tests for HT Cables:

i. Conductor resistance test
ii. Partial discharge test
iii. High voltage test with power frequency
iv. Resistance test for Aluminium armour

Type Test Certificates for HT Cables: The Bidder shall furnish the type test certificates for the tests as per relevant Standards as mentioned below.

Tests on Conductor

i. Conductor resistance test
ii. Conductor water penetration test

Tests on Insulation

i. Tensile strength & Elongation at break (before ageing)
ii. Ageing in air oven
iii. Tensile strength & Elongation at break
iv. Tests for thickness of insulation
v. Eccentricity and Ovality of insulation
vi. Hot set test
vii. Shrinkage test
viii. Gravimetric test (Water absorption)
ix. Volume resistivity/ Insulation Resistance

Tests on Inner Sheath

i. PVC thickness

Tests on Extruded semi-conducting screen

i. Volume resistivity test of conductor screen
ii. Volume resistivity test of core screen

Tests on Outer Sheath (PVC)

i. Flammability test for outer sheath
ii. Thickness
iii. Tensile strength and Elongation at break (before ageing)
iv. Tensile strength and Elongation at break (after ageing)
v. Variation due to ageing
vi. Loss of mass test
vii. Shrinkage test
viii. Hot deformation test
ix. Heat shock test
x. Thermal stability test
xi. Flammability test
xii. Oxygen index
xiii. Temperature index
xiv. Acid gas generation
xv. Smoke density

Tests on Armour for 3 Core Cable

i. Tensile test
ii. Torsion test
iii. Wrapping test
iv. Resistance test
v. Mass of zinc coating
vi. Uniformity of zinc coating
vii. Adhesion test

Tests on Armour for 1 Core Cable

i. Tensile test
ii. Torsion test
iii. Wrapping test

iv. Resistance test

Tests on complete cable

i. Partial discharge test
ii. Thermal ageing test
iii. Bending test
iv. Dielectric power factor test
v. High voltage test
vi. Heat cycle test
vii. Impulse withstand test

Core Identification:

Two core	Red and Black
Three core	Red, Yellow and Blue
Four core	Red, Yellow, Blue and Black
Single core	Green cable with Yellow strips for earthing
Phase	Red, Yellow and Blue
Neutral	Black

5.2.4.4 **Warranty:**

All cables shall be warranted for a minimum of 1 (one) year against all material/ manufacturing defects and workmanship from the date of supply. The warranty certificate shall be issued by OEM directly in the name of TVNL.

5.2.4.5 **Testing:**

Type, routine and acceptance test requirements shall be as per relevant standards for all cable sizes.

5.2.4.6 **Cable Installation:**

Type, routine and acceptance test requirements shall be as per relevant standards for all cable sizes.

i. Cable installation shall be as per IS 1255.
ii. Cables within the transformer yard and switchyard shall be laid through RCC cable trench/ cable trays with supports.
iii. Cable terminations shall be made with properly crimped lugs and passed through cable glands at the entry and exit points of the cubicles. Bimetallic lugs shall be used for connecting the Cu bus bar and Al cables or vice-versa.
iv. All AC cables shall be provided with punched/embossed aluminium tags. The marking shall be done with good quality letters and numbers of proper size so that the cables can be identified easily.
v. All the earthen excavated cable trench with alternate layers of sand and brick as per relevant IS from PV arrays to inverter/Inverter room to control room to switchyard shall

be provided by the Contractor. Cable trench warning tape is to be laid in the cable trench.

5.2.5 Clamps and Connectors:

The bus-support clamps, spacers, T-connectors and various equipment connectors shall be supplied as per the enclosed drawings. The material to be used for these items shall be generally as per below detail.

The materials shall be of the best workmanship, and all the sharp edges and corners shall be rounded off. The thickness of tinning, wherever applicable, shall be not less than 10 microns. The minimum thickness of pads made of copper shall be 10 mm and those made out of Aluminium Alloy shall be 12 mm, unless otherwise indicated in the specifications.

All the clamps and connectors shall be designed to carry a continuous current not less than 125% of the rated current of the conductor (twin/single as the case may be)/equipment terminal to which these are to be connected. The temperature rise of the connector under the above condition shall not be more than 50% of the temperature of the main conductor/equipment terminal.

Sr.	Application	Material
Bolted type connection		
i.	For connection to ACSR/AAAC/ Aluminium terminal	Aluminium Alloy conforming to designate A6 as per IS 617
ii.	For connection to copper terminals, with a crimping facility to connect the ACSR/AAAC jumper	Electrolytic grade copper forged and tinned.
Crimping type connection		
i.	For connection to ACSR/AAAC jumper	Electrolytic grade aluminium

i. All the fasteners (i.e., nut bolts, washers, check nuts, etc.) used in the clamps and connectors shall be of non-magnetic stainless steel. The straight bolts shall be fully threaded, and the U-bolts shall be threaded up to 30 mm from the ends. For connectors made from Aluminium/Aluminium Alloy, the bolts shall be 12 mm in diameter, and for copper connectors, the bolts shall be 10 mm in diameter.
ii. The clamps and connectors meant for ACSR and AAAC shall have the same crimping dimensions. It shall be possible to use the same clamp/connector for ACSR or AAAC, as would be required, without any modification/change at the site.
iii. The length of the bolt shall be chosen such that after fully tightening the nut and check-nut, a minimum of 5 (five) threads of the bolt shall project outside the nut/check-nut.
iv. As an alternative to the various types of clamps and connectors detailed under 2.0 above, the Contractors may offer connectors of Power Fired Wedge Pressure Technology (PFWPT). However, the same needs to be specified in the Bid.

v. Connectors of PFWPT type shall meet the general requirements for various connections/joints as indicated in the relevant drawings. PFWPT type connectors shall comprise of:

Tapered `C' - shaped spring member

a. Wedge connectors for connecting solid/stranded conductors along with handle, suitable for connection between Aluminium and Aluminium
b. Copper and Copper
c. Aluminium and Copper
d. Aluminium and Aluminium alloy
e. Copper and Aluminium alloy
f. Aluminium alloy and Aluminium alloy

vi. Components of the PFWPT type connectors shall be made of Aluminium Alloy suitably heat-treated to ensure that the required Mechanical and Electrical parameters are in line with ANS 1 specification no. C 119.4-1991.
vii. The connectors shall have `self-cleaning' capability during application. The connector shall ensure stable and low contact resistance under varying load conditions and the thermal cycling effects.
viii. The special tools and tackles required for the installation of the PFWPT-type connectors shall be identified in the offer. One set of these bolts and tackles shall be included in the scope of supply.
ix. The successful Bidder shall furnish the following information in their bill of material:
    a) Availability of the PFWPT connectors indigenously.
    b) Unit rate of each item
x. Notwithstanding anything stated above, the final decision regarding acceptance of the type of clamps and connectors (conventional/PFWPT type) shall rest.

5.2.6 Lightening Protection and PV array:

i. A Lightning Protection System (LPS) for the entire plant against direct and indirect lighting strokes shall be provided as per IS/IEC 62305:2010.
ii. Protection level for the entire plant shall be **Level III**.
iii. Air terminals, down conductors and earth termination systems shall be designed as per relevant parts of IS/IEC 62305:2010.
iv. Necessary foundation/anchoring for holding the air terminal in position to be made after giving due consideration to shadow on PV array, maximum wind speed and maintenance requirement at site in future.
v. The product shall be warranted for a minimum of 2 (two) years against all material/ manufacturing defects and workmanship.
vi. Type test reports as per IS/IEC 62305:2010 shall be submitted during detailed engineering for approval.

vii. Necessary foundation/anchoring for holding the lightning conductor in position to be made after giving due consideration to shadow on PV array, maximum wind speed and maintenance requirement at site in future. Lightning arresters shall be equipped with lightning counters.

viii. The lightning conductor shall be earthed through flats and connected to the earth mats as per applicable Indian Standards with earth pits. A minimum of two earth pits shall be provided for each lightning arrestor. Each lightning conductor shall be fitted with an individual earth pit as per required Standards, including accessories, and providing masonry enclosure with a cast iron cover plate having locking arrangement, watering pipe using charcoal or coke and salt as required as per provisions of IS and Earth Resistance of Lightening System must be less than one (1) Ohm.

ix. If necessary, more numbers of lightning conductors may be provided. The Contractor is also free to provide Franklin rod / Early Streamer type of lightning arrestors on the MMS structure designed in such a way as not to cast a shadow on the next raw of solar PV modules. The Contractor is to submit necessary calculations based upon the rolling sphere method for the lightning protection system.

5.2.7 Power Transformers and Inverter Duty Transformers (IDT)

i. The transformer shall be copper wound, 3 phase, naturally cooled, core type construction, oil-immersed and shall be suitable for outdoor applications.

ii. Step-up transformer (Inverter duty Transformer) as per system requirement, complete with cubicles and all necessary accessories such as bushings, off-circuit tap changer, CTs, instrumentation, fittings etc. SPT(s) shall be compatible with an offered model of grid connected PCU inverters.

iii. The transformers should have a voltage range of 240-800V on the primary side and 33kV on the secondary side, or suitable primary side voltage and current aligned with the inverter AC output. These transformers are intended to be 3-phase with an appropriate power rating and a frequency of 50 Hz. In cases where necessary based on design, a "two primary and one secondary" configuration with three windings can be utilized. Noise levels should adhere to the standards outlined in NEMA TR-1.

iv. The transformers should be equipped with an Off Circuit Tap Changer that offers tapings of at least +/- 15%, with individual steps at 2.5% intervals. Vector group, impedance, bushing rating, HV/LV termination, and neutral earthing should all meet system requirements and conform to specified standards. Air clearance should align with CBIP norms.

v. To meet system protection needs, appropriate Bushing Current Transformers (CTs) need to be included. The design and specifications of the transformers must align with IS: 2026 or an equivalent international standard. Approval of designs and specifications will be subject to TVNL's review.

vi. Bidders and their sub-vendors are expected to have experience in designing, manufacturing, and supplying transformers with a voltage class of 33 kV or higher, totalling a capacity of 50 MVA or more. Of these supplies, at least one instance should involve a single plant requiring transformers of 10 MVA or greater capacity. The reference plant where transformers of 10

MVA or more were provided must have demonstrated successful operation for a minimum of six (6) months prior to TVNL awarding the contract to the bidder.

vii. The Contractor shall be responsible for arranging the calibration and testing of the Power Transformer and Inverter Transformer through a NABL-accredited laboratory agency, including any associated charges, on an annual basis.

5.2.7.1 **General Construction:**

i. The construction of the transformer must adhere to the standards IS: 2026 and IS: 3639, or any equivalent international standards. The transformer should be fully comprehensive and operational, falling within the supplier's responsibilities. Additional critical construction details are outlined as follows.

ii. The transformer tank and cover must be manufactured using high-grade, tested-quality, low-carbon plate steel. Both the tank and the cover should be fabricated through welded construction, and provision must be made for crane lifting.

iii. A double float-type Buchholz relay that conforms to IS: 3637 specifications must be included. The relay should also feature a test cock, which is suitable for a flexible pipe connection, enabling the verification of its operational status.

iv. Valve shall be provided on both sides of the Buchholz relay between the main tank and the conservator tank. The tank cover should have appropriately sized inspection hole(s) with welded flange(s) and bolted cover(s). These inspection holes must be designed to allow convenient access to the lower ends of the bushings, terminals, and other components.

v. All bolted connections that are attached to the tank must have suitable oil-tight gaskets. These gaskets should be capable of providing reliable performance throughout the transformer's entire lifespan under operating conditions, assuming the connections are not opened for maintenance at the site.

vi. The transformer is required to have a conventional single-compartment conservator. The upper part of this conservator should be linked to the atmosphere using a transparent silica gel breather. An oil seal will isolate the silica gel from the surrounding atmosphere.

vii. The transformer should feature a conservator tank with ample capacity to accommodate both the oil preservation system and the volumetric expansion of the total transformer oil. The conservator tank must be securely bolted in place while still allowing for its removal when cleaning is necessary.

viii. The conservator tank shall be provided with Aircel.

ix. The transformer shall have an Oil Temperature Indicator and a Winding temperature Indicator with an accuracy class of +/-2 deg. The OTI and WTI shall be digital type indicator with RS 485 terminal to be communicated with SCADA.

x. Detachable radiators of the detachable type are to be installed on the transformer tank. Each connection point to the tank must have a shut-off valve. Additionally, a drain valve should be located at the bottom, and a relief valve at the top of the radiators.

xi. Before being poured into the transformer, the new insulating oil must meet the specifications outlined in IS: 335. The oil should not contain any inhibitors. Furthermore, oil

samples collected from the transformer on-site must adhere to the criteria specified in IS: 1866

xii. Each transformer should include a weather-proof, vermin-resistant, and dustproof sheet steel marshalling box. This box is intended to house temperature indicators and terminal boards for both incoming and outgoing cables.

xiii. All items of equipment and materials shall be thoroughly cleaned and painted in accordance with relevant Indian Standards. The finish paint shall be done with two coats of epoxy-based final paint of colour Shade RAL 7032 of IS:5 for indoor equipment.

xiv. Standards and relevance

Code	Particular
IS: 2026 (Part 1 to 4)	Specifications for Power Transformer
IS: 10028	Selection, installation and maintenance of transformer
IS: 2099 and IEC60137	Bushings for alternating voltage above 1000 V
IS: 3639	Fittings and accessories for power transformer
IEC: 60076 (Part 1 to 5)	Specifications for Power Transformer
IS: 9921 Part 1 to 5	Alternating currents dis-connector (isolators) and earthing switches rating, design, construction, tests etc.
IS: 2705 Part 1 to 4 and IEC: 60185	Current transformers
IS: 3156 Part 1 to 4	Voltage Transformer
IS: 3070 part 1 to 3	Lightning arrestors
IS: 2544	Porcelain insulators for systems above 1000 V
IS: 5350 Part III	post insulator units for systems greater than 1000V
IS: 5621	Hollow Insulators for use in electrical equipment
IS: 5556	Serrated lock washers – specification
IS: 3637	Gas operated relays
IS: 4257	Dimensions for clamping arrangements for porcelain transformer bushings
IS: 335	New insulating oils
IS: 6600	Guide for loading of oil-immersed transformer

5.2.7.2 **Reference Weather Conditions for Transformer Design**

Sr.	Particulars	Specifications
1.	Maximum ambient temperature	50 degree C
2.	Maximum daily average ambient temp	45 degree C
3.	Maximum yearly weighted average ambient temp	40 degree C
4.	Minimum ambient air temperature: (Cooling medium shall be Air)	Minus 5 degree C
5.	Climatic Conditions:	
5.1	Maximum relative humidity	100%
5.2	Yearly average number of thunderstorms	Varies from 30 to 50
5.3	Average no. of rainy days per annum	60 days
5.4	Fog	The atmosphere is subject to fog for two months in winter
5.5	Number of months during which tropical monsoon conditions prevail	3 months
5.6	Dust storms	occur at frequent intervals
5.7	Average annual rainfall	60 cms
5.8	Maximum wind speed	180 kmph

5.2.7.3 **Ratings and specifications**

i. The typical rating and electrical characteristics of the inverter transformer shall be as follows. However, the ratings may vary subjected to detailed engineering design by the bidder and relevant to the respective IS codes:

Sr. No.	Particulars	Inverter Transformer
1	Continuous kVA ratings	As per design
2	Type	Oil immersed
3	Frequency	50 Hz
4	Type of cooling	Oil Natural Air Natural (ONAN)
5	No. of phases	3 (Three)
6	Rating voltage H.V. side	33 kV
7	Highest System voltage on H.V. side	36 kV r.m.s.
8	Rated voltage on L.V. side	As per the design and selection of Inverter

9	Vector Group	As per design (Dy5/Dy11)
10	Connections	Appropriate as per design calculations
11	Off load taps on H.V. Side (for H.V.	+ 10 to – 10.0 % (in steps of 2.5%)
12	Transformer connections	LV side – Cables (Enclosure)
		HV Side –Bushing with enclosure
13	Impedance voltage (%) as per IS 2026	4%
14	Minimum Creepage distance	25 mm/ KV
15	Color Shade	RAL 7035

ii. The rating and electrical characteristics of the Outdoor type of transformer (typical) shall be as follows. However, the ratings may vary, subject to design and relevant to the respective IS codes.

Sr. No.	Particulars	Power Transformer (220 KV)
1	Continuous kVA ratings	As per design
2	Type	Oil immersed
3	Frequency	50 Hz
4	Type of cooling	Oil Natural Air Natural (ONAN)
5	No. of phases	3 (Three)
6	Rating voltage H.V. side	As per design
7	Highest System voltage on H.V. side	As per design
8	Rated voltage on L.V. side	As per design
9	Vector Group	As per design / Discom/ Transco/ TVNL requirements
10	Connections	Appropriate as per design calculations
11	On load taps on H.V. Side (for H.V.	+ 5 to – 10.0 % (in steps of 1.25%)
12	Impedance voltage (%) as per IS 2026	As per design and IS 2026
13	Transformer connections	LV side – Cables
		HV Side – Bushing
14	Minimum Creepage distance	25 mm/ KV
15	Colour shade	RAL 7035

5.2.7.4 **Windings:**

i. The contractor is responsible for ensuring that the windings of all transformers are manufactured within a dust-proof and conditioned atmosphere.
ii. The contractor is required to provide information about the facilities available at their works as part of their bid submission.
iii. The conductors used should be made of electrolytic-grade copper that is free from scales and burrs.
iv. All windings of the transformers must be completely insulated.

5.2.7.5 **Core:**

i. The core construction must utilize high-grade, non-aging, cold-rolled, super grain-oriented silicon steel laminations.

ii. The core isolation level should be 2 kV (rms.) for a duration of 1 minute in an air environment.
iii. Sufficient lifting lugs will be included to facilitate the lifting of both the core and windings.

5.2.7.6 **Fittings:**

The transformer will be equipped with the following fittings:

i. A breather for conservators must be positioned no higher than 1400 mm above the rail top
ii. A minimum of two spring-operated pressure relief devices (PRDs), each equipped with alarm/trip contacts, should be incorporated. The discharge from these PRDs should be appropriately channelled through pipes, ensuring it is directed away from the transformer and other equipment.
iii. Air release plug.
iv. Inspection openings and covers.
v. Bushing with metallic components and suitable gaskets must be provided to align with the termination arrangement.
vi. Cover lifting eyes, transformer lifting lugs, jacking pads, towing holes, as well as core and winding lifting lugs shall all be included.
vii. A protected-type mercury or alcohol-in-glass thermometer should be integrated into the design.
viii. Both bottom and top filter valves, accompanied by threaded male adapters, should be provided. Additionally, a bottom sampling valve and a drain valve must be included.
ix. Rating and diagram plates need to be affixed on both the transformers and auxiliary apparatus.
x. Prismatic or toughened glass oil gauges must be installed for both the transformers and the Tap Changer chamber.
xi. A 150 mm dial-type oil temperature indicator, equipped with alarm and trip contacts, a maximum reading pointer, and a resetting device, should be included.
xii. A 150-mm dial-type winding temperature indicator featuring alarm and trip contacts, a maximum reading pointer, and a resetting device should also be integrated.
xiii. Flanged bi-directional wheels. (As applicable)
xiv. Marshalling Box
xv. Bushing current transformers.
xvi. Drain valves or plugs need to be furnished to allow independent draining of each section of pipe work. Furthermore, a sludge valve at the bottommost point of the tank should be included for convenient flushing and removal of sludge during maintenance.
xvii. Terminal marking plates.
xviii. Valves schedule plates.
xix. Equipment earthing.
xx. The fittings mentioned above serve as indications, and additional fittings that are typically necessary for the satisfactory operation of the transformer are understood to be included.

5.2.7.7 **Performance:**

i. The highest flux density within any area of the core and yoke, considering the rated MVA, voltage, and frequency, should be limited to a level where it does not surpass 1.9 Tesla under continuous voltage conditions of up to 110%.

ii. Both the transformer and all accompanying accessories, including CTs, must be engineered to endure the thermal and mechanical impacts of any external short circuit to earth and short circuits at the terminal of any winding for a duration of 2 seconds without sustaining damage. The contractor is required to provide short circuit withstand calculations for validation.

iii. The transformer must be capable of enduring combined voltage and frequency fluctuations that result in the subsequent over-fluxing conditions without causing harmful heating:
   - Continuous operation at 110%
   - 125% for one minute
   - 140% for five seconds

iv. The contractor is required to ensure that the transformer has a voltage withstand capacity of 150% for a specific time/cycle.

v. The transformers should have the capability to operate continuously at the rated MVA without any risk, even when subjected to a voltage variation within the range of ±10%.

vi. The transformers must have the ability to handle loading as specified in IS: 6600 / IEC: 60354, up to a load of 150%. No restrictions should be imposed by elements like bushings or any other related equipment.

5.2.7.8 **Tests and Inspection:** The Type Test and Routine tests for the transformer must adhere to IS: 2026 or any other specified guidelines in this specification. The type test report of critical test such as short circuit, impulse etc, shall not be older than 5 years from the date of supply of material at site. The type tests should have been carried out at a Govt. laboratory or an independent Govt. authorised NABL accredited laboratory / test house. Additionally, a tank vacuum test and tank pressure test, aligned with CBIP norms, will be conducted as type tests. Furthermore, an oil leakage test will be carried out as part of the routine testing process.

5.2.7.9 **Vacuum Test:** Each type of transformer tank will undergo a designated vacuum test. For tanks designed to withstand full vacuum, a test will be performed at an internal pressure of 3.33 kN/sq. m absolute (25 tor) for a duration of one hour.

5.2.7.10 **Tank Pressure Test:** For each type of transformer tank, a pressure test will be conducted using a pressure equal to either twice the normal head of oil or the normal pressure increased by 35 kN/sq. m, whichever value is lower. This pressure will be measured at the base of the tank and sustained for duration of one hour. After the excess pressure has been released, the permanent deflection of the plates should not surpass the figure specified for the vacuum test.

5.2.7.11 **Oil Leakage test on assembled Transformer:** To ensure oil tightness, all tank and oil-filled compartments will undergo a test. This involves completely filling them with oil of a viscosity no greater than that of the specified oil, at ambient temperature. Subsequently, a pressure equivalent to the normal pressure increased by 35 kN/sq. m will be applied and measured at the base of the tank. This pressure should be maintained for at least 24 hours, during which no sweating should occur.

5.2.7.12 Nitrogen Injection Fire Protection System (NIFPS): NIFPS to be provided for all power transformers rating more than 10 MVA. NIFP system shall be provided with automatic control for fire prevention and fire extinction. The system shall be tested by UL, FM, LPCB or the national testing body of BIS accredited laboratory's Test Report required.

5.2.8 Instrument Transformer (220 kV Switchyard)

i. The instrument transformers i.e., current and voltage transformers, shall be single-phase transformer units and shall be supplied with a common marshalling box for a set of three single-phase units. The tank as well as top metallic shall be hot dip galvanized or painted grey colour as per RAL 9002.

ii. The instrument transformers shall be oil-filled, hermetically sealed units. The instrument transformers shall be provided with filling and drain plugs.

iii. 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.

iv. Current Transformer, Voltage Transformer, Circuit Breaker and Relays should match –Local distribution TVNL requirements.

5.2.9 Current Transformer (220 kV Switchyard)

i. Current transformers may be either of the bushing type or wound type. The bushing types are normally accommodated within the transformer bushings and the wound types are invariably separately mounted. The location of the current transformer with respect to the associated circuit breaker has an important bearing upon the protection scheme as well as the layout of the substation. Current transformer class and ratio is determined by electrical protection and metering consideration.

ii. Technical Specifications – Current ratings, design, Temperature rise and testing etc. should be in accordance with IS: 2705 (part I to IV).

Type and Rating

i. The current transformer should be of outdoor/ indoor type, single phase, oil immersed, self-cooled and suitable for operation in 3 phase solidly grounded system.
ii. Each current transformer should have the following particulars under the site conditions for the system under design (typical values for 220 kV systems are given).
iii. General Parameters: 220 kV CT.
    a. Each current transformer should have the following particulars under the site conditions for the system under design (typical values for 220 kV system are given).

General parameters for 66 kV CT

Sr.	Particulars	Details
1	Highest system Voltage (Um)	245 kV rms
2	Rated frequency	50 Hz
3	System Neutral Earthing	Effective earthed
4	Installation	Outdoor/indoor (IP 65)
5	Rated short time thermal current	25 kA for 3 sec or appropriate thermal current as per design calculations
6	Rated dynamic current	63 kA (Peak) appropriate dynamic current as per design calculations
7	Rated min power frequency withstands voltage (rms value)	460 kV
8	Rated lightning impulse withstand voltage (peak value)	1050 kV
10	Minimum Creepage distance	25 mm/kV
11	Temperature rise	As per -IS 2705/1992
12	Type of insulation	Class A
13	Partial discharge	Max.10 (PC)
14	Number of cores	For Transformer: Three (3) with One (1) protection core and One (1) metering core (1)

		Diff. Protection of Transformer For ABT Meter Line Side: Min Two with Metering Core Class 0.2S Main and Check
14	CT secondary current	Protection cores – 1 Amp. Metering Core – 1 Amp (With Highest Accuracy Class)
15	Number of terminals in marshalling box	All terminals of control circuits wired up to marshalling box plus 20 terminals spare
16	CT ratio and Rated VA Burden, short time thermal rating, class of accuracy	Minimum burden required (As per Discom/ Transco/ TVNL requirement): 1. Metering core – 5VA min. 2. Protection core – 10VA min.

5.2.10 General Parameters of 220 kV VT

Sr.	Particulars	Details
1	Highest system voltage (rms)	245 kV
2	System neutral earthing	effective earthed
3	Installation	Outdoor (IP 65)
4	Ratio a) Primary side (KV) b) Secondary Side (V)	220/√3 110/√3
5	Rated min power frequency withstand voltage (rms value)	460 kV @HV 3 KV @LV
6	Rated lightning impulse withstand voltage (peak value)	1050 kV
7	Standard reference range of frequencies for which the accuracy is valid	96% to 102% for protection and 99% to 101% for measurement
8	Rated voltage factor	1.2 continuous and 1.9 for 30 sec
9	Class of Accuracy	PTs shall be of accuracy class 0.2 for metering and 3P for protection as per IS:3156 / IEC 186
10	Minimum Creepage distance	25 mm/kV
11	Stray capacitance and stray conductance of LV terminal over entire carrier frequency range	As per IEC:358
12	Partial discharge	Max.10 (PC)
13	Temp. rise over an ambient temp. of 50 deg. C	As per IS 3156/1992

14	Number of terminals in control spare.	All terminals of control circuits wired Cabinet up to marshalling box plus 10 terminals
15	Rated total thermal burden	300 VA min.
16	Number of cores	2 (two) – 1 for protection and one for metering with 0.5 class accuracy.
17	Rated Output, insulation level, transformation ratio, rated voltage factor	Should be provided by the Contractor.

5.2.11 Circuit Breaker 220 KV:

i. 220 KV Circuit breakers shall be of SF6 type.

ii. The circuit breakers shall be capable of rapid and smooth interruption of currents under all conditions, completely suppressing all undesirable phenomena even under the most severe and persistent short circuit conditions or when interrupting small currents or leading or lagging reactive currents. The circuit breakers shall be 'Restrike-Free' under all operating conditions.

iii. The details of any device incorporated to limit or control the rate of rise of restriking voltage (RRRV) across, the circuit breaker contacts shall be stated.

iv. The over voltages caused by the circuit breaker while switching inductive or capacitive loads shall not exceed 2.5 times the highest phase to neutral voltage.

v. The actual makes and break times for the circuit breakers throughout the ranges of their operating duties shall be stated in the offer and guaranteed.

vi. The arc quenching chambers shall have devices to ensure almost uniform distribution of voltage across the interrupters.

vii. Temperature Rises:

The temperature rises and the maximum temperature on any part of the equipment when in service of site under continuous full load conditions and exposed continuously to the direct rays of the sun shall not exceed the permissible limits as per IEC latest publication, this shall not be exceeded when corrected for the difference between the ambient temperature at site and the ambient temperature specified in the relevant specification. The correction proposed shall be stated in the bid and shall be subject to the approval of the purchaser.

viii. The circuit breaker shall have the following operating capabilities.

1. Shunt capacitor switching capacity,
2. Breaking capacity for kilometric fault
3. Transformer charging current breaking capacity.
4. Restriking voltage-breaking capacity
5. Recovery voltage and power factor breaking capacity.
6. Automatic rapid reclosing (three phase)

ix. Guaranteed Technical Particular

Sr. No.	Particular	Specification
1	Nominal system voltage (KV)	220
2	Highest system voltage (KV)	245

3	Rated frequency (Hz)	50
4	Number of poles	3
5	Type	Outdoor SF6
6	Number of poles	3
7	Type of operation	Individually operated single poles. However, 3 poles shall be Electrically gang operated)
8	Basic insulation level (a) 1.2 x 50 microsecond impulse withstand voltage (KVP) to earth (b) One minute power frequency withstands voltage (KV rms)	a) 1050 b) 460
9	Rated normal current (Amp.)	2000
10	Rated short circuit breaking current (KA rms)	40
11	Total break time for any current up to the rated breaking current (Cycle)	3
12	Closing time (Cycle)	3
13	Short time current carrying capacity for 3 Sec (KA rms)	40
14	Rated duration of short circuit (Sec)	3
15	Phase to phase spacing in the switchyard i.e., inter -pole spacing for breaker (mm)	4500
16	Required ground clearance from the lowest line terminal (mm) up to plinth level (a) If both the terminals are not in the same horizontal plane(b) If both the terminals are in the same horizontal plane	5500
17	Minimum height of the live part to ground level (mm)(up to plinth level	5500
18	Operating mechanism	Spring charge
19	Rated transient recovery voltage for terminal fault	As per IS: 13118
20	Rated line charging current breaking capacity (Amp)	As per IEC
21	Small inductive current breaking capacity	As per IEC
22	Rated short circuit making current (KA rms)	110 KA
23	First pole to clear factor	1.3
24	Rated operating duty	O-0.3S CO-3min-CO
25	Total minimum creepage distance (mm) for support insulation	25mm/KV
26	Control circuit voltage (Volt)	220/110DC
27	Automatic rapid reclosing	1 phase and 3 phase
28	Maximum acceptable difference at the instance of closing/operating of contacts	As per relevant IES/IS

x. Applicable Standard: The materials shall conform in all respects to the relevant Indian Standard Specifications/ IEC Standards, with the latest amendments indicated below in table.

Indian Standard	Title	International recognized standard
ISS-13118/1991	General requirements for Circuit breakers for voltage above 1000 V	IEC 62271-100-1/2001
ISS-2705/1992	Current Transformers	
ISS-2099/1986	Bushings for alternating voltages above 1000 V	
ISS-2633/1964	Methods of testing uniformity of coating of zinc-coated articles	
ISS-3231/1986	Electrical relays for power system protection	
ISS-1248/1983	Specification for Ammeters and Voltmeters	
ISS-335/1983	New insulating oils Electrical Clearances	IEC 71 (For oils in CTs)
ISS-2147/1962	Degree of protection provided by enclosures for low voltage switchgear and control gear	

xi. CONTROL:

1. The close and trip circuits shall be designed to permit use of momentary contact switches and push buttons.
2. Each breaker pole shall be provided with two (2) independent tripping circuits and coils each connected to a different set of protective relays with one set of pressure switch per pole and one number of densities monitor per pole.
3. The breaker shall normally be operated by a remote electrical control. Electrical tripping shall be performed by shunt trip coils. However, provisions shall be made for local electrical control. For this purpose, a local/remote selector switch and close and trip push buttons/switch shall be provided in the breaker central control cabinet. Remote-located push buttons and indicating lamps shall be provided.
4. The trip coils shall be suitable for trip circuit - supervision. The trip circuit supervision relay would be provided by the purchaser. Necessary terminals shall be provided in the central control cabinet of the circuit breaker by the supplier. Trip circuit supervision shall be operative in both close and open conditions of the breaker.
5. Closing coil shall operate correctly at all values of voltage between 85% and 110 % of the rated voltage. Shunt trip shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity of the circuit breaker and at all values of supply voltage between 70% and 110% of the rated voltage.
6. The pressure switches used for interlock purposes shall have adequate contact ratings to be directly used in the closing and tripping circuits, if the DC supply to the interlock circuit falls, then operation lockout shall take place.

xii. Interlocks:

1. It is proposed to electrically interlock the circuit breaker with TVNL's associated air brake isolating switches in accordance with the switchyard safety interlocking scheme.

xiii. Fittings and Accessories:

1. Central control cabinet with the following materials:
   a. Cable glands
   b. Local /remote changeover switch
   c. Operation counter
   d. Gas pressure gauges. Fuses/MCB as required.
   e. The number of terminals provided shall be adequate to wire out all contacts and control circuits, plus 12 terminals spare for owner's use.
   f. Anti-pumping relay/Contactor. Rating and diagram plate in accordance with IEC incorporating year of manufacture.
2. All external paintings shall be as per shade RAL 7035

xiv. Galvanizing

1. All ferrous parts exposed to the atmosphere of the breaker shall be hot dip galvanized or epoxy painted. Bolts, nuts, etc. hardware shall be hot dip galvanized or stainless steel.

xv. Earthing:

1. The operating mechanism housing, control cabinets, dead tanks, support structure etc. shall be connected to the earth mat.

xvi. Terminal Connector

1. The terminal connectors shall meet the following requirements:
   a. Terminal connectors shall be manufactured and tested as per IS:5561
   b. All ferrous parts shall be hot dip galvanized, confirming to IS:2633.
   c. Flexible connectors shall be made from tinned/copper/aluminium sheets.
   d. All current carrying parts shall be designed and manufactured to have minimum contact resistance.
   e. The terminal connector shall be compression-type and boltless type.

xvii. Fuses

1. All Fuses/MCBs shall be of the HRC cartridge type, conforming to IS:2208 and suitable for mounting on plug-in type of fuse bases. Fuses shall be provided with visible operation indicators to show that they have operated.

xviii. Specification for Control Cabinets

1. Control cabinets shall be sheet steel enclosed and shall be dust weather and vermin proof. Sheet steel shall be at least 3 mm thick.
2. Control cabinets shall be provided with a hinged door and padlocking arrangement. The door hinges shall be of union joint type to facilitate easy removal.
3. Equipment and devices shall be suitable for operation on 240 V, 1 phase or 415 V, 3 phase, 3 wire or 4 wire, at frequency from 90% to 105% of normal 50 Hz.
4. Motors rated I KW and above being controlled from the control cabinet would be suitable for operation on a 415 V, 3 phase 50 Hz system.

5. Vertical run of cables to the operating mechanism box shall be properly supported by providing the perforated closed type of galvanized cable tray.
6. At least 10% spare terminal blocks for control wire terminations shall be provided.
7. CT loads shall be terminated on a separate block suitable for 4 sq.mm and shall have provision for short-circuiting the CT secondary terminals.
8. Strip heaters shall be provided inside the cabinet complete with thermostat (preferably 30 to 80 0C setting) to prevent moisture condensation.

xix. Earthquake and wind design loads
1. Circuit breaker including its supporting structure shall be designed to withstand repeated earthquake acceleration of 0.5g (H) and wind loads of 180 Km/h on the project area

5.2.12 <u>Vacuum Type 33 KV Circuit breakers</u>

Each switchgear panel shall be provided with a three-position dis-connector (Open, Close and Earth).

i. Mechanical indicators shall be provided to indicate OPEN/CLOSE/EARTH positions of the three-position dis-connector. The circuit breaker operating mechanism shall be based on motor-operated spring charging, and it shall be re-strike free, trip free both electrically and mechanically, with anti-pumping feature.
ii. The rated control voltage of the spring charging motor shall be 110 V / 220 V DC. The Closing coil shall operate at all values of voltages between 85% and 110% of rated voltage. The opening coil shall operate correctly under all operating conditions of the circuit breaker up to the rated breaking capacity and at all values of supply voltage between 70% and 110% of rated voltage.
iii. Each circuit breaker shall be provided with two tripping coils operated through independent DC supplies. Each trip coil shall have its own actuating contacts.
iv. The spring charging motor shall have adequate thermal rating such that continuous sequence of the closing and opening operations is possible if the power supply is available to the motor. It shall also be possible to charge the spring manually and close the breaker in the event of failure of motor/control supply to motor.
v. Operating handle shall be provided for charging the operating mechanism. After failure of control supply to the motor, one open-close-open operation shall be possible with the energy contained in the operating mechanism.
vi. The motor rating shall be such that it requires not more than 30 seconds for full charging of the closing spring. Closing action of the circuit breaker shall compress the opening spring ready for tripping. When closing springs are discharged after closing the breaker, they shall be automatically charged for the next operation.
vii. Suitable indicators shall be provided to indicate OPEN/CLOSED positions of the circuit breaker and CHARGED/ DISCHARGED positions of the closing spring. An operation counter shall also be provided.
viii. HT panel should be provided with min 12 window annunciator and indication lamps for ON, OFF, Trip, and phase indication.
ix. Hooter shall be provided with the LT chamber of HT panels.

x. Codes and Standards

IS CODE	Name of equipment
IS:722	AC electricity meters
IS:996	Single-phase small AC universal motors
IS:13947	Degree of protection by enclosures for low voltage switch gear and control gear
IS:2544	Porcelain post insulators for systems with nominal voltages greater than 1000volts
IS:9046	AC contactors for voltages above 1000 volts and up to and including 11000volts
IS:13703	Low voltage fuses
IS:9385	HV fuses
IS/IEC 62271-100	High-voltage alternating circuit breakers
IS/IEC62271-200	High voltage metal-enclosed switchgear and control gear
IEC:60947-7-1	Terminal blocks for copper conductors
IS: 1248	Direct Acting indicating analogue electrical measuring instruments and Accessories
IS: 2705	Current transformers
IS: 3156	Voltage Transformers
IS: 6005	Code of practice for phosphating of iron and steel.
IS: 5082	Specification for wrought aluminium and aluminium alloy bars, rods, tubes, and selections for electrical purposes.
IEC:61850	Communication Standard for Numerical relays
IEC: 61131-3	Automation Standard for Numerical relays
IS: 9046	AC contactors for voltages above 1000 volts and up to and including 11000 Volts.
IS: 9431	Specification for indoor post insulators of organic material for system with nominal voltages greater than 1000 volts up to and including 300 kV
IS: 9921	A.C. dis-connectors (isolators) and Earthing switches for voltages above 1000 V
IS: 11353	Guide for a uniform system of marking and identification of conductors and apparatus terminals.
IS: 13118	Specification for high voltage AC circuit breakers.
IEC:60099-4	Metal oxide surge arrestor without gap for AC system
IS/IEC:62271-100	High voltage alternating current circuit breakers.
IS/IEC:62271-200	High voltage metal enclosed switchgear and control gear.

5.2.12.1 **Relays:**

i. All relays shall be microprocessor-based numerical type. The relays shall be flush mounted on panel front with connections from the inside.

ii. The relays shall be capable of operating continuously between 80 – 120% of the rated voltage.

iii. All numerical relays shall have an adequate number of freely configurable, optically isolated, Binary Inputs (BI) and potential free Binary Outputs (BO).
iv. All numerical relays shall have a minimum four no. of current inputs, three for phase current and one for earth current, suitable for CT secondary current of 1A. The current inputs shall be compatible with both residual connected CT and Core Balance CT (CBCT). In addition, numerical relay in main outgoing feeder shall have three no. of voltage inputs for Under Voltage/Over Voltage protection.
v. All I/Os shall have galvanic isolation. Analog inputs shall be protected against switching surges and harmonics.
vi. All numerical relays shall have provision for measurement and storage of electrical parameters such as voltage, current, frequency, active power, reactive power etc. Measurement accuracy shall be 1% for RMS voltage and current. The Solar PV system and the associated power evacuation system interconnections should be protected as per IEC 61727 Ed.2, norms.
vii. All relays should be numerical type and should be remote operating and controlling facility from the control room.
viii. The operating voltage of the relays shall be 110 V DC/220 V DC as per the battery bank rating.
ix. Detailed Design calculations shall be provided on fault power computations and the philosophy of protective relaying with respect to short circuit kA calculations. The design, drawing and model of protection relay shall be approved by the Company/Electricity Authority.
x. The numerical relay shall be able to record faults and events in non-volatile memory. The sequence of events shall have 1 ms resolution at the device level.
    a. Fault record – At least 5 recent faults including the protection function operated, operating phase(s), voltages, and currents along with date and time stamp.
    b. Event record – At least 200 events with date and time stamp.
    c. The numerical relay shall have a feature for time synchronization through the SCADA System/networking.
    d. The numerical relay shall be provided with a backlit alphanumeric LCD to access protection settings, measurement parameters, fault, and event records. Read and write access to protection settings shall be password protected.

5.2.12.2 **Instrument Transformers:**

i. Instrument transformers shall be completely encapsulated cast resin type, suitable for continuous operation at the ambient temperature prevailing inside the switchgear enclosure, when the switchgear is operating at its rated load and the outside ambient temperature is 40°C.
ii. All instrument transformers shall withstand the power frequency and impulse test voltage specified for the switchgear assembly. The current transformer shall further have dynamic and short-time ratings at least equal to those specified for the associated switchgear and shall safely withstand the thermal and mechanical stress produced by maximum fault currents specified when mounted inside the switchgear for circuit breaker modules.

iii. Polarity marks shall indelibly be marked on each instrument transformer and at the lead terminals at the associated terminal block.

iv. HRC fuses of suitable rating shall be provided on primary side of voltage transformers. For secondary side, four pole Miniature Circuit Breakers (MCB) shall be provided with its supervision facility.

5.2.12.3 **Cable Entry and Busbar arrangement:**

i. Busbar shall be made of copper with uniform cross-section or electrolytic grade aluminium with HR PVC-sleeved insulation throughout their length. They shall be adequately supported on insulators to withstand electrical and mechanical stresses due to specified short circuit current.

ii. Busbar shall be supported on the insulators such that the conductor expansion and contraction are allowed without straining the insulators.

iii. Busbar support insulators shall be made of non-hygroscopic, arc and track resistant, high strength, non-combustible material and shall be suitable to withstand stresses due to over voltage and short circuit current.

iv. All busbars shall have suitable phase identification.

v. The successful bidder shall submit busbar sizing calculation for specified continuous and short time current ratings during detailed engineering.

vi. Only Bottom cable entry for incoming and outgoing cables provision to be provided.

5.2.12.4 **Earthing of Switchgear Panel:**

i. An earth bus made of copper shall be provided at the bottom throughout the length of the panel. It shall be bolted/welded to the framework of each panel and each breaker earthing contact bar.

ii. The earth bus shall have sufficient cross section to carry maximum fault current without exceeding the allowable temperature rise.

iii. All non-current carrying conductors of the panel shall be connected to the earth bus. All joints to the earth bus shall be made through at least two bolts. Hinged doors shall be earthed through flexible earthing braid of adequate cross section. Suitable provision shall be provided at each end of the earth bus for connection to Earth grid.

iv. All metallic cases of relays, instruments and other panel mounted equipment shall be connected to earth bus by independent copper wires of size not less than 2.5 sq. mm with green colour insulation.

v. The instrument transformer's secondary neutral point shall be earthed at one place only on the terminal block. Such earthing shall be made through links so that the earthing of one circuit may be removed without disturbing the earthing of other circuits.

5.2.12.5 **Measuring Instruments:**

i. All the measuring instruments shall be digital, flush mounting type with communication facility.

ii. All feeders except main outgoing feeder shall be provided with digital Multi-Function Meter (MFM). Tri Vector Meter (TVM) shall be provided for the main outgoing feeder (in the HT Panel). The accuracy class of MFM shall be 0.2 and that of TVM shall be 0.2S.

iii. Measuring instruments shall have provision to display the following parameters.
   a) Line and phase voltages
   b) Line and phase currents
   c) Active power, Reactive power, Apparent power
   d) Frequency
   e) Power factor
   f) Total Harmonic Distortion (THD)

5.2.12.6 **Wiring and Terminal Blocks:**

i. All internal wiring shall be done with 650 V grade, 1.5 sq.mm. PVC insulated stranded flexible copper wire. For CT secondary circuits, 2.5 sq.mm copper wire shall be used.

ii. Wire terminations shall be made with solder less crimping-type tinned copper lugs, which shall firmly grip the conductor. Insulation sleeves shall be provided at all the wire terminations.

iii. Printed identification ferrules, marked to correspond with the panel wiring diagram, shall be provided at both ends of each wire. The ferrules shall be firmly located on each wire so that they cannot move or turn freely on the wire. Wire identification shall be done in accordance with IS 11353.

iv. The Contractor shall be solely responsible for the completeness and correctness of the internal wiring and for the proper functioning of the connected equipment.

v. All internal wiring to be connected to the external equipment shall terminate on terminal blocks. Terminal blocks shall be rated for 650 V, 10 A and made of non-inflammable material.

vi. CT and VT secondary circuits shall be terminated on stud type, disconnecting terminal blocks.

vii. At least 10% spare terminals shall be provided on each panel and these spare terminals shall be distributed on all terminal blocks.

5.2.12.7 **Warranty:**

The panel shall be warranted against all material/ manufacturing defects and workmanship for a minimum of 1 (One) year from the date of supply. Warranty certificate shall be issued by OEM directly in the name of TVNL.

5.2.12.8 **Testing and Inspection:**

Type Tests

i. The switchgear panel shall be of type tested design. Type test reports of switchgear panel as per IS/IEC 62271-200 shall be submitted during detailed engineering. The tests should have been conducted on the similar equipment by NABL accredited laboratory.

ii. In case the contractor is not able to submit the test reports during detailed engineering, the contractor shall submit the reports of type/special tests either conducted by NABL accredited laboratory or witnessed by TVNL.

iii. Routine Tests Routine tests and acceptance tests shall be as per the Quality Assurance Plan (QAP) approved by the TVNL.

5.2.12.9 **Guaranteed Technical Particular**

Sr.	Particulars	Details
1	Type of Breaker	Metal enclosed, compact module, panel type, IEC 62271-200. Transformer Breaker must be VCB.
2	Highest System Voltage	33 kV
3	Rated operating voltage	36 kV
4	Rated frequency	50 Hz (+3% to -5%)
5	Number of poles	Three (3)
6	Rated / minimum power frequency Withstand voltage	70kV
7	Rated lightning impulse Withstand voltage	170 kV
8	Rated Current Busbar	800 A
10	Minimum Creepage distance	25 mm/kV
11	Rated operating duty cycle	0 - 0.3 sec. - CO – 3 min. – CO
12	Rated line charging breaking	As per IEC
13	Reclosing	Single and three phase high speed auto reclosing
14	Maximum fault level	21 kA (rms) for 1 sec. Or appropriate as per design
15	Rated Making Capacity	52 kA
16	Rated Breaking Capacity	21 kA
17	Auxiliary contacts	As required plus 6NO and 6NC contacts per pole as spare.
18	Noise level	Maximum 140dB at 50m distance from base of circuit breaker

5.2.13 Earthing for PV Plant:

i. The earthing shall be designed for 25 years of plant life. Earthing system shall consist of earth grids and electrodes buried in soil in the plant area, embedded in concrete inside the buildings/rooms to which all the electrical equipment, metallic structures are connected to have earth continuity for safety reasons.

ii. The earthing system shall be designed with consideration of the earth resistivity of the project area. The earth resistivity values shall be measured prior to designing the earthing system.
iii. Unless otherwise specified, the earthing system shall be in accordance with IS: 3043 and IEEE 80, Indian Electricity Rules, Codes of practice and regulations existing in the location where the system is being installed.
iv. The permissible system fault power level at all voltage shall be kept in consideration while designing the earthing system. Each array structure of the PV yard, LT power system, earthing grid for switchyard, all electrical equipment, control room, PCU, All junction boxes, ACDB and DCDB, all motors and pumps etc. shall be grounded properly as per the standard mentioned above.
v. Earthing Mesh is to be prepared and installed in the entire power plant.
vi. All the bolts of the earthing system shall be of Stainless steel (SS) type.
vii. All PV Modules, Module Mounting Structures (MMS) and String Combiner Box (SCB) structures in the PV array field and HT, EHT system shall be bonded to the earthing system by two distinct connections.
viii. The Contractor should submit the earthing system design calculations along with the system layout for the Company's approval prior to the installation of the system.
ix. The equivalent resistance of the earth network shall be less than 0.5 ohm. Further, each earth pit resistance shall be less than 2 Ohms. For SCADA and PCU, earth pit resistance shall be less than 1 Ohm.

5.2.13.1 **PV Array Earthing**

i. All PV Modules, Module Mounting Structures (MMS) and String Combiner Box (SCB) structures in the PV array field shall be bonded to the earthing system by two distinct connections.
ii. Each PV Module frame shall be earthed using copper wire of sufficient cross-section. The copper wire shall be connected to the earth hole provided in the module frame using suitable arrangement in line with the manufacturer's recommendation. The earthing arrangement shall use stainless washers to prevent galvanic corrosion between aluminium frame and copper wire. To achieve effective earthing, serrated/star washers shall be employed to penetrate the anodization layer of the module frame.
iii. Continuous copper earthing wire shall be run to connect a group of modules, and both ends of the loop shall be bolted to the DC earth grid using bimetallic lugs and stainless-steel fasteners. The copper earthing wire shall be routed in such a way to avoid physical contact with the module aluminium frame.
iv. The connection between MMS and DC earth grid shall be bolted or welded. Portion of the MMS which undergoes welding at site shall be coated with two coats of cold galvanizing and anti-corrosion paint afterwards.
v. Earth electrodes of the DC earth grid shall be uniformly distributed throughout the PV array field so that optimum earth resistance is offered to leakage current flowing from any module frame or MMS.

vi. SCB equipment earthing point shall be connected to the DC earth grid using flexible copper cable of sufficient cross section as recommended by the manufacturer. The connection with the DC earth grid shall be done using suitable bimetallic lugs and stainless-steel fasteners.

5.2.13.2 **PCU Earthing**

i. DC negative bus bar of the PCU shall be earthed to avoid Potential Induced Degradation (PID) or as suggested by OEM. In case DC negative grounding is not possible, an appropriate anti-PID device shall be provided.
ii. DC negative bus bar and PCU equipment earth shall be bonded to the PCU earth bus and connected to earth electrodes through the flexible copper cable of sufficient cross section as mentioned by the OEM.
iii. The interconnection of PCU earth electrodes with DC earth grid shall be as per PCU manufacturer's recommendation.

5.2.13.3 **Fencing and cable tray Earthing**

The fencing shall be earth through a minimum earth flat size of 25x6 at a minimum distance of 50 meter. The gate of fencing shall be earth with flexible GI wire having minimum size 10 Sq.mm.

All cable trays in the plant buildings as well as inside the trenches, shall be connected to the earth grid at an interval of about 10 meters.

5.2.13.4 **Transformer Earthing**

i. Transformer neutral shall be floating, not to be earthed. However, the recommendation of the inverter manufacturer and OEM shall also be considered.
ii. Transformer tank, cable box, marshalling box and all other body earth points shall be earthed.
iii. Inverter transformer shield shall be earthed separately using a minimum two no. of earth electrodes. The earthing conductor between shield bushing and earth electrodes shall be copper flat of suitable size not less than 25 x 6 mm.
iv. Neutral and body of the auxiliary transformer shall be earthed.
v. Inverter Room and Main Control Room Earthing
   a. Metallic enclosure of all electrical equipment inside the inverter room and main control room shall be connected to the earth grid by two separate and distinct connections.
   b. Cable racks and trays shall be connected to the earth grid at a minimum of two places using a galvanized steel flat.
   c. SCADA and other related electronic devices shall be earthed separately using a minimum of two no. of earth electrodes.

5.2.13.5 **Control Room and Switchyard Earthing:**

Following are the minimum requirement for design of the system:

i. The earthing conductors/risers shall be as per IEEE/IS and approved calculation.

ii. The mesh spacing of the ground mats in CR and Switchyard shall be as per IEEE/IS and approved calculation.
iii. Earthing conductors in the ground or above ground should be interconnected as per IS/IEEE.
iv. Surge protection shall be provided on the DC side, data lines and the AC side of the solar plant.
v. Main earthing conductors shall be laid in the form of a grid. Spacing between conductors, number of parallel conductors, etc., shall be decided such that step and touch potential are within safe limits.
vi. Earthing Conductor Layout in Switchyard/ Transformer yard.
    a. The maximum permissible step and touch potentials shall be calculated in accordance with the formula given in IEEE-80.
    b. The aging effect of the conductor shall also be taken into consideration while arriving at the maximum permissible step and touch potentials.
    c. Earthing conductors shall be provided around the outside edge of the fence at approximately 1000 mm. This shall be connected to the switchyard-earthing grid.
    d. An earthing mat comprising closely spaced (about 150 mm) conductors shall be provided below the operating handles of disconnecting switches and breaker operating kiosks for the additional safety of the operating personnel.
    e. Each earth lead of all transformers neutral shall be directly connected to separate treated pit pipe electrodes with disconnection link in the RCC chamber, which in turn will be connected to the station grid.
    f. One earth lead of CVT/PT/EMPT neutral shall be directly connected to rod electrodes with a disconnection link in the RCC chamber and the other lead shall be connected to the station grid.
    g. Earth leads of all Lightning arrestors shall be directly connected to two separate treated pit pipe electrodes with a disconnection link in the RCC chamber.
    h. The earth grids of different areas of the plant shall be interconnected through test pits to enable the measurement of earth resistance for each area separately.
vii. The metallic framework of all switchyard equipment and support structures shall be connected to the earth grid by means of two separate and distinct connections. Switchyard shall be shielded against direct lightning strike by the provision of overhead shield wire or, earth wire or, spikes(masts) or a combination thereof as per CEA regulations 2010.
viii. For the Transformer yard/ switchyard, a separate earth grid shall be suitably formed and treated earth pits, including raisers, shall be provided for transformer neutral and LAs. Earthing of all equipment shall be carried out by the Contractor. Separate electronic earthing shall be provided each for PCU, SJB and switchyard SCADA systems.

5.2.13.6 **Tests:**

Type test reports for earthing electrode, earth enhancing compound and its associated accessories shall be submitted during detailed engineering for approval.

On completion of installation, continuity of earth conductors and efficiency of all bonds and joints shall be checked.

Earth resistance at earth terminations shall be measured and recorded. The earth plate shall be provided to facilitate its identification and for carrying out periodical inspection.

5.2.14 Isolators cum Earthing Switches, Contacts, Insulators, Busbars

5.2.14.1 Isolator

i. This specification covers design, manufacture, testing and supply of. Manually operated 220 KV, 800 Amps Upright mounting type with manually operated with earth switch Isolators.

ii. The Isolators and Isolator-cum-Earthing Switched shall comply with the requirements of the IS: 9921 and IEC: 129 (latest edition) except specified herein.

iii. The Insulators shall comply with the requirements of IS: 2544 and IEC: 168-1988 (latest edition) for 220 kV pole mounted structure wherever required. 66 kV pole mounted structure would be supplied, installed, and commissioned by the Contractor wherever required.

iv. The isolator shall be of the manual operated type with earthing switches and shall complete with all parts and accessories including insulator operating rods, mounting attachments, necessary for their efficient operation.

v. The equipment shall confirm in all respect to high standards of engineering Equipment shall be capable of performing in continuous commercial operation up to the suppliers guarantee in a manner acceptable to the client, The equipment offered shall be complete with all components necessary for its effective and trouble free operation along with associated equipment's, interlock, protection schemes, etc.

vi. Such components shall be deemed to be within the scope of the Contractor's supply irrespective of whether those are specifically brought out in this specification or not.

vii. All similar parts particularly removable ones shall be interchangeable.

viii. Each pole shall have three Pedestal type of Insulator's stacks. Necessary arrangements shall be provided for proper alignment of the contacts. Ganged operated links shall be so designed that all phases shall make and break simultaneously.

ix. All movable parts which may be in current path shall be shunted by flexible copper conductor of adequate cross-section and capacity, which shall be furnished under bill of material.

x. Service Condition:

   a. The 220 kV triple pole air brake isolators are intended to be used primarily for sectionalizing 220 kV overhead portion of the line

b. Isolator shall confirm IS: 9921(Part 1 to 4) and IEC 600 - 129 "alternating current disconnects (Isolators) and earthing switches", and IS 9921 (Part-I to IV) "Specification for alternating current disconnects (isolators) and earthing switches for voltages above 1000V".

c. The moving and fixed contacts shall be made of hard drawn electrolytic grade copper strips and shall be heavy duty self- aligning and high-pressure type preferably which applies pressure to the contact surfaces after the blades are fully closed and release the pressure before they start to open.

d. High pressure type contacts shall wipe the contact surfaces, while opening and closing. The contacts shall be so designed that wiping, action shall not cause securing or abrasion on the contact surfaces.

e. The wiping action shall be sufficient to remove oxide film, formed during the operation of the switches. The pressure shall be developed by rotation of the entire blade.

f. The temperature rises of contacts due to the flow of rated short circuit current for a period of 3 seconds shall not cause any annealing or welding of contacts.

g. The moving contacts, if provided, shall close first and open last so that no damage is caused due to arcing whatever to the main contacts. The Successful Bidder shall give full details of such contacts with necessary drawings.

h. The arcing contacts, if provided shall close first and open last so that no damage is caused due to arcing whatever to the main contacts. The Contractor shall give full details of such contacts with necessary drawings.

i. The female contact and its tensioning by spring shall be such that there will, always, be a positive contact with adequate pressure to give enough contact surface for the passing of current. The springs provided should not go out of alignment or get entangled with the male contact during operation. The details of springs shall be furnished on the G.A. drawing.

xi. INSULATORS:

a. The isolator shall be provided with solid core insulators. These shall be of stacking type to be used. The dimensions and other parameters unless otherwise specified shall generally conform to IS - 5350-Part-11 and IEC 273.

b. The cylindrical type of post insulators shall be of solid core type. Insulators of similar type shall be interchangeable.

c. The mechanical strength class for outdoor cylindrical post insulators shall be of strength class 6, corresponding mechanical strength in tension, compression and torsional shall be as per IS: 53550 Part - II. When operated at maximum system voltage, there shall be no electrical discharge. Shielding rings, if necessary, shall be provided.

d. The parameters of the insulators required shall conform to IS: 0350 - Part - II - 1973 or IEC 273.

e. The cylindrical post insulators shall consist of single unit only.

f. The insulator shall be provided with a completely galvanized steel base designed for mounting on the support. The base and mounting arrangement shall be such that the insulator shall be rigid and self-supporting and no guying or cross bracing between phase shall be necessary.

xii. Porcelain of the insulator:

a. The porcelain used for the manufacture of the insulators shall be homogenous, free from laminations and other flaws or imperfections that might affect the mechanical or dielectric quality and shall be thorough vitrified, tough and impervious to moisture.

b. The glazing of the porcelain shall be uniform brown colour, with a smooth surface arranged to shade away rainwater and free from blisters, burns and other similar defects. Insulators shall be inter-changeable.

c. The porcelain and metal parts shall be assembled in such a manner and with such materials that any differential thermal expansion between the metal and porcelain parts throughout the operating temperature range will not loosen the parts or electrical strength or rigidity.

d. The assembly shall not have excessive concentration of electrical stress in any section or across leakage surfaces. The cement used shall not give rise to chemical reaction with metal fittings.

e. The insulator shall be suitable for water washing by rains or artificial means in service conditions. Further the insulators to be supplied shall be of high- quality and should not result in mismatch and misalignment of stacks during erection and operation.

f. Each cap shall be of a high-grade cast iron or malleable steel casting or steel forging. Cap and base insulators shall be interchangeable with each other. The insulator shall conform the requirement of the latest edition of IS: 2544, or any other equivalent standard. The Bidder should furnish the characteristics of insulators in the Bid.

xiii. Busbars:

a. The outdoor busbars and equipment connections shall be with ACSR conductor (Zebra/suitable size as per design).
b. The busbars and the connection jumpers shall be supported on post insulators wherever required.
c. The ACSR bus bars are an underground system of wires strung between two supporting structures and supported by strain type insulators. The stringing tension may be limited to 500-900 kg. depending upon the size of the conductor used. These types of bus bars are suitable for earthquake prone areas.
d. Bus bar Material – The materials in common use for bus bars and connections of the strain type are ACSR conductor.
e. Since aluminium oxides rapidly great care is necessary in making connections. In the case of long spans expansion joints should be provided to avoid strain on the supporting insulators due to thermal expansion or contraction of pipe.
f. The bus bar sizes should meet the electrical and mechanical requirements of the specific application for which they are chosen.
g. The isolator shall be provided with padlocking device to permit locking of the isolator in both fully open and fully closed positions.

5.2.15 Drop Out Fuse

i. The D.O. Fuse assembly should be suitable for 33 KV supply and in accordance with IS 9385 / 1985. and provided with a test certificate.
ii. The assembly shall be mounted on double pole structure complete with 3 fuse elements of required ampere rating. The fuse link shall consist of iron channel base, stack insulator per phase, fuse carrier Bakelite tube, non-ferrous metal parts and spring-loaded phosphor-bronze contacts. The insulator shall comply with impulse voltage test in accordance with IS 3106.

5.2.16 Lightning Arrestor

Type and Rating

Lightning arrestor shall be station class, heavy duty, non-linear resistance type with rating as 33 KV. The arrestor shall have adequate thermal discharge capacity for severe switching surges, long duration surges and multiple strokes.

Constructional Features

i. The arrestor shall be single pole and hermetically sealed off. It shall be of robust construction with excellent electrical and mechanical characteristics.
ii. Insulators must be non-hygroscopic and shall be wet process porcelain, brown glazed and free from imperfection. All metal parts and hardware shall be hot dip galvanized.
iii. Creepage distance shall correspond to heavily polluted atmosphere. Grading ring if required shall be provided to maintain voltage gradient within permissible limit.
iv. The arrestor shall be provided with pressure relief device if applicable to prevent shattering of approach in case excessive gas pressures build up.

Accessories

i. Lightning arrestor shall be furnished complete with insulating base, surge counter and anchoring hardware for mounting on steel structure.
ii. A surge counter shall be mounted at a convenient height for reading counter Terminals shall be such as to permit connections with minimum bends.
iii. A leakage current detector shall be furnished with the counter as an integrate part. This is for monitoring the leakage to indicate any possible breakdown.
iv. A suitable sized bypass shunt along with necessary terminals shall be furnished for bypassing the discharge counter if required.

Terminals

i. All connection terminals shall be of corrosion resistant material and shall be provided with complete connection hardware.
ii. High voltage line terminal connector suitable for ACSR, AAAC conductor.

Related Civil Work

Foundation require for two pole structure in switch yard area shall be carried out by vendor with respective civil material as required to complete the job successfully as mentioned in our drawing.

5.2.17 Low Voltage Switchgear

Current Transformer	
Accuracy class	0.5 for metering, 5P20 for protection
Ratio	As per system design
Rated VA burden	As per system requirement
Insulation class	Class E or better
Voltage Transformer	
Accuracy class	0.5 for metering, 3P for protection
Ratio	As per system design
Rated VA burden	As per system requirement
Insulation class	Class E or better

5.2.17.1 AC Distribution Panel Board and LT Switchgear

A: LT Switchgear

I. **Standard and Codes:**

All equipment provided under LT switchgear shall comply with latest revisions and amendments of the relevant IEC standards and IS codes. In particular, the switchgear shall comply with the following standards and codes.

Standard/Code	Description
IEC 61439-1	Low-voltage switchgear and control gear assemblies - Part 1: General rules
IEC 61439-2	Low-voltage switchgear and control gear assemblies - Part 2: Power switchgear and control gear assemblies
IEC 60947-1	Low-voltage switchgear and control gear - Part 1: General rules
IEC 60947-2	Low-Voltage Switchgear and Control gear: Circuit Breakers
IEC 60947-3	Low voltage switchgear and control gear: Part 3 Switches, dis-connectors, switch-dis-connectors and fuse combination units
IEC 60947-4-1	Low-voltage switchgear and control gear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor starters
IEC 60947-5-1	Low-voltage switchgear and control gear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices
IEC 62052-11	Electricity metering equipment (a.c.) - General requirements, tests and test conditions - Part 11: Metering equipment
IS 694	Polyvinyl chloride insulated unsheathed-and sheathed cables/ cords with rigid and flexible conductor for rated voltages - up to and including 450/750V
IEC 61869	Instrument Transformers
IS 3043	Code of practice for earthing
IEC 60255	Measuring relays and protection equipment - Part 1: Common requirements

II. Technical Parameters:

Parameter	Specification
System detail	
Rated system voltage	As per system requirement ± 10%, 3 Phase, 50Hz, 4 wire, Neutral Solidly Earthed
Digital Multifunctional Meter (MFM)	
Accuracy class	0.5 class for main distribution board at main control room and 0.5 class for DB at inverter room(s)
Communication with SCADA	RS485 communication with Modbus RTU
Current transformer (CT)	
Type	Cast Resin Bar Primary
Voltage class and frequency	As per system requirement, 50 Hz
CT Secondary Current	1 or 5 A
Class of insulation	Class F
Accuracy class and burden	

a) For Protection	5P20, 5VA PS Class for REF and core balance CT (CBCT)
b) For Metering	Class 0.5, 5VA (min)
Minimum primary earth fault current to be detected by CBCT	, 1 A
Instrument Security Factor for metering CT	5
Voltage transformer (VT)	
Type	Cast Resin
Accuracy class	0.5
Rated Voltage factor	1.1 continuous, 1.5 for 30 seconds
Class of insulation	E or better
Moulded case circuit breaker (MCCB)	
Rated voltage	As per system requirement
Release	Thermal-Magnetic/Microprocessor
Rated current	
Poles	4 poles
Rated insulation level	As per system requirement
Rated ultimate and service short circuit breaking Capacity	As per system requirement
Rated Making capacity (as per system requirement)	2.1 × Short circuit breaking Capacity
Utilization category	A

III. Construction:

i. The panel shall be metal enclosed, free standing, floor mounted, modular type with compartmentalized construction having degree of protection of IP 4X (Indoor) and IP 55 (Outdoor) as per IS/IEC 60529. All doors and covers shall be provided with neoprene gaskets to prevent entry of vermin and dust.

ii. All switches, push buttons etc. shall be operated front and shall be flush/semi-flush mounted.

iii. The panel shall be fabricated from 2 mm CRCA sheet steel for frame and load bearing surfaces. Partitions may be fabricated from 1.6 mm CRCA if no components are mounted on them.

iv. Cable entries shall be from bottom. The opening of cable entry shall be covered by 3mm thick gland plates with proper sealing to avoid water and rodent entry.

v. Earthing bus bar of suitable cross section shall be provided throughout the length of panel.

vi. The panel shall be duly wired with suitable size of 1.1kV, PVC insulated cable and terminals shall be brought out for cable connections. 10% spare terminals subjected to minimum one of each rating shall be provided on each distribution switchgear. All wire shall have ferrules as per wiring diagram.

vii. The panel shall be painted with 2 coats of primer after pre-treatment and 2 coats of Polyurethane / epoxy paint with shade as decided by the Owner.

viii. The panel shall be of dead front construction suitable for front operated and back maintained functioning.

ix. 240 V, 5 A, 3 pin industrial socket-outlet with ON/OFF switch shall be provided in each panel.

x. Each panel shall be provided with LED lamp rated for 240 V, 50 Hz, single phase AC supply for interior illumination controlled by door switch.

xi. Suitable lifting hooks shall be provided for each panel.

xii. Each switchgear panel shall be provided with thermostatically controlled space heaters to prevent condensation within the enclosure. The space heater shall be connected to 240 V, 50 Hz, single phase AC supply through suitable switch and fuse.

xiii. MCCB

a. The MCCBs shall be designed in accordance with the IEC Publications 60947.1 and 60947.2.
b. All MCCBs shall be manually operated and shunt trip type.
c. MCCB shall have current limiting feature. MCCB of identical ratings shall be physically and electrically interchangeable. MCCB shall be provided with 1 NO and 1NC auxiliary contacts.
d. The MCCB contacts shall be of the self-cleaning type, made from an approved arc resisting material. All contacts shall be self-aligning and shall be readily replaceable.
e. MCCB shall be provided with Microprocessor based inbuilt front adjustable releases (overload and short circuit) and shall have adjustable earth fault protection unit also.

xiv. Fuses

a. All fuses shall be of HRC cartridge fuse link type. Screw type fuses shall not be accepted. Fuses for AC circuits shall be rated for 80kA rms (prospective) breaking capacity at 415V AC and for DC circuits, 20kA rms breaking capacity at 240VDC.
b. Fuse ratings for motor feeders shall be coordinated by the Bidder to achieve class-II protection coordination and to match the motor characteristics.
c. Fuse shall have visible operation indicators. Insulating barriers shall be provided between individual power fuses. Fuse shall be mounted on insulated fuse carriers, which are mounted on fuse bases.

xv. Contactors

a. Motor starter contactors shall be of air brake, electromagnetic type rated for uninterrupted duty as per IS: 13947 Part-4 Section- 1. Contactors shall be double-break, non-gravity type and their main contacts shall be silver faced.
b. The number of normally open (NO) and normally closed (NC) auxiliary contacts of a contactor shall be as per requirement. It shall, however, be not less than 2NO+2NC. The contactor shall operate satisfactorily between 85% and 110% of the rated voltage.

xvi. Current transformers

a. The current transformer shall be single phase single core inductive type. It shall be mounted within the cubicles and shall comply with the requirements of relevant IEC 60044-1.
b. Air circuit breakers shall have single core CTs of suitable rating (based on capacity of breaker) for protection of 5P20 class. The secondary windings of all current transformers shall be grounded at one point only and means shall be provided to facilitate the secondary windings to be short-circuited.
c. The burden rating of all current transformers shall not be less than 200% of the overall computed burden of apparatuses connected to each transformer.

xvii. Painting
a. All sheet steel work shall be pre-treated, in tanks, in accordance with IS: 6005.
b. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "Class-C" as specified in IS: 6005.
c. The phosphate surfaces shall be rinsed and passivated. After passivation, Electrostatic Powder Coating shall be used. Powder should meet requirements of IS 13871 (Powder costing specification).

xviii. Power Cable Termination
a. Cable termination compartment and arrangement for power cables shall be suitable for heavy duty, stranded aluminium conductor, PVC/ XLPE insulated, armoured / unarmoured and PVC sheathed cables.
b. All necessary cable terminating accessories such as supporting clamps and brackets, hardware etc., shall be provided by the contractor, to suit the final cable sizes.
c. All power cable terminals shall be of stud type and the power cable lugs shall be of tinned copper solderless crimping ring type conforming to IS:8309. All lugs shall be insulated/ sleeved.
d. All cable terminations shall be appropriately tightened to ensure secure and reliable connections.

xix. Derating of Components
a. The Bidder shall, ensure that the equipment offered will carry the required load current at site ambient conditions specified and perform the operating duties without exceeding the permissible temperature as per Indian Standards / Specification. Continuous current rating at 60-degree C ambient in no case shall be less than 90% of the normal rating specified.
b. The Bidder shall clearly indicate the derating factors if any employed for each component and furnish the basis for arriving at these derating factors.
c. Protection Co-ordination
d. It shall be the responsibility of the Contractor to fully coordinate the overload and short circuit breakers/fuses with the upstream and downstream circuit breakers / fuses, to provide satisfactory discrimination.

xx. Terminal Blocks

a. Terminal blocks shall be 1100V grade, 10Amps rated, made up of unbreakable polyamide 6.6 grade.
b. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals, the screw shall be captive, preferably with screw locking design.
c. Terminal blocks for CT and VT secondary leads shall be of stud type, made up of unbreakable polyamide 6.6 grade. They shall be provided with links to facilitate testing, isolation star / delta formation and earthing.
d. Terminal blocks for CT secondary shall have the short-circuiting facility. The terminals for remote ammeter connection etc. shall also be disconnecting type only.
e. All metal parts shall be of nonferrous material. Screws shall be captive.
    I. At least 10% spare terminals for external connections shall be provided on each panel and these spare terminals shall be uniformly distributed on all terminal blocks. Space for adding another 10% spare terminals shall also be available in each panel.
    II. There shall be minimum clearances of 250 mm between the terminal blocks and the cable gland plate and 150 mm between two rows of terminal blocks.

xxi. All panel wring for external connections shall terminate on separate terminal blocks which shall be suitable for connecting two (2) stranded copper conductors of 2.5 sq. mm on each side, or alternatively, the terminal blocks shall have the possibility of double shorting space to facilitate looping. Warranty: Distribution panels (ACDB and DCDB) shall be warranted against all material/ manufacturing defects and workmanship for minimum of 1 (one) year from the date of supply. Warrantee certificate shall be issued by OEM directly in the name of TVNL.

xxii. Testing: Routine test and acceptance tests requirements shall be as per relevant standards for all cable size

xxiii. Execution: Single front / compartmentalized, modular design, degree of protection IP52 with provision of extension on both sides.
a. Incomer feeders: mains incomer - Electrically operated draw out type Air Circuit Breakers (ACBs).
b. Outgoing feeders: Electrically operated draw out type Air Circuit Breakers (ACBs) / Moulded Case Circuit Breakers (MCCBs).
c. The colour finish shade of switchgear enclosure for interior shall be glossy white and for exterior it shall be light grey, semi glossy shade 631 of IS: 5. If a different exterior shade is desired by the Purchaser, the same shall be intimated to the supplier.
d. The PCC shall be fabricated out of CRGO sheet steel; 2 mm thick for the outer shall all-round. The internal walls and separators shall be of 1.6 mm thick CRGO sheet steel.
e. The gland plates shall be minimum 3 mm thick.

5.2.18 Control and Relay Panel for 415 V TPN Power Control Centre

i. This specification is for the 415V TPN Power Control Centre (PCC).

ii. The PCC shall be rated for the maximum output of the supply transformer feeding the system. The short circuit withstand rating (1 sec) at rated voltage of the switchgear shall be minimum of 20 kA (rms) and corresponding dynamic rating shall be 50 kA (peak)

iii. The configuration of the PCCs shall be as per the Single Line Diagram of the system.

I. Execution

Power Control Centres (Construction)

i. Single front / compartmentalized, modular design, degree of protection IP52 with provision of extension on both sides.

ii. Incomer feeders: mains incomer - Electrically operated draw out type Air Circuit Breakers (ACBs).

iii. Outgoing feeders: Electrically operated draw out type Air Circuit Breakers (ACBs) / Moulded Case Circuit Breakers (MCCBs)

iv. The colour finish shade of switchgear enclosure for interior shall be glossy white and for exterior it shall be light grey, RAL 7032 of IS: 5. If a different exterior shade is desired by the PURCHASER, the same shall be intimated to the supplier.

v. The PCC shall be fabricated out of CRGO sheet steel; 2 mm thick for the outer shall all-round. The internal walls and separators shall be of 1.6 mm thick CRGO sheet steel.

vi. The gland plates shall be 3 mm thick.

II. Control Circuit

i. Control supply for breaker closing / tripping - 110V DC.

ii. Air Circuit Breaker spring charge motor – 240 V AC, 1 phase.

iii. Moulded Case Circuit Breakers – 240 V AC, 1 phase.

iv. Indications, annunciation – 110V DC

v. Space heater, sockets, etc. – 240 V AC, 1 phase.

III. Busbar and Cable Cavity

i. The material for main bus bars and tap off bus bars shall be electrolytic grade aluminium with HR PVC sleeved insulation.

ii. Bus bars shall be suitable for short circuit rating and current suitable for all connected loads.

iii. Bottom cable entry for incoming and outgoing cables

iv. A suitable gland plate shall be supplied for termination of power, control and instrumentation cables.

v. Whenever feeders are housed in multi-tier configuration, these tiers shall be segregated by sheet metal barriers.

5.2.19 Control Room Electrical Wiring

i. Electrification of building shall be carried out as per IS 732-1989, IS 4648-1968 and other relevant standards. Suitable AC Distribution Board should be designed to Supply AC power in Control room.

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

5.2.20 Auxiliary Power Supply:

i. The Contractor shall install a separate auxiliary transformer to supply power for internal equipment such as power for control equipment, area lighting, water pumps, conference room fixtures, control room lighting and air- condition, etc. A separate kWh energy meter is to be provided by contractor for accounting of electricity consumed for auxiliary equipment's. The transformer of suitable capacity, based on the lighting and other auxiliary load of the plot, shall be connected to the LT side of the IDT.

5.2.21 DC Battery and Charger:

i. Adequate capacity DC battery Bank should be provided for emergency control supply of inverters, control / protection system and emergency lighting. An appropriate capacity battery charger with relevant IS/IEC standards and 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.

ii. A DC power supply Distribution panel/board should be supplied along with the Charger as per relevant IS standards. Control room DC Battery Bank and DC supply system theoretical design, calculations, and detailed explanations along with drawing shall be provided and approved by TVNL.

iii. DC Batteries the batteries shall have the following specifications.
   a) Type : Nickel Cadmium Stationary, sealed type, storage battery
   b) Rating : 110 V D.C., Minimum 80 Ah at 8 Hour rate of discharge
   c) Standard : IS 1651 – 1979; performance as per IS 8702
   d) Container : Plastic Resin, ABS or PP
   e) Terminal Post: Designed suitably to accommodate external bolted connections

iv. The battery shall be provided with epoxy paint coated exhaust fan for removal of gasses released from the battery cells.

v. The data sheet for the battery shall be submitted along with the Bid for evaluation.

5.2.22 Earthing:

i. Earthing bus bar shall be terminated at both ends of the switchgear to suit the connections to outside earthing conductor. All components inside the module are required to be earthed individually and are to be looped and connected to the horizontal earth bus.

I. <u>Terminals</u>

i. CT circuit - Isolating link type terminals with shorting facility
ii. PT circuit – clip on type terminals
iii. Spare contacts shall be wired up to terminal block. 10% spare terminals shall be provided for each module.

II. <u>Specific Requirements:</u>

i. All ACBs shall be 4 pole, electrically operated, draw-out type, with closing coil, spring charge motor, trip coil, TNC switch for close and trip, manual closing and tripping push buttons, door I/L, test and service position micro.
ii. switches, emergency P.B., safety shutters, etc. The circuit breaker shall be provided with anti-pumping feature.
iii. ACBs shall be complete with microprocessor release and shall be provided with over current, short circuit and earth fault protections.
iv. Minimum10% spare feeders of each rating shall be provided in the switchgear.
v. All current transformers shall have 5/1A secondary and all meters shall be suitable for 5/1 A operation.
vi. All indicating lamps shall be of LED cluster type. ACB feeders shall be provided with ON, OFF, AUTOTRIP, SPRING CHARGED, TEST, SERVICE, TRIP CIRCUIT HEALTHY indications.
vii. All indicating instruments shall be flush mounting, Digital, 96 sq. mm size.
viii. Window annunciator with hooter and accept, test, reset button shall be provided. Necessary auxiliary relays for contact multiplication shall be provided in the panel.
ix. The maximum temperature of the bus bars, droppers, and contacts at continuous current rating under site reference ambient temperature of 50º C shall not exceed 105º C.
Instrumentation: Switchgear instrumentation shall be provided as follows:
a) Mains Incomer – Voltmeter with selector switch
b) Ammeter with selector switch
c) Power Factor meter
d) Frequency meter
e) TVM + MD meter
f) Potential indicating lamps.
g) Outgoing Feeders
h) Ammeter with selector switch on all feeders

5.2.23 General Technical Specifications of Control Panel:

i. The panel shall be self-supporting, free-standing, floor mounted, modular type with construction having degree of protection of IP 54 as per IS 2147.
ii. The panel shall be fabricated from 14 SWG CRCA sheet steel for frame and load bearing surfaces. Partitions may be fabricated from 16 SWG CRCA if no components are mounted on them.
iii. The panel shall be painted with 2 coats of primer after pre-treatment and 2 coats of Polyurethane / epoxy paint with shade as decided by the Company.
iv. Stiffeners shall be provided at corners and between modules to make the panel rugged. The stiffeners will necessarily be required for relay compartments or doors where heavy components are mounted.
v. The openable covers shall be provided with lift off type hinges, quarter turn door locks and flexible copper wire for earth connection.
vi. The panel shall be dust and vermin-proof. Synthetic or neoprene gaskets shall be provided at all openings.

vii. The panel shall be of dead front construction suitable for front operated and back maintained functioning.
viii. Panel shall be provided with fl. lamp of 20 w capacity operated by door operated limit switch. Panel shall also have space heaters and thermostat arrangements.
ix. Panel shall be provided with 3 pin switch socket combined unit of 5 Amp capacity.
x. Lifting hooks shall be provided at the top of the panel.
xi. The hardware components used in the panel shall be hot dipped galvanized.
xii. The control components shall be fixed on mounting plate by drilling and tapping.
xiii. Aluminium anodized legend plates shall be provided for all the components. For components mounted on the front face, a legend plate from inside shall also be provided.
xiv. Pre-treatment by 7 tank process shall be done before painting / powder coating the panel.
xv. Panel shall have provision of drawing pocket.
xvi. The panel shall be designed to ensure maximum safety during operation inspection, connection of cables and maintenance. Inside panel, checking and removal of components shall be possible without disturbing other units.
xvii. Cable entries will be from bottom. The opening of cable entry shall be covered by 3 mm thick gland plates.
xviii. The panel shall be provided with all necessary components / devices and instruments as per the enclosed schematic diagram and functional requirements.
xix. The components such as protective relays, auxiliary relays, push buttons, switches, and instruments shall be flush mounted on the front side of a panel.
xx. The control wiring shall be done with PVC insulated flexible copper wire. For CT secondary circuits 2.5 sq.mm. wire shall be used. For control wiring 1.5 sq.mm. wire shall be used.
xxi. Earthing busbar of suitable cross section shall be provided throughout the length of panel.
xxii. The panel shall be fully wired all the terminals shall be brought out for cable connections. 10% spare terminals shall be provided on each terminal block. Separate terminal block shall be provided for different voltages. All wire shall have P.V.C. ferrules as per the wiring diagram.
xxiii. Proper shrouding to incoming and outgoing terminals shall be provided to ensure safety during operation, inspection, and maintenance.
xxiv. Indicating lamps shall be with multiple LEDs and shall be suitable for the voltage specified.
xxv. All the components in the panel shall be properly labelled. The labels shall be made of non-rusting metal or engraved PVC material properly fixed by screws.
xxvi. The panel layout shall be made in such a way that it will always facilitate easy removal and reconnection of control cables without disturbing other wiring.
xxvii. Centre lines of control switches, push buttons and indicating lamps shall be matched so as to give neat appearance. Similarly top lines of indicating instruments and relays shall also be matched.
xxviii. The panel shall be provided with electrolytic grade aluminium busbar of suitable cross section to maintain max current density of 0.8 AMP/ Sq.mm.
xxix. Bus bars shall be provided with colour coded heat shrinkable sleeves.

xxx. Bus bars shall be supported by high quality epoxy insulators provided at specified distances to withstand to the given fault level.

xxxi. The busbar chambers shall be provided with suitable ventilation arrangements to limit the maximum temperature of 85°C while carrying rated current.

xxxii. Proper clearance of minimum 25 mm shall be maintained between phase bus bars and between bus bars.

xxxiii. The panel shall be inspected at manufactures works before dispatch to site at the discretion of TVNL.

xxxiv. All routine tests shall be carried out on the panel in presence of the Company / its representative. These tests shall include following:

a) Verification of components ratings and operation.
b) High voltage measurement test.
c) Insulation Resistance measurement.

xxxv. Control testing

xxxvi. Approval on following drawings shall be obtained before manufacturing the panels.

a) General arrangement drawing.
b) Wiring Diagram.
c) Detail bill of material.
d) 220 KV Transmission Line

The Contractor shall provide 220 KV transmission with bay and metering on Turnkey basis as per client's requirement as per the application. Bidder shall confirm the same in the Bid.

5.2.24 Electrical Panel for Prefabricated Control room cum Operator Room

Electrical panels shall have electrical panel adequate inputs to take in from the centralized Push Button Switching Unit having suitable mimic with power flow indicator and status indicator of different PCU's. The Panel shall be floor-mounted type.

i. 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.

ii. All the Power cables shall be taken through backside of the Panel via sufficient concrete cable trench and cable trays with cover at top.

iii. The Panel shall be fitted with suitable rating and size, HRC fuses/circuit breaker/isolators, indicators for all incomer and outgoing terminals, voltmeter, and ammeter with suitable selector switches to monitor and measure the power to be evacuated.

iv. Nuts and bolts including metallic cubicle shall have to be adequately protected against atmosphere and weather prevailing in the area.

v. The dimension, 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.

vi. Prefab Control room cum Inverters Room shall be of adequate size and of standard manufacturer with sufficient lighting points and RCC cable trenches with covers and shall have exhaust chimney and also sufficient ventilation.

vii. All prefab control room cum Inverters room shall be layer on RCC plinth with sufficient foundation and Grad Slab. The plinth shall minimum 450 mm high from formation level of the plant.

viii. All the design and drawing related to 33 KV Substation / Two Pole Structure/ interconnection with grid should be as per requirement of Discom/TVNL and approved from Discom/TVNL.

ix. The Contractor shall provide to the Company detailed civil, electrical, plumbing, etc. drawings and equipment specifications for the inverter/ control room and take approval from client/consultant.

x. The drawings of Panels with the make of components should be approved from the Company. All the design and drawing related to switch yard / interconnection with grid should be as per requirement of state electricity rules as approved by competent authority. Prefab structure shall have sufficient number of lighting point/ACDB/MCB boar.

xi. The Contractor shall provide to the Company detailed civil, electrical, plumbing, etc. drawings and equipment specifications for the inverter/ control room and take approval from the Company.

5.2.25 Area Lighting

i. This scope includes design, supply, installation and testing, commissioning, operating and maintaining LED based area lighting for the solar farm covering all key areas for O&M purpose.

ii. Fixture shall be minimum IP 66 rated along with minimum IP 65 rated control gear, luminance efficacy of the fixture shall be more than 70%, colour temperature shall be 3000~4000 K to match the peripheral area lighting of the campus.

iii. GI poles as per IS guideline, shall be used made of B class pipes with preferable integral junction box and sufficient protection per pole. This shall include all necessary electrical cabling, earthing Timer based control panel etc as required to complete the system. The connector box shall be made of stainless steel, Dust and Vermin Proof, which is to be recessed at the base of each Yard Lighting system. The connector box shall have suitable brass or copper made connector terminal.

iv. Area lighting arrangement shall be made to illuminate the entire periphery of the sites at an appropriate lux level for night hours or bad light hours. Area lighting arrangement shall have adequate numbers of lighting poles (50 mm diameter with 3 mm thick at 25 meter spacing) on the sides of peripheral roads, etc) as per requirement by TVNL.

v. All the yard lighting towers, and lighting fixtures shall be effectively grounded using adequate size of GI earthing wires / GI earthing strips.

vi. The lighting poles shall be concreted with 600 mm coping above ground level for pole protection with sufficient reinforced concrete foundation below ground.

vii. Loop in – Loop out power cables shall be brought up to the control gear box through of adequate size for cable protection.

viii. The cables shall be properly glanded to the control gear box gland plate.

ix. XLPE / PVC insulated armoured Cu/Al cables of adequate size shall be used for interconnection and supply of power to Yard lighting systems.

x. Cable terminations shall be made with suitable cable lugs and sockets etc., crimped properly and passed through brass compression type cable glands at the entry and exit point of the connector box and at the entry point to MCB distribution Box for controlling the yard lighting system.

xi. Lighting fixtures shall be installed closed to the fencing.

5.2.26 Metering System

i. The Solar power would be used for local consumption of TVNL, and excess generated power will be fed into the grid.

ii. ABT energy meter shall be provided as approved by TVNL, Discom, Transco to measure the delivered quantum of energy to the grid for sale. The responsibility of arranging for the meter, its inspection/calibration/testing charges etc. rests with the Contractor. All charges incurred on Meter testing, shall be borne by the Contractor. ABT energy metering system is to be approved by Discom.

iii. Meter must be provided with the necessary data cables.

iv. Power requirement for the internal plant use must not consider in total generation capacity. It will be net metered with import and export power utilisation and the auxiliary power should interfere with accounting of solar electricity feed into the grid. Contractor to consider necessary Electrical Distribution for internal plant requirement from common network.

v. The Bidder shall provide ABT compliant meters at the interface points. Interface metering shall conform to the Central Electricity Authority (Installation and Operation Meters) Regulation 2006 and amendment thereof Commercial settlement of solar Photovoltaic Grid Interactive based power project shall be in accordance with the Discom guidelines and TVNL order.

vi. Meter shall be suitable for interfacing for synchronizing the built-in clock of the meter by GPS time synchronization equipment existing at the station either through a synchronization pulse received from the time synchronization equipment or through a remote PC synchronized to GPS clock shall also be in the scope of Bidder.

vii. All charges for testing and passing of the meter with relevant government agency shall be borne by Bidder, TVNL will assist Bidder for necessary document as and when required.

viii. ABT compliant Energy Meters shall have technical specification as given below (not limited to specified requirement, Bidder can provide Meter with latest facilities):

ix. Shall be microprocessor-based conforming to IEC 60687 / IEC 6205211/ IEC 62053- 22 / IS 14697

x. Shall carry out measurement of active energy (both import and export) and reactive energy (import) by 3-phase, 4 wire principle suitable for balanced/ unbalanced 3 phase loads.

xi. Shall have an accuracy of energy measurement of at least Class 0.2 for active energy and at least Class 0.5 for reactive energy according to IEC 60687 and shall be connected to Class 0.2 CT cores and Class 0.2 VT windings.

xii. The active and reactive energy shall be directly computed in CT and VT primary ratings.

xiii. Shall compute the net MWh and MVARh during each successive 15-minute block metering interval along with a plus/minus sign, instantaneous net MWh, instantaneous net MVARh, average frequency of each 15 minutes, net active energy at midnight, net reactive energy for voltage low and high conditions at each midnight.

xiv. Each energy meter shall have a display unit with a seven-digit display unit. It shall display the net MWh and MVARh with a plus/minus sign and average frequency during the previous metering interval; peak MW demand since the last demand reset; accumulated total (instantaneous) MWh and MVARh with a plus/minus sign, date and time; and instantaneous current and voltage on each phase.

xv. All the registers shall be stored in a non-volatile memory. Meter registers for each metering interval, as well as accumulated totals, shall be downloadable. All the net active/reactive energy values displayed or stored shall be with a plus /minus sign for export/import.

xvi. At least the following data shall be stored before being over-written for the following parameters:

Sr.	Parameters	Details	Min No of Days.
1	Net MWh	15 min Block	90 days in meter
2	Average Frequency	15 min Block	90 days in meter
3	Net MVARh for > 103 %	15 min Block	90 days in meter
4	Cumulative Net MWh	At every Mid-night	30 days in meter / 90 days in PC
5	Cumulative Net MVARh for v > 103 %	At every Mid-night	30 days in meter / 90 days in PC
6	Date and time blocks of VT failure on any phase		

xvii. Shall have a built-in clock and calendar with an accuracy of less than 15 seconds per month drift without assistance of external time synchronizing pulse.

xviii. Date/time shall be displayed on demand. The clock shall be synchronized by GPS time synchronization equipment existing at the station provided by Bidder.

xix. The meter shall be suitable to operate with power drawn from the VT supplies. The burden of the meters shall be less than maximum 2 VA.

xx. The power supply to the meter shall be healthy even with a single-phase VT supply. An automatic backup, in the event of non-availability of voltage in all the phases, shall be provided by a built-in long-life battery and shall not need replacement for at least 10 years with a continuous VT interruption of at least 2 years. Date and time of VT interruption and restoration shall be automatically stored in a non-volatile memory.

xxi. Even under the absence of VT input, energy meter display shall be available, and it shall be possible to download data from the energy meters.

xxii. Shall have an optical port on the front of the meter for data collection from either a handheld meter reading instrument (MRI) having a display for energy readings or from a notebook computer with suitable software.

xxiii. The meter shall have means to test MWh and MVARh accuracy and calibration at site in-situ and test terminal blocks shall be provided for the same.

xxiv. The meter shall have a unique identification code provided by the Company and shall be permanently marked on the front of the meter and stored in the non-volatile memory of the meter.

xxv. The Company shall have the right to carry out surprise inspections of the Metering Systems from time to time to check their accuracy.

xxvi. A separate kWh energy meter is to be provided by contractor for accounting of electricity consumed for auxiliary equipment.

5.2.27 SCADA and Remote Monitoring System

i. The plant shall be automatically operated and shall be controlled by microprocessor-based control system SCADA. There shall be simultaneous data logging, recording and display system for continuous monitoring of data for different parameters of different sub systems, power supply of the power plant at DC side and AC side.

ii. An integrated SCADA shall be supplied which should be capable of communicating with all inverters and provide information of the entire Solar PV Grid interactive power plant. All the location should be interconnected with the Fiber optic cables.

iii. SCADA system shall comply with IEC 62443 for cyber security.

iv. Computer-aided data acquisition unit 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 and software, which will be robust and rugged suitable to operate in the control room Environment.

v. Reliable sensors for solar insolation, temperature, and other weather and electrical parameters are to be supplied with the data logger unit.

vi. The data acquisition system shall measure and continuously record electrical parameters at inverter output, 220 KV ABT meter at evacuation point, ambient temperature near array field, control room temperature, AC and DC side electrical parameters of each inverter, power characteristics of the HT side.

vii. 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 and representation of monitored data shall be in graphics mode or in tabulation form. All instantaneous data can be shown in the Computer Screen. Provision should be available for Remote Monitoring.

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

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

x. SCADA shall provide following data at a 5–15-minute interval.
   a) Power at 220 KV ABT meter at switchyard
   b) Ambient temperature near array field.
   c) Wind Speed
   d) AC and DC side Power of each inverter
   e) Solar irradiation/isolation

f) Voltage of the HT Side

x. Any other parameter considered necessary by supplier based on current prudent practice.

xi. SCADA shall provide 15 minutes daily, monthly, and annual average of following parameters:
   a) Exported Energy to grid at 220 kV.
   b) Energy of each inverter
   c) Solar Radiation
   d) Temperature

xii. The SCADA server PC shall be of Industrial type, rugged and robust in nature to operate in a hostile environment. The PC shall have minimum Intel Core i5 processor having 2 X 500 GB SDD with 16 GB RAM. The PC shall also have 42" TFT Colour monitor, DVD Drive with Writer, Floppy Drive, USB drive, Scroll Mouse, and UPS for 4 hours Power back up.

xiii. The printer shall be of industrial type, rugged and robust in nature and of reputed make. The printer shall be equipped for printing, scanning, copying and fax.

xiv. String Monitoring System: String Monitoring System designed exclusively for parallel connection of the photovoltaic field strings, allowing for protection in the case of breakdown and monitoring the entire photovoltaic field, by means of the following checks.
   a. Reading the string currents (10 channels available)
   b. Reading the total voltage of the field
   c. Checking the fuses positioned in the system, to protect the photovoltaic panels.
   d. Checking the state of the internal protection against over-voltages.
   e. Should be very low power consumption.
      - 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 any fault at string level could be recognizable by that system.
      - A provision should be present for remote monitoring of the power plant at string detail over the web.
      - The Contractor shall provide to TVNL the detailed specifications, and all administrative rights/ privileges/ passwords to the string monitoring system.

xv. Weather Monitoring Station and Data logger
   a) Contractor shall provide the data over remote webserver with rights to control or modify the same through appropriate arrangements.
   b) Contractor shall provide necessary licensed software and hardware solution to offer monitoring of electrical parameters of grid and solar generator monitored at individual string level over remote web server. The Contractor shall provide all necessary accessories like power supply, connection cords, sensors, active SIM card with appropriate data plan etc. to make the system complete in all respect.
   c) The cost of data plan during the project and O&M shall be borne by the Contractor. At the end of the O&M, the same shall be transferred to TVNL at no extra cost.
   d) It shall also have local data logging and communication through Bluetooth / Wi Fi and Ethernet port.

e) The Remote Monitoring System shall be capable of sustaining maximum – minimum temperature, rainfall, wind gusts and UV radiation. The enclosure shall be IP65 for outdoor installation / IP21 for indoor installation.
f) The Remote Monitoring System shall have capability to log and send data from weather sensors.
g) The data shall be available for every minimum 15 minutes interval.
h) The system shall have sufficient internal memory storage to retain data for one complete year and shall have provision of expanding memory through external memory card / USB drive.
i) The system shall be able to communicate wirelessly in a proximity.
j) The Contractor shall provide to the Company the detailed specifications, and all administrative rights/ privileges / passwords to the string monitoring system.
k) The data acquisition system shall measure, continuously record power at PV module ambient temperature near array field, cell temperature, wind velocity, AC and DC (string level) side power of each inverter, power characteristics of the HT side, fault messages, alarms etc. in Indian Standard Time.
l) 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 in graphics mode or in tabulation form. All instantaneous data can be shown in the Computer Screen.
m) Provision should be available for Remote Monitoring and Data Retrieval over web server. Moreover, Successful Bidder shall also provide one no. of PC with required hardware and licensed copies of software to make it fully functional for normal operation and data logging through Bluetooth / Wi Fi / RS port from the site.
n) The Bill of Materials associated with the equipment must clearly indicate especially the details about the PC and other accessories.
o) The Data Acquisition System should be housed in appropriate enclosure to sustain outdoor environment as per generation design guidelines laid for enclosures. The same shall have provision of locking the same to prevent unauthorized operation. Remote Monitoring System (RMS) shall provide following data at a 15-minute interval.
    - Power, Current and Voltage at individual solar PV strings (Instantaneous)
    - Ambient temperature near array field, cell temperature measured at module front and back surface.
    - Wind Speed
    - Cumulative AC and DC side Power of each inverter
    - Cumulative AC and DC energy of each inverter
p) Solar irradiation/isolation over horizontal and in-plane of the module
q) Voltage, frequency, and other important electrical parameters etc. in the local grid.
r) Any other parameter considered necessary by supplier based on current prudent practice.

s) 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.

t) data should be in graphics mode or in tabulation form. All instantaneous data should be shown in the Computer Screen.

u) RMS 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 Bidder shall provide compatible software and hardware so that data can be transmitted via Standard modem.

v) RMS shall be provided with independent solar PV based power supply along with maintenance free battery having 3 days autonomy.

w) The RMS shall be compatible to the requirements for measuring and reporting the performance-ratio of the power plant.

x) The contractor shall provide all administrative rights/ privileges/ passwords of the RMS system to TVNL.

y) The Bidder shall submit the data sheet with technical specifications of the RMS system in the Bid.

5.2.28 Weather Monitoring System

5.2.28.1 The Contractor shall provide two numbers of Weather Monitoring System (WMS). One of the WMS shall be installed in PV Plant area A-15/A-16 and second WMS shall be installed at the main administration building of the TTPS, Lalpania.

5.2.28.2 Each WMS shall have following measuring instruments with all necessary software and hardware compatible with the Data logging and web-based monitoring system.

i. **Pyranometer:** The Contractor shall provide two no. of pyranometers for measuring incident global solar radiation, one each on the horizontal surface and in the same orientation (inclination and azimuth) as the photovoltaic modules. The pyranometers shall have following specifications mentioned in Table below.

Sr.	Particulars	Specification
1	Class	I
2	Spectral Response	0.31 to 2.8 micron
3	Sensitivity	Approx. 9 micro - volt/w/m2
4	Time response (95%)	Max 15 sec.
5	Nonlinearity	±0.5%
6	Temperature Response	±2% (-20^{O}C to +50 ^{O}C)
7	Temperature Response	Max ±2%
8	Tilt error	±0.5%.
9	Zero offset thermal radiation	±7 w/m2
10	Zero offset temperature change	±2 w/m2
11	Operating temperature range	- 40 deg. to +80 deg.
12	Uncertainty (95% confidence Level)	Hourly- Max-3%
13	Daily-	Max -2%
14	Non stability	Max ±0.8%
15	Resolution	Min + / - 1 W/m2
16	Input Power for Instrument and Peripherals	230 Vac (If required)
17	Output Signal	Analogue form which is compatible with the data

ii. **Temperature Sensor:** The Contractor shall provide suitable nos. of RTD type temperature sensors with required weather shield as per Indian Standards, to measure individually and simultaneously both, ambient temperature, and module temperature. To measure module temperature, the temperature sensors shall be located on the back of representative modules and on front glass surface. Care must be taken to ensure that the temperature of the cell in front of the sensor is not substantially altered due to the presence of the sensor. Instrument shall have a range of -5°C to 60°C.

iii. **Anemometer and Wind Vane:** The Contractor shall provide double cup anemometer on tubular type made up of hot dipped Galvanized Iron. Velocity range up to 65 m/s, accuracy limit of 0.1 m/s. the anemometer shall have valid calibration certificates which should be produced during one month of the installation. 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. Bidder shall provide Instrument manual in hard and soft form.

5.2.29 Testing Instruments for Electrical and Electronics:

The Contractor shall also provide required set of onsite testing instruments/equipment viz. earth resistance tester, rheostats, insulation tester, millimetres, clamp meters, CRO, Function Generator, Transformer oil BDV kit, Relay testing kit, infra-red thermal imaging handheld temperature meter, inverter testing kit etc.

5.2.30 Electronic LED Display Board:

The Contractor shall provide an electronic LED Display board that can display the Solar PV plant parameters like total generation till date, daily generation, instantaneous generation, instantaneous frequency, etc. The LED display board has to be erected at a height of 8 feet above ground level and should be large enough to be read from a distance. The LED display board is to be placed between the Control Room and the main gate, the exact location of which will be provided by the Company/ Consultant after award of the project.

5.3 DETAILED CIVIL AND OTHER NON-ELECTRICAL WORK

All material, installations, fixtures, accessories etc. to be provided shall be as per the relevant IS specifications. These shall be of best quality and of standard manufacturer as approved by the Engineer-In- Charge (EIC) on site, when there are no standard specifications.

The fresh OPC of 43 grade cement and TMT steel reinforcement bars Fe 415 shall be used confirming to relevant IS specifications of the approved manufacturers of TVNL. The agency has to keep the full proof records of purchase and consumption along with original purchase bills of Cement and Steel as per the TVNL procedures and rules. The agency has to provide best workmanship with skilled manpower for all the civil items as per the standard specifications/ best practice as approved by the EIC. The booklet Standard Specifications for Civil Works will be applicable wherever there is dispute in the items of civil works. TVNL will not supply any material for this work.

5.3.1 Topographical Survey

Topographical survey shall have to be done of the proposed site at 10 m interval by Plain Table or any other suitable standard method of survey and 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 to be fixed with reference to High Flood Level of the proposed site. The formation level shall be 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 and 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 TVNL for approval. Drawings of complete plant capacity must be submitted for approval. Topographical survey drawings for complete 50 MW (AC) for Sabo substation Bokaro, Lalpania, Jharkhand, India 829149, along with drawing shall be submitted as per designed layout.

5.3.2 Soil Test:

Bidder has to carry out detailed Geotechnical investigation to ascertain soil parameters of the proposed site for the use of planning / designing / construction / providing guarantee /

warranty of all civil work including but not limited to foundations / piling for module mounting structures, etc.

The Contractor shall carry out soil investigation through NABL accredited labs Govt. approved / certified soil consultant. These reports shall be furnished to the Company prior to commencing work.

All RCC works shall be provided of Minimum M20 grade with 340 kg cement/cu.mtr of concrete as per relevant IS specifications as well as soil data considering appropriate earthquake seismic zone, wind velocity, whether effect, soil characteristics etc.

The scope of 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 soil condition and submission of detail reports along with recommendation regarding suitable type of foundations for each bore hole along with recommendation for soil improvement where necessary. 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. 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. The Contractor shall submit the reports in six hard copies and a soft copy Contractor shall provide certificate of foundation design from competent licensed engineer in support of the foundation design/Module Mounting Structure proposed by him.

5.3.3 Land Development and Cleaning:

The site is in few pockets, the Contractor shall visit the site and do the topographical survey to ensure the land profile and plan for necessary development work. Also, The Contractor can also use the natural contour of the land if shadow is not affecting the generation. However, the Contractor shall take reasonable care to ensure that the plant is aesthetically designed.

5.3.4 Storm Water Drains:

The Contractor has to design, submit and take approval from the Client/Consultant for storm water of the plant. It shall be designed considering rain fall, catchment area, natural gradient of the plot, outlet of the plot and in a such way that it can be easily drain off rainwater and

water required for module cleaning by providing sufficient slope. Storm water drain shall be of Trapezoidal section.

All the internal storm water drains i.e. on both side of main central road, approach road to all inverter rooms, control room, switchyard shall be of brick/ stone pitching which is backed up by cement mortar bed which is backed by PCC on side slope and at bottom of drain and all joints of Brick/Stone masonry are to be filled up with cement mortar in C.M. 1:4, further, plaster is to be applied in case of brick masonry surface.

The Contractor shall provide RCC Hume pipe (NP3 grade), RCC culvert at the crossing of road, cable corridor/network, other cross drains at required locations as cross drainage work.

All along the peripheral drainage shall be constructed by simply excavating and by carrying out dressing and compacting and maintaining the side slope of the drains of required size and with required trapezoidal section in which no brick pitching is required. Also, the Contractor shall provide RCC Hume pipe (NP3 grade) at the crossing of road and drains and at required locations.

5.3.5 Foundation

The contractor is responsible for the detailed soil investigation and subsequent foundation design of the structures in the plant. The foundation of the module mounting structures, buildings, switchyard foundation, transformer foundation and other important structures must be approved through TVNL prior to construction.

The contractor shall provide the detailed design report with calculations of the proposed foundation. Pedestals over the MMS foundation shall be projected minimum 200 mm above the finished ground level.

Contractor has to submit mix design report to client for reinforced cement concrete along with admixture for approval before execution. Contractor shall submit batch report of each concrete batch or engage concrete mixer equipment having facility of batch report of each concrete batch. All necessary test related to materials of concrete mix like cement, sand, steel, aggregates etc shall be carried out regularly as per relevant IS code. Test related to concrete like compressive strength, workability etc shall be carried out as per relevant IS Codes. Contractor shall carry out any special treatment if required for strengthening foundation base's soil characteristics. Backfilling by excavated soil in the trenches for switchyard, Transformer foundations and, backfilling my Muroom/river sand in foundations of rooms and plinth are to be done.

Bidder shall carry out Pull out, Lateral and compression test if bidder has opted for cast in site pile foundation/pre cast pile foundation/Driven pile foundation. Numbers of the test will be directed by TVNL (Owner). Numbers of Routine test is also carried as per relevant IS code. If the Bidder is opting for Ramming then necessary test is to be carried out for ensuring it's stability against uplift force, Lateral force and compression force.

The foundations should be designed considering the weight and distribution of the load of structure and its assembly. The foundation shall be designed for maximum wind speed of 180 km per hour (50 m/sec). Seismic effect relevant to the seismic zone of the area and highest flood level has to be considered while making the design of the foundation.

In general, the MMS foundation shall be constructed using RCC/concrete pile foundation of required diameter and depth based on approved design.

5.3.6 Design of Components:

i. The Contractor shall carry out Shadow Analysis at the site and accordingly design strings and arrays layout considering optimal use of space, material, and man- power and submit all the details / design to Company for its review / suggestions / approval.
ii. The Contractor shall obtain and study earthquake and wind velocity data for design of module mounting structure, and considering all parameters related to the weather's conditions like Temperature, humidity, flood, rainfall, ambient air etc.
iii. Prefabricated structures for control room including inverter cum office rooms with toilet and Pantry shall be strictly as per relevant IS standards and designed for 180 Km per hour.

5.3.7 Storage, Construction, Power, and Water

The Contractor has to arrange Construction Power Supply at the site at its own cost.

The Contractor may approach TVNL for getting connection for construction power.

The Contractor shall make his own arrangement for storage of material, site security, and accommodation for labours etc., required for site execution.

5.3.8 Main Entrance Gate:

i. The plant is within TVNL protected boundary, but the contractor has to provide main gate and its location shall finalise by TVNL.
ii. All-weather main gate with width of at least 6 meters shall be erected at the entrance of the plant site.
iii. The Prefabricated Watchman's Cabin of 2.5 meter x 2.5 meter at the main entrance gate shall be designed in the Bid document and constructed by the Successful Bidder keeping in view the safety and security of the power plant.
iv. The Bidder shall provide detailed civil, electrical, plumbing, etc. drawings and equipment specifications for the Prefabricated Watchman's cabin.

5.3.9 Water Tank:

The Contractor has to provide 2 (Two) lakh litre Sintex/RCC tank rested on sufficient foundation/platform such that it cannot create any shadow. FRP or HDPE (3 to 4 layers) water storage tanks are accepted.

5.3.10 Water Supply for Module Cleaning System:

5.3.11 All necessary arrangement for pipeline network with valve and pumping assembly for wet cleaning of the solar panels shall be in the scope of the bidders and accordingly the agency has to provide all the necessary equipment, accessories, tool and tackles, pumps and piping arrangement which are required for the same.

5.3.12 The successful bidder has to plan pipeline network such that it shall not block the passage between two arrays. Contractor shall have to provide water softener plant as per daily washing requirement of module, if required.

5.3.13 Module Mounting Structures

5.3.13.1 **General: -**

i. 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 of the modules and design wind pressure (as per site wind zone).

ii. Scope of work under this section covers the provision of labour, tools, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, and preservation, installation, commissioning, performance and acceptance testing of Module Mounting Structures as per the specifications here under, complete with all auxiliaries, accessories, spare parts and warranting a trouble-free safe operation of the installation.

iii. The Module Mounting Structure (MMS) should be designed as per IS 875 and for an optimum seasonal/fixed tilt angle, to meet the offered NEEGG. The angle should be systematically optimized for maximum energy generation throughout the year based on location and local weather variables for each module technology.

iv. Plot A-12 and Plot A-16 are ash-filled areas where the contractor shall be responsible for designing the MMS after conducting a thorough study and assessment.

v. Bidder has to carry out proper shadow analysis of proposed area to meet offered NEEGG. MMS structure design is a combination of two elements named Substructure (Foundation) and Super structure. Bidder must submit the all the quality test documents and test certificates complying with the requirement of the structure. Suitable provision for mounting DWC pipes for routing DC cable from Array to Inverter must be provided (Separate DWC Pipe for Positive and Negative DC Cables as mentioned elsewhere in this tender document).

5.3.13.2 **Code and Standards:**

The applicable codes and standards are as mentioned below.

S. No	Standards and Codes	Remark
1	IS 875: Part 1 and 2	Code of practice for the design loads for building and structures
2	IS 875: Part 3	Code of practice for the design loads for building and structures- wind load

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 Aluminium and its Alloys

5.3.13.3 **Design and Material Requirement – Foundation/Pile:**

i. Excavation/Auguring shall be done such that it shall not damage existing structures. If during the course of time if it is damaged, then the contractor has to repair it at their own cost.
ii. Soil investigation shall be carried for finalizing the foundation requirements.
iii. Depth of Pile or Open Foundation shall be done as per the Soil Investigation report. Any treatment required to the foundation shall be done as per soil investigation report.
iv. Loose material shall be disposed of out of the plant premises.
v. Mix design of concrete shall be carried out with minimum cement content of 350 Kg/Cum.
vi. Reinforcement shall be provided as per code provision. 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".
vii. Height of the Pile or Open foundation shall be a minimum of 150 mm above the ground.
viii. Whitewash on the exposed concrete surface shall be matched with the existing structure within then premises to maintain the aesthetic appearance of the plant.
ix. All required test like Cube test to be carried out as per IS code IS 456-2001. The numbers of the cube have to be tested as per the concrete M-cube. Curing of all piles or open foundations shall be done thrice a day and be maintained for a period of seven days from the date of casting.
x. All designs and drawings are to be submitted for approval in Editable, AutoCAD, STAAD file, PDF format to Company or its designated agency before starting the work. Design of the foundation shall be done for 25 years life such that structure strength shall not reduce for the designed life.
xi. The Contractor has to ensure and arrange the necessary/ essential requirement for all activities during night-time.

5.3.13.4 **Module Mounting Structure:**

i. The MMS structure should be safe, and designed to allow easy replacement of any module and easy access to the O&M staff. It should be designed for simple mechanical and electrical installation, should support Solar PV modules at a given orientation, absorb and transfer the mechanical loads to the ground properly and there should be no requirement of welding or complex machinery at site. Irrespective of design, none of the components shall be less than 1mm.
ii. The array structure shall be so designed that it will occupy minimum space without sacrificing the output from Solar PV panels at the same time it will withstand severe cyclonic storm with wind speed up to maximum 180 Kmph.

iii. 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 and is strictly not allowed.

iv. Modules shall be mounted on a non-corrosive support structure (EPDM rubber gasket /Stainless Steel Star Washer). The frames and leg assemblies of the array structures shall be made of hot dip Galvanized steel per ASTM A123

v. 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 TVNL.

vi. The Contractor shall provide fixed type or Seasonal Tilt type structure to hold modules in place at desired tilt and angle so as to meet the offered NEEGG.

vii. Irrespective of design, none of the components shall be less than 1 mm in thickness and Column Post shall not be less than 2.50 mm in thickness.

viii. Design drawings with material selected shall be submitted for approval of TVNL. Modules shall be mounted on a non-corrosive support structure.

ix. Minimum clearance between finished ground level and lowest edge of module shall be 450 mm for Ground mounted System.

x. For multiple modules mounting structures located in a single row, the alignment of all modules shall be within an error limit of 10 mm in vertical/horizontal line.

xi. The foundations of module mounting structures shall be based on site related data, design calculations and drawings shall be submitted to TVNL for approval.

xii. The frames assemblies (i.e., I channel, C channels, rafter, purlins, rails and 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.

xiii. Bidder can go for Aluminium-Zinc (Aluzinc or Galvalume) 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 and shall comply with all basic terms and conditions mentioned above.
   c) The concept of wind tunnel studies shall be considered in the design philosophy for fixed-type and single-axis seasonal type module mounting structure. and it must be done from the reputed institutes of India or certified by a Charted Engineer.
   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 certified by Charted Engineer.

xiv. All fasteners shall be of Stainless steel - SS 304 or higher grade. Nut and bolts, supporting structures including module Mounting Structures shall have to be adequately protected against all climatic conditions. Hot dip Galvanized steel Nuts and 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. The vendor credentials, base material test report, GTP and QAP shall be submitted to TVNL. Before the dispatch of material TVNL 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 the Contractor.

xv. The Module Mounting Structures shall be warranted for up to 05 years by the manufacturer. The structure shall be designed to allow easy replacement of any module and easy access to the O&M staff and P and P (Personnel and Protection).

xvi. The structure shall be designed for simple mechanical and electrical installation. It shall support Solar PV modules at a given orientation and absorb and transfer the mechanical loads to the ground properly.

xvii. There shall be no requirement of welding or complex machinery at the site. The drawings along with the detailed design shall be submitted in six sets to TVNL for approval before starting the erection work. The work will be carried out as per designs approved by TVNL.

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

xix. All nuts and bolts (fasteners) shall be made very good quality stainless steel of grade SS 304 required for module fixing and for other components of MMS, superstructure or switchyard, inverter room, control room, etc. in the plant premises nuts and bolts (fasteners) shall be of MS material with minimum Grade HDG: 5.6.

xx. Design and dimensions of the structure must confirm to withstand a minimum wind speed of 180 km/h with an appropriate safety factor of 1.5. The design calculations shall be submitted to TVNL and the same shall be get approved from TVNL.

5.3.13.5 **Module Mounting Structure Approval and tests:**

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

ii. The Contractor has to plan for pile load test like pull out, lateral and compression of minimum 5,5,3 is required to be conducted for plant at strategic location in the presence of the TVNL representative, immediately after receiving LoI. Based on the results of above-mentioned tests, final approval for design of pile shall be provided.

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

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

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

vi. The Contractor shall provide a pre-dispatch inspection call to TVNL for inspection at manufacturer works, as per TVNL approved drawings, for all fabricated items such as steel structure members, galvanization process etc. Prior to inviting TVNL for pre-dispatch inspection, the vendor shall submit a detailed quality. Assurance plan (QAP) before manufacturing for TVNL approval. QAP shall include type tests, routine tests, factory

acceptance tests, sampling plans, applicable standards etc., the bidder shall bear the lodging, boarding, accommodation and traveling charges of TVNL or authorized inspectors for PDI. After the inspection, a complete set of test reports shall be submitted. Bought-out terms, test certificates as per relevant standards shall be submitted.

5.3.14 Structural Steel Work:

i. The structural steelwork required for termination incoming 220 KV line/ Cable, equipment supports, lighting masts and for shielding towers together with all foundation bolts shall be included by the Bidder in its scope of work. The steel work shall be fabricated from galvanized structural sections. Specific requirement for thickness of galvanization should be at least/ minimum 80 microns at any point on any component of module mounting structure when measured.
ii. The height of structures for incoming line shall be as per the design developed by the Bidder in line with standard practice followed by Discom and drawings are to be submitted. The necessary modification in existing 220 KV substation is in the scope of the bidder.
iii. The incoming line gantry shall be designed based on ACSR conductor/Cable considered in the design and also considering that the terminal tower will be located at a distance of approximate 0.1 Km from the incoming gantry at the SPV power station switchyard. The Bidder shall consider wind load, temperature variation etc. while designing the gantry structure. The column shall be provided with step bolts and anti-climbing devices.
iv. The entire structural steel work shall conform to IS: 802 and if other applicable. The Bidder shall furnish design calculations for approval by the Company before procuring the material.
v. All structure pertaining to 220 KV switchyard have to be applied outdoor with white paint (lime wash).

5.3.15 Hardware:

i. Metal fittings of specified material for string hardware meant for power conductor and earth wire shall have excellent mechanical properties such as strength, toughness, and high corrosion resistance. The suspension and tension clamps shall be made from Aluminium alloy having high mechanical strength. Suspension and tension clamps offered shall be suitable for ACSR / AAAC conductor as per design.
ii. All hooks, eyes, pins, bolts, suspension clamps and other fittings for attaching insulators to the tower or to the power conductor shall be so designed as to reduce (to a minimum) the damage to the conductor, insulator or the fitting arising from conductor vibration.
iii. All drop-forged parts shall be free-from flaws, cracks, or other defects and shall be smooth, close-grained and of true forms and dimensions. All machined surfaces shall be true, smooth, and well-finished.
iv. All ferrous parts of hardware shall be galvanized in accordance with IS 2629. The galvanization shall withstand four dips of 1-minute duration each in copper-sulphate solution as per the test procedure laid down in the relevant ISS.
v. The threads in nuts and tapped holes shall be cut after galvanizing and shall be well-lubricated/greased. All other threads shall be cut before galvanizing.

vi. Both the suspension and the tension hardware shall be of ball and socket type and shall be with `R' and `W' type security clips of stainless steel or phosphor Bronze conforming to IS 2486. The tension clamps of both compression type and bolted type as shown in the relevant drawings shall be offered. Arcing horns shall be provided on the line side for both the suspension type and compression type hardware.

5.3.16 Fire Extinguishers:

Liquefied CO2 fire extinguisher shall be upright type of capacity 10 kg having IS: 2171. 7 and 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 and Gas.

5.3.17 Sand Buckets:

Sand buckets should be wall mounted made from at least 24 SWG sheet with bracket fixing on the wall conforming to IS 2546. Bucket stands with four buckets on each stand shall be provided in the Transformer Yard, Switchyard, Inverter Rooms, Control Cum Conference room, Security cabin and one (1) number each for the area covered by 50 MW for a plant.

5.3.18 Sign Boards:

The signboard for nomenclature of sufficient size which can be visible from a distance containing brief description of various components of the power plant like switchyard, control room, inverter room etc. as well as the complete power plant in general shall be installed at appropriate locations of the power plant. Contractor shall also have to provide the signboards to the units of control room. Contractor shall also provide signage for fire and safety wherever required. The Signboard shall be made of steel plate of not less than 3 mm thick. Letters on the board shall be with appropriate illumination arrangements. The Contractor shall provide to the Company, detailed specifications of the signboards. The language of instructions shall be English/ Hindi as per TVNL approval.

5.3.19 General Guideline:

Any civil or electrical work, which is not mentioned or included in this Tender Document but necessary for the plant shall be borne by the Bidder. Successful Bidder shall prepare all designs/drawings have based on the specifications given in the Tender and considering relevant BIS standard. The Company reserves the right to modify the design at any stage, to meet local site conditions/project requirements. All work shall be carried out in accordance with the latest edition of the Indian Electricity Act and rules formed there under and as amended from time to time.

Disclaimer:

1. Any civil/electrical/mechanical/other work, which is not mentioned or included in this Tender Document but necessary for the plant shall be borne by the Bidder. All specifications mentioned in this Tender indicates minimum technical requirement.
2. The Contractor may propose alternate specifications or design though the final acceptance of the same is subject to the Company's/Consultant's discretion.

3. Unless otherwise specified, all equipment and materials shall confirm to the latest applicable Indian Standards. Equipment complying with any other International Standards will also be considered if it ensures the performance of equipment is equal to a superior to Indian Standard.

5.3.20 Roads:

All internal and peripheral roads shall be of Asphalt type. The Contractor has to design as per the relevant IS, submit and take approval from the Company / Consultant for Asphalt Road. Asphalt Road shall connect Control Room, Switchyard, all Invertor rooms and main gate. Asphalt road shall also be provided at periphery of the entire plant area. An asphalt road shall have sufficient courses like a subgrade, sub-base, base courses, and surface course as per IS specifications. The width of asphalt road shall be of 4-metre carriageway with 0.5 mtr shoulders on both sides and with sufficient thickness for access of heavy equipment like transformers/ Inverters/ Switchyard equipment during construction as well as subsequent maintenance. If the Contractor uses string inverters, they shall construct an approach road using concrete block pavements up to the string inverters to facilitate better maintenance.

5.3.21 Security Cabins:

The contractor has to provide prefabricated security cabins at least at four (4) corners of the plant. The size of the security cabin shall be 1.5 x 1.5 x 3 mtr height which is rested on RCC foundation.

5.3.22 CCTV Cameras:

The contractor shall also include to design, supply, installation, testing, commissioning, operating and maintaining a complete day night CCTV Surveillance system for the solar plant covering all key areas from surveillance point of view (at least at 5 places). The system shall include high quality day/night vision outdoor rated IP base cameras with required mounting arrangement, IP rated termination boxes, cables, hoods, etc along with a centralised DVR system which shall be capable to have last 15 days' 24X7 Data Storage of CCTV footage in it. Remote base operation facility shall be provided for the system. All the components of the system shall be in line with latest IEC codes and relevant standards. One PTZ camera has to be placed near Main control room.

5.3.23 Main Control Room /Pre-fab Control cum Conference Room:

i. The FFL +1.000 m from FGL for Pre-fab Control cum Conference room shall be considered by Contractor. Civil work for Pre-fab Control cum Conference room shall be of adequate size and of the standard manufacturer with sufficient lighting points and RCC cable trenches with epoxy painted edge angle of 65mm x 65mm x 6mm and checker plate covers of 8 mm thickness with epoxy paint and shall have exhaust chimney and also sufficient ventilation in terms of approved make aluminium windows and ventilators with MS GI coated grill, approved make exhaust fans and louvers for air circulation. Opening of 3.00 m x 3.00 m with approved make rolling shutter shall be provided for the access of the panels. All prefab Control cum Conference Room shall be laid on RCC plinth with sufficient foundation, and reinforced grade slab with Vitrified of 8-10 mm thickness tile flooring and 100 mm skirting of same tiles. Plinth

protection shall be given throughout perimeter of width 1.2m for Control cum Conference Rooms. Sufficient steps at the entry of the room and RCC ramp of sufficient angle shall be provided for shifting the equipment in the rooms for Control cum Conference Room. Rainwater pipe at various locations with gutter at the top shall be provided to discharge rainwater. Approved make gear operated Hot dip GI coated rolling shutter shall be provided for Control room. All pre-fab structure of control room shall be suitable match at plinth level to avoid any dust and water ingress. All pre-fab structure shall be water proof from roof to avoid any rain water inside the control room.

ii. RCC frame structure below plinth for Control cum Conference Room shall have adequate size of footing, pedestal columns, plinth beam, with reinforcement or pile foundation with plinth beam as per relevant IS specifications considering seismic zone, wind and soil detail etc. Backfilling material shall be of river sand. The Control cum Conference Room shall have approved make gear operated rolling shutter irrespective to the provision made in IS Standards at the front side and also provision of additional emergency exit door. For cables and other services elevated false floor with pre-fab cable trenches shall be kept with sufficient marginal space to reduce heat of electrical evacuation. The dimension /design of false floor shall be based on electric, SCADA panel dimensions and control cables with sufficient maintenance space. All structural steel shall be GI coated or suitable epoxy painted. HDG 8.8 grade foundation bolts with hot-deep galvanizing shall be provided for erection of pre-fab structure. After erection and alignment of pre-fab structure, bolt shall be grouted using non shrink grout materials.

iii. Control cum Conference room shall be of adequate size for fixing the panels, battery banks etc. With a) Conference room; b) SCADA Room with Work station with Desktop and Chairs; c) Store Room with almirah; d) Pantry unit of sufficient size with sandwich type of platform with one sink (Nirali Make) plumbing fixture and exhaust fan; e) Toilet unit for Gents with urinals and Ladies having wash basins in each; f) RCC cable trenches with covers and cable trays and all openings of cable entry shall have vermin proofing using spray foam or mortar; g) Furniture like conference table, chair and sofa etc.; h) Lighting points and fixtures; and i) Plumbing fixtures j) Transformer yard with chain-link fencing and gate adjoining to building (outside). k) All other amenities for the operation &maintenance of Solar Photovoltaic Power Plant. l) All windows shall be equipped with sun-film protection sheet and vista make vertical blind.

iv. **Facilities required for Control cum Conference Room:** It shall also have adequate size SCADA cabin with necessary 2 numbers of work station with drawers of Godrej/ Durian/ Zuari make, 2 numbers Computer and 1 number of LED TV of 48 inch of Sony/ Phillips / Samsung make, 4 numbers of chairs for workstation, 2 Nos. of almirah and split A.C of 2 Ton of Voltas/ Hitachi/ Samsung/LG make for operating staff for work station. Conference Room shall also be equipped with conference table of 10 persons with Power Sockets with 10 chairs of Godrej/ Durian/ Zuari/ Usha/ Lexus and sofas. In Control cum Conference room, except control room (where panels are fixed) all other rooms like SCADA cabin, conference room, store, pantry and passage shall have False ceiling that shall consist of 600 x 600 x 12.5 mm gypsum board/Fibre Glass with one coat of primer and two or more coat of Acrylic emulsion paint. The suspension

system shall consist of as per manufacturer's specifications. Conference room shall be equipped with an all-in-one printer cum scanner, landline phone, refrigerator (min. 250 litre) of Voltas/Godrej/Whirlpool make, projector and screen of 2m x 2m. All material, installations, accessories to be provided shall be of best quality and of standard manufacturer as approved by the EIC/ the Company. All units of the Control cum Conference Room shall have marked signage of SS sheet of 1mm along with engraving words and filled with black colour at all facilities within Control cum Conference room and on all equipment. The lighting points and fixtures shall be of Anchor/Philips make. The fans shall be of Khaitan/Usha/Bajaj make and lights (only LED shall be used) shall be of Philips/Syska/Havells make.

v. **Structural Steel, Insulated Walls and Roof for Pre-fabricated Super structure:** Design of Super-Structure i.e. Steel Structure like purlin, rafter, columns, truss etc. for fixing the Pre-Fabricated Panels conforming to relevant IS codes and of Jindal/ Tata/ RINL make. It shall include all necessary fitting like nuts, bolts, washers etc, of good quality. All structural steel shall be treated with Marine paint/The steel work shall be fabricated from galvanized structural sections/ Hot dip G I Coatings, specific requirement for thickness of galvanization should be at least minimum /100 microns at any point of the galvanized structure. Galvanization shall be measure with elcometer or the material can be sent for testing laboratory as and when required. No averaging is allowed for measuring the thickness of galvanization. All side shall be galvanization with same specification and shall be maintained for any hollow components of PEB structures. The gap between base plate of structural members and concrete top of foundation shall be filled with GP-2 grouting material of reputed make. The material of all J-bolts shall be of 8.8 Class. The Insulated panels should be of required size for roof and walls. The insulated wall and roof panels shall be sandwich type. The panels shall be made out with 0.35mm thick pre coated steel sheet on both side of Poly Urethane Foam (PUF) for both wall and roof. The density of PUF shall be 40±2 kg/m3 and thermal conductivity shall be within range of 0.019-0.021 W/mK at 10°C. The total thickness of the panels for walls shall be 60mm and for roof is 40mm. The panels shall be joined together by tongue and groove method. The joints of the panels shall be filled with silicon or equivalent filling material. Panels shall be cuts such that the exposure of PUF and patch work is avoided. The fixing of the panels shall be such that there should not be any gaps at joints like wall and roof, wall to wall, etc. from which air and water particle can pass (Air and Water tight). Roof panel shall be extended 300mm from the eaves wall and 150mm from Gable walls. Rain water gutter shall be provided throughout the periphery with rain water pipes (CPVC pipes) with proper clamping at regular interval. Provision of future installation of Solar panels on the top of the roof shall be done by "I or C" section with Small base plate assembly.

vi. **Doors, windows, ventilators:** It shall be made out from Aluminium sections. All sections shall be anodized with 20 microns thickness. Sections of Door frame and window frame shall be min 2 mm thick and of approved make. Door shutters shall be made out from aluminium sections and combination of compact sheet and clear float / wired glass with sun film sheet on it. Room shall have required numbers and size of openable window / louvers with sun film sheet to provide adequate ventilation / fresh air circulations. All hardware / fixtures for doors

and windows shall be of good quality (make: Dorma, Godrej and Kich) and shall be approved by the Owner. All the windows shall have hot dip GI coated MS Grill. Main door to switchgear room shall be steel door with epoxy paint having adequate area to admit switchgear. There shall be minimum two doors to the switchgear room of flush welded steel type. For Electrical panel room, there shall be provision of gear operated GI Rolling Shutter of adequate width and height to facilitate to load / unloading of heavy electrical panels.

vii. Flooring:

a. False Floor system:

i. Removable type false flooring system shall be provided in computer rooms and control rooms as required. RCC floor slab will be sunk to the required depth which shall be the height of the false floor system. The flooring shall consist of high-pressure laminate /vinyl tile composed of steel and cellular concrete tiles whose edges are protected with high wear-resistant hard PVC edge profiles. The flooring system shall be mounted on GI Coated steel pedestals of adjustable height and a supporting steel grid system to provide underfloor space. The floor shall be capable of supporting a point load of 75kg/sq.cm and a maximum distributed load of 1000kg /sqm. The false flooring system shall be installed as per the manufacturer's specifications.

ii. The floor has sufficient load-carrying capacity to withstand the load of electric panels. Heavy duty approved quality false floor/ raised floor. A raised floor (also raised flooring, access flooring), or raised access SCADA floor) provides an elevated structural floor above a solid substrate (often a concrete slab / M S Hot Dip G I coated base platform) to create a hidden void for the passage of mechanical and electrical services. Raised floors are widely used in modern office buildings, and in specialized areas such as command centres, Information technology data centres, and computer rooms, where there is a requirement.

iii. To route mechanical services and cables, wiring, and electrical supply. Such flooring can be installed at varying heights from 100 mm to heights above 1,000 mm to suit services that may be accommodated beneath. Additional structural support and lighting are often provided when a floor is raised enough for a person to crawl or even walk beneath.

iv. This type of floor consists of a gridded metal framework or substructure of adjustable-height supports (called "pedestals") that provide support for removable (liftable) floor panels, which are usually 60×60 cm. The height of the legs/pedestals is dictated by the volume of cables and other services provided beneath, but typically arranged for a clearance of at least 15 cm with typical heights between 500 mm to 1000 mm.

v. The panels are normally made of steel-clad particleboard or a steel panel with a cementations internal core, although some tiles have hollow cores. Panels may be covered with a variety of flooring finishes to suit the application, such

as carpet tiles, high-pressure laminates, marble, stone, and antistatic finishes for use in computer rooms and laboratories. When using a panel with a cement top surface the panels are sometimes left bare and sealed or stained and sealed to create a tile appearance.

vi. For SCADA Room, Conference room, Pantry area, Lobby area, open area, entrance area: Heavy duty approved quality False floor tile thickness shall be as per standards of manufacturing company.
vii. Battery room: Approved quality Acid/Alkali resistance tile flooring.
viii. Lobby: Heavy duty approved quality raised floor
ix. Toilet: Heavy duty approved quality vitrified floor tile with ceramic wall tile dado up to lintel level.
x. Entrance Steps: Brickwork and plastering with antiskid tiles

b. Electrical requirements for Control cum Conference Room:
   i. The Panels 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 PCU's.
   ii. 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.
   iii. All the Power cables shall be taken through backside of the Panel via sufficient /concrete cable trench and cable trays with cover at top.
   iv. 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.
   v. Nuts & bolts including metallic cubicle shall have to be adequately protected against atmosphere and weather prevailing in the area.
   vi. The overall dimension shall be fitted with other Power Conditioning Units of the Power Plant. However, dimension, weight, sheet thickness, painting etc. should be indicated by the Bidder. The bill of material associated with the equipment should be clearly indicated while delivering the equipment.
   vii. The Contractor shall provide to the Owner detailed civil, electrical, plumbing, etc. drawings and equipment specifications for the inverter/ control room and take approval from client/consultant. The drawings of Panels with the make of components should be approved from the Owner.
   viii. All the design & drawing related to switch yard / interconnection with grid should be as per requirement of State Transco and approved from State Transco.
   ix. Pre-fab structure shall have sufficient number of lighting point/ACDB/MCB board

c. Toilet: Toilet shall be designed for 10 persons; and constructed with following finish
   i. Floor: Vitrified tiles
   ii. Door and window: made out of aluminium sections, 5mm float glass
   iii. Ventilators : Mechanical exhaust facility
   iv. Plumbing fixtures : Jaquar and Kohler make
   v. Sanitary ware : Hindware, Cera or equivalent make
   vi. EWC : 390 mm high with health facet, toilet paper roll holder and all fittings
   vii. Urinal (430 x 260 x 350 mm size) with all fittings.
   viii. Wash basin (550 x 400 mm) with all fittings.
   ix. Bathroom mirror (600 x 450 x 6 mm thick) hard board backing
   x. CP brass towel rail (600 x 20 mm) with C.P. brass brackets
   xi. Soap holder and liquid soap dispenser

d. **Water Supply for Toilets**: All plumbing and sanitary shall be of TVNL approved make. CPVC pipes of approved make & brand shall be laid down for water supply one (01) Nos. of three layered Sintex Water tank of 2000 Ltr capacity shall be installed for Control room / Conference room & Toilet / Pantry.

e. **Drainage for Toilets:** Drainage pipes shall be of UPVC (6 kg/cm2) Supreme, Prince or equivalent make. Gully trap, inspection chambers, septic tank for 10 person and soak well to be constructed for abovementioned requirement.

f. **Air Conditioner for Main Control Room:** The control room shall be equipped with appropriate numbers of fans for effective heat dissipation. The SCADA cabin and Conference room shall have split type air conditioning units (2 Ton each).

g. **Fire Extinguishers:** Liquefied CO2 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. Bidder shall provide 10 no. of portable fire extinguisher as given below.

h. **Sand Bucket:** Sand buckets should be wall mounted made from at least 24 SWG sheet with bracket fixing on wall conforming to IS 2546. Bucket stands with four buckets on each stand shall be provided in the Transformer Yard – 4 Nos.

i. **Sign Boards:** The sign board containing brief description of various components of the power plant as well as the complete power plant in general shall be installed at appropriate locations of the power plant.
   i. For Switchyard and Transformer Yard: The Signboards shall be made of steel plate of not less than 3 mm. Letters on the board shall be with appropriate illumination arrangements.
   ii. All Inverter Rooms and Control and Conference Room: The name boards shall be made of acrylic sheet of 300mm height and fixed at the entry of the all facilities.
   iii. The Contractor shall provide to the Owner, detailed specifications of the sign boards.

5.3.24 Quality Control Laboratory

i. A fully equipped quality control laboratory shall be established at site with qualified personnel to conduct acceptance test on all construction materials, concrete cubes, compaction of soil testing samples etc. This laboratory shall be housed in a covered building. All testing equipment like Owen, electrically operated cube testing machine, Sieves for grading of sand & aggregates, flakiness and elongation index testing sieve, Density of Aggregate, electrically operated vibratory aggregate siever, jars for sand testing, Abrasion testing equipment, Impact testing equipment, Bitumen testing equipment like thermometer, marshal test apparatus etc.

ii. Cube moulds, Slump cones, Vicat apparatus, Moisture meter, Soil testing equipments shall be arrange for laboratory. Contractor shall arrange for design mix of concrete for each grade of concrete from TVNL approved external laboratory or NABL.

iii. All testing equipment shall be periodically calibrated to the satisfaction the Owner

TEST SHEDULE

SR.	Materials	Name of Laboratory Tests	Frequency of Test
1	**2**	**3**	**4**
1	SAND	1. Fineness Modulus 2. Specific Gravity 3. Water absorption 4. Alkali reaction 5. Specific gravity 6. Gradation	One Test per working seasons or with change of source.
2	CRUSHED METAL KAPACHI FOR CONCRETE	1. Gradation 2. Water absorption 3. Impact value 4. Absorption. 5. Specific gravity 6.Soundness 7.Flakiness 8.Elongation	One Test for season or with change of source.
3	C.C.Cube Workability test.	1. Compressive Strength (7 Days & 28 Days)	As per IS 456 Standard.
4	T.M.T BAR	1.Yield Elongation Test IS:1608 1972 2. Bent Test IS: 1590 196 3. Releaned (In case of HYSD bars only) Chemical property test for Carbon, Phosphorous and Mn.	One sample for each lot.

BUILDING MATERIALS

A1: GENERAL MATERIALS

Sr.	MATERIALS/ ITEMS	VENDOR / MANUFACTURERS
1.	The cement shall be used of type SRC cement , Portland slag cement, Pozzolana portland cement	ULTRATECH SANGHI SIDHHI ACC JAYPEE CEMENT Ambuja JK Lakshmi
2.	REINFORCEMENT STEEL HYSD/TMT BARS GRADE FE 500 with anti-corrosive paint.	SAIL TISCO RINL THERMAX ELECTROTHREM
3.	ALUMINIUM SHEETS	HINDALCO INDAL JINDAL,
4.	P.V.C PIPES/ CPVC pipes	FINOLEX SUPREME TRUEBORE
5.	VITRIFIED CERAMIC TILES (USE OF EPOXY AT JOINT)	NITCO RAK BRAND , KAJARIA, ASIAN,GRANITO OR AS SPECIFIED IN ITEM
6.	GLASS	FLOAT GLASS : SAINT GOBIN MODI GLASS
7.	GEAR OPERATED G I ROLLING SHUTTERS	SURAJ ROLLING SHUTTERS BARODA OR APPROVED MAKE BY OWNER ,
8.	BRICKS	APPROVED MAKE BY OWNER
9.	FLUSH DOORS	GODREJ, FALCON PLYWOOD AND INDUS- GODHRA GREEN PLY KIT PLY
10.	STAINLESS STEEL	SS – 304 GRADE FROM SALEM STEEL PLANT
11.	WATER PROOFING	APP SHEET OF TIKIDAN, FOSROC or PIDILITE
12.	PAINTS	ONLY BRAND NAMES GIVEN : BERGER ASIAN ICI
13.	SEALANTS	FOSROC

		SICA
14.	R.C MANHOLE COVER	PRECONS PRECAST CONCRETE PRODUCT CO. OR EQUIVALENT
15.	HARDENERS	FOSROC SICA
16.	PLYWOOD PRODUCTS	IPM, NOVOPAN PARTICLE BOARDS BHUTAN BOARDS NUWOOD PARTICLE BOARDS
17.	ALUMINIUM DOORS, WINDOWS, PARTITIONS	GODREJ INDAL JINDAL
18.	WATER PROOFING COMPOUNDS/ADMIXTURES/ EPOXY FLOORING	MATERIAL OF CONSTRUCTION FOSROC SICA PIDILITE
19.	PAINTS AND ACRYLIC DISTEMPERS, WEATHER PROOF PAINTS AND EXTERIOR EMULSION PAINTS	ASIAN PAINTS ICI BERGER.
20.	DOOR CLOSERS	EVERITE MAKE
21.	METAL CLADDING SYSTEM, SANDWICH PANEL	TATA BLUE SCOPE, LLOYD INSULATIONS (INDIA) LIMITED, KING SPAN TURKEY SINTEX
22.	PUTTY	BIRLA ASIAN BERGER,
23.	PLASTICISER/ADMIXURE	FOSROC SIKA,
24.	ACID /ALKALI RESISTING PAINT	ASIAN BERGER
25.	NON SHRINK GROUT MATERIAL	FOSROC
26.	GYPSUM FALSE CEILING (gyp board)/ Fibre Glass board	ARMSTRONG/SAINT GOBAIN

A2. SANITARY AND WATER SUPPLY WORK (INTERNAL) (FIRST QUALITY TO BE-USED)

SR.	MATERIALS/ ITEMS	VENDOR / MANUFACTURERS
1.	RCC PIPES	APPROVED MANUFACTURER CONFORMING B.I.S. STANDARD
2.	G.I. PIPE	TATA MEDIUM CLASS.
3.	G.I. FITTINGS	"R" BRAND

4.	CPVC Pipes	FINOLEX,SUPREME AND ANY OTHER APPROVED BRAND
5.	SLUICE VALVES, CHECK VALVES ETC.	LEADER ENGINEERING WORKS, JALANDHAR; KIRLOSKAR BROS. LIMITED, PUNE;
6.	BRASS FITTINGS	LEADER ENGINEERING JALANDHAR; L & K MATHURA,
7.	C.P., FITTINGS	L & K make
8.	W.C. PAN WASH BASIN, URINALS SINK LOW DOWN FLUSHING CISTERN	EID, PARRYWARE, HINDUSTAN SANITARYWARE, CALCUTTA; KOHLER
9.	STAINLESS STEEL SINK WITH DRAIN BOARD	NIRALI
10.	MIRRORS	PHILCO, ATUL GLASS WORKS, VALLABH GLASS WORKS, GOLDENFISH
11.	WHITE GLAZED & COLOUR GLAZED CERAMIC TILES.	H&R JOHNSON TILES, SPARTEK, NITCO
12.	GLAZING GLASS.	MODI FLOAT SAINT GOBAIN.

NOTE:

1. Wherever the make is not specified for any other items, the Contractor shall submit credential for vendors for relevant items / equipments, out of which the Owner shall decide acceptance of vendor based on review of credentials. This shall have no price implication. The Owner reserves the right to reject the proposed vendor without assigning any reason.
2. Bidder may suggest /request for approval of Additional vendor with credentials and details for review and approval of Owner. The Owner may consider the request in case proposed additional vendor is reputed and meeting the tender specification requirements. The Owner reserves the right to reject the proposed vendor without assigning any reason.

5.3.25 Clean up of Work Site

i. After completion of all works, the Contractor shall have to demobilize all the equipments, machinery and materials from plant premises. The Contractor shall have to clean the entire area by removing all unwanted construction materials, unwanted temporary structures, debris, and excess earth, all type of scrape, wastage and unwanted materials from plant premises as directed by the Owner.

----End Section---

6 General Terms and Conditions

6.1 Use of Contract Documents and Information:

6.1.1 The Contractor shall not, without TVNL's prior written consent, disclose the Contract or any provision thereof or any specification, plan, drawing, or pattern therewith to any person other than the person employed by the Contractor in the performance of the Contract. Disclosure to any such employed person shall be made in confidence and shall extend strictly for the purpose of performance only.

6.1.2 The Contractor shall not, without TVNL's prior written consent, make use of any document or information except for the purpose of performing the Contract.

6.1.3 Any document other than the Contract itself shall remain the property of TVNL.

6.2 Patent Rights:

6.2.1 The Contractor shall indemnify TVNL against third-party claims of infringement of patent, trademark or industrial design rights arising from the use of goods/design or any part thereof.

6.3 Materials and Workmanship:

6.3.1 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 respects to the latest edition of the relevant Bureau of Indian Standard (BIS) specification wherever Indian specifications apply or British Standard (BS) or International Electro-technical Commission (IEC) or internationally accepted standard.

6.3.2 The Contractor shall supply and deliver all equipment and materials for installation at site. The Contractor shall arrange for transportation, loading and unloading and safe storage of materials at the project site at his own cost and risk.

6.3.3 If the Contractor offers equipment manufactured in accordance with other internationally 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 should comply with one consistent set of Standards only as far as possible.

6.3.4 No deviation in foreign exchange rate shall be admissible at any point of time after submission of the Bid.

6.4 Inter-Changeability:

6.4.1 All the parts shall be made accurately to standard gauges and specifications to facilitate replacement and repairs. All corresponding parts of similar apparatus shall be inter-changeable.

6.5 Packing and Marking:

6.5.1 The Contractor shall be responsible for securely protecting and packing the plant and equipment as per prescribed standards in force to withstand the journey and ensuring the safety of materials and the arrival of materials at the destination in original condition and good for contemplated use. Packing case size and weight shall take into consideration the remoteness of the goods' final destination and the absence of heavy material handling facilities at all points in transit.

6.5.2 Packing lists of materials shall be provided in each package to facilitate checking up of the contents at the destination.

6.5.3 In order to import any items associated with the Project from abroad or from any other state in India, the Contractor shall have to arrange any clearance, permission, if required at his own risk, from any Government (Government of Jharkhand and Government of India) or any Government (Government of State and Government of India) controlled organization for transportation of materials from manufacturing shop to delivery at site. Necessary certificates if so required, shall be issued by TVNL within a reasonable time after getting a written request from the Bidder along with the necessary documents substantiating the necessity of such approvals. All packing Material is the property of TVNL and shall be immediately deposited by the Contractor to TVNL's Store at the Project Site.

6.6 Negligence

6.6.1 If the Contractor neglects to manufacture or supply the plant and equipment with due diligence and with expeditiousness or refuses or neglects to comply with any reasonable order given to it in writing by TVNL or contravenes any provisions of the Contract, TVNL may give seven (7) seven days' notice in writing to the Contractor, to make good the failure, neglect or contravention complained of. If the Contractor fails to comply with the notice 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 TVNL thinks fit, it shall be lawful for it 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 TVNL shall be entitled to retain any balance which may be otherwise due on the Contract by it 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.

6.6.2 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, TVNL shall take action in the manner it may consider deemed fit in terms of the Contract.

6.7 Statutory Responsibility:

6.7.1 The Contractor shall comply with all applicable laws, by-laws, rules, and regulations and shall procure and maintain their validity all necessary Municipal, Panchayat and Government permit and licenses etc. at its own cost.

6.7.2 Compliance of Scheduling and forecasting shall be carried by the successful EPC contractor as per State Notification (FORECASTING, SCHEDULING, DEVIATION SETTLEMENT AND RELATED MATTERS OF SOLAR AND WIND GENERATION SOURCES) REGULATIONS and any changes from time to time. Further all the cost for hiring QCA (Qualified Coordinating Agency) for forecasting and scheduling shall be in scope of the Successful EPC contractor.

6.7.3 Penalty due to mismatch in scheduling and forecasting shall be 100% responsibility of the successful EPC Contractor.

6.8 Insolvency and breach of contract:

6.8.1 TVNL may, at any time by notice in writing, summarily terminate the Contract without compensation to the Contractor in any of the following events:

a) If the Contractor at any time, is adjudged insolvent or has a receiving order or order from the administration of its state made against it or shall take any proceeding for compensation under any Insolvency Act for the time being in force or make any conveyance or assignment with its creditors or suspend payment. 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.

6.9 Timeline:

6.9.1 The Contractor shall provide a full programme of the supply in detail and a delivery schedule along with the work schedule thereto. Strict adherence and a guaranteed delivery schedule mentioned in the terms and conditions shall be the essence of the Contract, and the delivery schedule must be maintained.

6.9.2 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 should strictly adhere to that schedule.

6.9.3 The issue of LoI/ WO shall be considered as the Zero Date

6.9.4 The Bar/ PERT Chart provided by the Contractor shall submitted to TVNL for approval prior to commencement of the execution of the Project. All comments and modifications provided by TVNL shall be incorporated and adhered to by the Contractor in the Timeline, Bar/ PERT Chart, detailed execution plan, etc. for execution of the Project.

6.9.5 This schedule shall be prepared to ensure the commissioning of the complete plant on before the **300 days** of LoI/ WO.

Best Effort Schedule

Sr.	Stage	Reference from Zero Date ("D")
1.	Issue of Letter of Intent	D
2.	Completion of site developmental work	D+30

3.	Commencement of civil work	D+45
4.	Approval of major drawings	D+60
5.	Completion of supply of major balance of system	D+120
6.	Completion of supply of PV modules, in phase wise, as per agreed schedule	D+140
7.	Completion of Civil work & erection of MMS in phase wise, as per agreed schedule	D+180
8.	Completion of Civil work for Control room, General Civil works, in phase wise, as per agreed schedule	D+240
9.	Installation and interconnection of all DC circuit	D+250
10.	Installation and interconnection of all AC circuit	D+265
11.	Interconnection and testing of entire plant	D+280
12.	Commissioning of entire plant	D+300
13.	Completion of Facilities	D+330
14.	Operational Acceptance Test	D+330
15.	Performance Guarantee Test-cum-Final Acceptance Test (Tentative) after completion of first year of operation after commissioning	D+665

6.9.6 Partial commissioning of the solar PV plant shall not be considered.

6.10 Delay in Execution or Failure to Supply:

6.10.1 Any delay in completion of the work shall attract liquidated damage/ penalty for late completion as per Liquidated Damage Clause 6.11 of this Tender.

6.10.2 If the Contractor fails to deliver the plant or fails to start the work within the specified time frame after the issue of LoI/ WO or leaves the work site after partial execution of the work, TVNL shall have the right to get the work done through any other agency at the risk and cost of the Contractor. Further to this, TVNL may, without prejudice to the right of the Contractor to recover damages for breach of trust of the Contract, may impose penalties.

6.11 Liquidated damages for Delay and Underperformance

DELAY In Commissioning

6.11.1 In case the Contractor fails to achieve successful Commissioning of the plant by the due date indicated in Timeline. Then TVNL shall levy the Liquidated Damages on the Contractor (wherein partial commissioning shall not be accepted).

6.11.2 The Liquidated Damages levied to the Contractor at half percent (0.5%) of EPC Contract Value (including taxes and duties) for delay of one (1) week or part thereof up to a maximum of ten percent (10%) of EPC Contract Value.

6.11.3 The maximum time allowed (with penalty) delay for the Commissioning of the Project shall be fifteen (15) months from the date of issue of LoI/WO. In case of delay for more than fifteen (15) months, TVNL may terminate the Contract and get the Project complete by another suitable agency at the risk and cost of the Contractor.

6.11.4 For the calculation of the penalty, the date of LoI/ WO shall be the reference date.

6.12 Penalty of loss of Generation during O&M

6.12.1 For each Contract Year, the Contractor shall demonstrate "Actual Delivered Energy" at the Metering Point as compared to the 'Base NEEGG' for the particular year (calculated as per the methodology given in Appendix 16).

6.12.2 If for any Contract Year, it is found that the "Actual Delivered Energy" is less than 'Base NEEGG' for the particular year, the Contractor shall pay the compensation to TVNL equivalent to Rs. (1.5 times of current tariff of TVNL billing at JSERC) per kWh of under- generation. All penalties shall be recovered from payments yet to be made by TVNL to the Contractor and/ or from the Bank Guarantees available with TVNL.

6.12.3 In case of any defect in the system after Commissioning, the Contractor shall repair it within forty-eight (48) hours. After 48 hours, the penalty shall be charged and the same shall be deducted from the Bank Guarantee submitted to TVNL. A penalty at the rate of Rs. (1.5 times of current tariff of TVNL billing at JSERC) per kWh shall be charged by the company for the loss of generation. The loss of generation shall be calculated with respect to the NEEGG of that particular year based on the actual radiation. Whereas if, at the end of the year, the Contractor is able to meet the NEEGG for the year, then the penalty amount shall be reimbursed to the vendor.

6.12.4 In case the Project fails to generate any power continuously for 6 months, any time during the O&M period, it shall be considered an "Event of Default".

6.12.5 Upon occurrence of any Event of Default mentioned in Clause 6.12.4 herein above, TVNL shall have the right to encash the entire amount of O&M Bank Guarantee submitted by the Contractor and withheld any other pending payment.

6.13 Defect Liability

6.13.1 The Contractor must warrant that the facilities or any part thereof shall be free from defects in the design, engineering, materials and workmanship of the Plant and Equipment supplied and of the work executed.

If it shall appear to the authorized representative of the Company that any supplies have been executed with unsound, imperfect or unskilled workmanship, or with materials of any inferior description, or that any materials or articles provided by the Contractor for the execution of Contract are unsound or otherwise not in accordance with the Contract, the Contractor shall on demand in writing inform the authorized representative of the Company specifying the item, materials or articles complained of, notwithstanding that the same may have been inadvertently or otherwise passed, certified and paid for. The Contractor shall forthwith rectify or remove and replace that item so specified and provide other proper and suitable materials or articles at its own charge and cost, and in the event of failure to do so within a period to be specified by the authorized representative of the Company in its demand aforesaid, the Project Manager may on expiry of notice period rectify or remove and re-execute the time or remove and replace with others, the materials or articles complained of as the case may be at the risk and cost in all respects of the Contractor. The decisions of the authorized representative of the Company as to any question arising under this Clause shall be final and conclusive.

6.13.2 The Contractor shall be liable for the operation and maintenance of the Facility and consequently shall be required to rectify any defects that emerge during the operation of the Facilities for the entire term of this Contract. The Defect Liability Period shall be eighteen (18) months from the date of expiry or early termination of this Contract ("Defects Liability Period"), including the operation and maintenance period.

6.13.3 If during the Defect Liability Period any defect found in the design, engineering, materials and workmanship of the Plant and Equipment supplied or of the work executed by the Contractor, the Contractor shall promptly, in consultation and agreement with TVNL regarding appropriate remedying of the defects, and at its cost, repair, replace or otherwise make good (as the Contractor shall, at its discretion, determine) such defect as well as any damage to the Facilities caused by such defect.

6.13.4 Furthermore, without prejudice to the generality of the foregoing, it is clarified that the Contractor shall also be responsible for the repair, replacement or making good of any defector of any damage to the Facilities arising out of or resulting from any of the following causes:

a) Improper operation or maintenance of the Facilities by the Contractor during operation and maintenance of the Facility; or

b) Operation of the Facilities violating specifications of the Facilities.

6.13.5 TVNL shall give the Contractor a notice stating the nature of any such defect, together with all available evidence thereof, promptly following the discovery thereof. TVNL shall afford all reasonable opportunities for the Contractor to inspect any such defect.

6.13.6 TVNL shall provide the Contractor all necessary access to the Facilities and the Site to enable the Contractor to perform its obligations.

6.13.7 The Contractor may, with the consent of the Company, remove from the Site any Plant and Equipment or any part of the Facilities that are defective if the nature of the defect and/ or any damage to the Facilities caused by the defect is such that repairs cannot be expeditiously carried out at the Site.

6.13.8 If the repair, replacement or making good is of such a nature that it may affect the efficiency of the Facilities or any part thereof, the Company may give to the Contractor a notice requiring that tests of the defective part of the Facilities shall be made by the Contractor immediately upon completion of such remedial work, whereupon the Contractor shall carry out such tests.

6.13.9 If such part fails the tests, the Contractor shall carry out further repair, replacement or making good (as the case may be) until that part of the Facilities passes such tests. The tests, in character, shall in any case be not inferior to what has already been agreed upon by TVNL and the Contractor for the original equipment/part of the Facilities.

6.13.10 If the Contractor fails to commence the work necessary to remedy such defect or any damage to the Facilities caused by such defect within a reasonable time (which shall in no event be considered to be less than seven (7) days), the Company may, following notice to the Contractor, proceed to do such work, and the reasonable costs incurred by TVNL in connection therewith shall be paid to TVNL by the Contractor or may be deducted by the Company from any monies due to the Contractor or claimed under the Performance Guarantee, without prejudice to other rights, which TVNL may have against the Contractor in respect of such defects.

6.13.11 If the Facilities or any part thereof cannot be used by reason of such defect and/ or making good of such defect, the Defect Liability Period of the Facilities, or such part, as the case may be, shall be extended by a period equal to the period during which the Facilities or such part cannot be used by the Company because of any of the aforesaid reasons. Upon correction of the defects in the Facilities or any part thereof by repair/ replacement, such repair/ replacement shall have the defect liability period of eighteen (18) months from such replacement.

6.13.12 In addition, the Contractor shall also provide an extended warranty for any such component of the Facilities and for the period of time. Such obligation shall be in addition to the Defect Liability Period specified under Clause 6.13.3.

6.14 Termination of Default

6.14.1 The Company 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 in part 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 TVNL pursuant to the clause 6.11 for Delay in Execution or Failure to Supply or, If the Contractor fails to perform any other obligations(s) under the Contract.

6.14.2 In the event the Company terminates the Contract in whole or in part, pursuant to above, the Company 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 Company for any excess costs for such similar goods. However, the Contractor shall continue the performance of the Contract to the extent not terminated.

6.14.3 In case the Contractor is not able to demonstrate the "Actual Delivered Energy" as per the "Base NEEGG" based on the procedure mentioned in Appendix 16 during the Performance Guarantee Test and after the penalties levied as mentioned in Clause 6.12.; TVNL reserves the right to terminate the Contract at its discretion if there are no efforts are made from the Contractor to correct the issues regarding plant performance.

6.14.4 In case of termination of the Contract due to default, the Contractor may be blacklisted by TVNL and its associate companies, etc. for future work.

6.15 Breach and Cancellation of the Contract

6.15.1 In case of non-performance in any form or change of the covenant and conditions of the Contract by the Contractor, the Company shall have the power to annul, rescind, cancel or terminate the order and upon its notifying in writing to the Contractor that it has so done, this Contract shall absolutely determine. The decision of the Company in this regard shall be final and binding.

6.15.2 The Company may cancel the order or a portion thereof, and if so purchase or authorize the purchase of the plant/equipment not so delivered or order Plant/ Equipment of similar description (opinion of the Company shall be final) at the risk and cost of the Contractor.

6.16 Force Majeure

6.16.1 In the event of either party being rendered unable by Force Majeure to perform any obligation required to be performed by them under this Contract, relative obligation of the party affected by such Force Majeure shall be treated as suspended during which the Force Majeure Clause lasts.

6.16.2 The term "Force Majeure" shall have herein mean riots (other than among the Contractor's employee), Civil commotion, War (whether declared or not), invasion, act of foreign enemies hostilities, civil war, rebellion, revolution, insurrection, military coup, damage from aircraft, nuclear fission, embargoes, quarantines, acts of god such as earthquake (above 7.0 magnitude on Richter scales), lightning, unprecedented floods, fires not caused by the Contractors negligence and other causes which the Contractor has no control and accepted as such by TVNL whose decision shall be final and binding. Normal rainy season and monsoons are not Force Majeure.

6.16.3 Upon the occurrence of such causes and upon its termination, the party alleging that it has been rendered unable as aforesaid, thereby, shall notify the other party in writing by registered notice within 24 (twenty-four) hours of the alleged beginning and ending thereof giving full particulars and satisfactory evidence in support of its claim.

6.16.4 Time for performance of the relative obligation suspended by the Force Majeure shall stand extended by the period for which such clause lasts.

6.16.5 If works are suspended by Force Majeure conditions lasting for more than two (2) months, TVNL shall have the option of cancelling this Contract in whole or part thereof, at its discretion.

6.16.6 The Contractor shall not claim any compensation for Force Majeure conditions and shall take appropriate steps to ensure men and materials utilized by it under the Contract well in advance.

6.17 Progress Report of Work:

6.17.1 The Contractor shall submit a weekly progress report on the execution of works conforming to the Bar/ PERT Chart and format provided by TVNL. 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 a modified Bar/ PERT Chart mentioning the action plan being taken to keep the due date of completion of the project unchanged. If required, the Contractor shall use additional manpower to keep the due date of completion of the Project unchanged.

6.17.2 The authorized representative of the Contractor shall review the progress of the Project work every fortnight on a prefixed day at the project site with TVNL or its representative as per the network and record the minutes.

6.18 Insurance:

6.18.1 During the construction period, i.e., before the Commissioning of the Project, all insurance related expenses shall be borne by the Contractor. The goods supplied under the Contract shall be fully insured against the loss or damage incidental to manufacture or acquisition, transportation, storage, delivery, theft, natural or other disaster, etc. in such a manner that the Company shall not incur any financial loss, as long as the construction of the Project continues to remain under the custody of the Contractor.

6.18.2 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 the Contractor.

6.18.3 The Contractor shall arrange to supply/ rectify/ recover the materials even if the claim is unsettled for the timely completion of the Project. The final financial settlement with the insurance company shall be rested upon the Contractor.

6.18.4 In case of any delay of the Project attributable to the Contractor, the Contractor himself in consultation with the Company, should take the extension of insurance. Any financial implications shall, however, be borne by the Contractor.

6.18.5 The Contractor shall arrange for providing insurance coverage to its workmen under the Workmen's Compensation Act or similar Rules and Acts as applicable during execution of work for covering risk against any mishap to its workmen. The Contractor shall also undertake a Third-Party Insurance. The Company shall not be responsible for any such loss or mishap.

6.18.6 The EPC Contractor shall provide or obtain and maintain in force throughout the period of O&M the following Insurance coverage: (i) Insurance to cover third party liability of appropriate value along with an undertaking indemnifying TVNL from any such claim. (ii) Workmen compensation and /or group personal accidents Insurance policy covering all its employees and works including of the sub-contractor. Pilferage, theft, burglary also are also to be covered by the EPC Contractor/O&M operator. (iii) Fire and allied perils including earthquake, flood, storms, cyclone, tempest, insurance policy shall be taken by the Owner regularly immediately after COD. In case of any loss/ claim under the policy, EPC Contractor/O&M Operator shall immediately inform the same to the Owner. (iv) It is the responsibility of the EPC contractor /O&M Operator to operate and maintain the solar plant and all the associated equipments at his own cost for the quoted O&M period for which the Owner shall pay the agreed O&M charges only. (v) Any replacement / repair / modification of any item / equipment shall be carried out by the EPC contractor /O&M Operator at his own cost for the quoted O&M period, so as to have minimum down time. The Owner shall not be responsible for any break down / failure of any equipment to any reason thereof except for Force Majeure / Fire & Allied Perils Events or extraneous reasons. (vi) The scope / type / form of insurance cover mentioned elsewhere in this tender, for the scope of the project for the quoted O&M period, would be superseded by this Clause

6.18.7 At the end of the term of insurance undertaken by the Contractor, the Contractor shall provide all the necessary documents to the satisfaction of the Company to enable the Company to take up the insurance of the Plant.

6.19 Statutory Acts, rules, and Standards

6.19.1 The work shall be executed in conformity with the relevant standard of Bureau of Indian Specification (or equivalent International Standard), Electricity Rules, 2010 (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 and maintenance period.

6.20 Tools and Tackles

6.20.1 The Contractor shall provide technically suitable tools and tackles for the installation and erection of Plant and Machineries conforming to relevant BIS safety and technical standards for proper execution of work. The Company, in no way, shall be responsible for the supply of any tools and tackles for implementation of the work and to carry out operation and maintenance activities.

6.21 Safety Measures

6.21.1 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. The Company shall not be responsible for any such accidents.

6.22 Hazardous Material

6.22.1 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 purposes after its operating/ working life, so that it may not affect the environment or any living being. The Contractor shall comply with the State Pollution Board regulation.

6.23 Stoppage of Work

6.23.1 The Company shall not be responsible and not liable to pay any compensation due to the stoppage of work as a reaction from the local public due to any undue action on the part of the Contractor causing annoyance to local people.

6.24 Hindrance Register

6.24.1 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 Project Manager or his authorized representative.

6.25 Responsibility of the Contractor

6.25.1 The Contractor shall provide a guarantee and be entirely responsible for the execution of the Contract in accordance with this Tender, including but not limited to its specification, schedules, and annexure. The Contractor shall further provide a 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 and maintenance.

6.26 Right of the Company to make Change(s) in Design

6.26.1 All designs shall be approved by TVNL prior to the execution of such designs.

6.26.2 The Company shall have the right to make any change in the design, which may be necessary in the opinion of TVNL to make the plant and materials conform to the provisions and contents of the specification without extra cost to TVNL.

6.27 Manuals

6.27.1 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 work in hard and soft copies.

6.28 Governing Language

6.28.1 The Contract shall be written in the English Language. All correspondence and documents pertaining to the Contract, which are exchanged by the Company and Contractor, shall be written in English.

6.29 Order Amendments

6.29.1 No variation in or modification of the terms of the contract shall be made except by written amendments issued by the Company.

6.30 Assignments or Subletting of Contract

6.30.1 The Contractor shall not, without the prior consent in writing of the Company, assign or, sublet or transfer its Contract in whole or in part, its obligations to perform under the 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.

6.31 Subcontracts

6.31.1 The Contractor shall notify the Company in writing of all subcontracts awarded under the Contract if not already specified in his Bid. Such notification in its original Bid or later shall not relieve the Contractor from any liability or obligation under the Contract.

6.31.2 Subcontracting a work shall not, under any circumstances, relieve the Contractor from its obligations towards the Project and the Company.

6.31.3 In case, the Contractor engages any Subcontractor to carry out a part of the work, the Subcontractor should have requisite Government License for carrying out such part of the work.

6.32 Inspection and Testing

6.32.1 The Contractor shall offer following Test / Inspection to the Owner

1) TVNL may depute its Engineer or representative or hire an agency for Third-Party Inspection, for pre-dispatch inspection at the manufacturing facility of the Contractor all items under this RFP as per applicable standards, approved QAP and documents. Samples for testing shall be drawn randomly in presence of TVNL/ inspecting agency from the lot offered for inspection. After Test/Inspection of the Items at factory, the Contractor is to submit the inspection & test reports to TVNL for review. After review of the inspection & test reports, TVNL will give dispatch clearance in writing. The Contractor shall not dispatch any item without dispatch clearance from TVNL, in writing.
2) TVNL may depute its Engineer or representative or third party inspection agency for inspection during manufacture and in assembled condition prior to dispatch in accordance with the standard practice/ QAP of the manufacturer and applicable Standards, at no additional cost to TVNL for demonstration and performing the test/inspection. The Contractor shall raise inspection call with internal test reports in advance for all items like PV Modules, MMS, cables, SJBs, Inverters, Transformers, HT & LT switchgears, DC system, Switchyard equipments, earthing system, SCADA, RMU etc.
3) Upon delivery of the photovoltaic modules on site, they shall be sampled randomly and tested for performance through an approved testing agency assigned by TVNL. The result of such testing agency shall be binding to both the parties and shall be considered final performance measurement report for the guarantee / warrantee conditions of this contract.

6.32.2 The TVNL or its authorized representative, including the appointed Consultant for the project shall have, at all times, access to the Contractor's premises and also shall have the power 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 premises other than the Contractor's, the necessary permission for inspection shall be obtained by the Contractor on behalf of TVNL or its duly authorized representative.

6.32.3 TVNL 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, the Company at his liberty, may reject all or any component of plant or workmanship connected with such work.

6.32.4 The Contractor shall issue a request letter to TVNL or his authorized representative for testing of any component of the plant, which is ready for testing at least Seven (7) days in advance from the date of the actual date of testing at the premises of the Contractor or elsewhere. When the inspection and the tests have been satisfactorily completed at the Contractor's works, TVNL shall issue a certificate to that effect. However, the TVNL 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 TVNL's presence, and it shall forthwith forward six (6) sets of duly certified copies of test results and certificates to the Company for approval of the Company. The Contractor, on receipt of written acceptance from TVNL, may dispatch the equipment for erection and installation.

6.32.5 For all tests to be carried out, whether in the premises of the Contractor or any Subcontractor or the supplier, 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 TVNL or its authorized representative to accomplish such testing.

6.32.6 The Company or his authorized representative shall have the right to carry out inward inspection of the items on delivery at the 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.

6.32.7 If the Company 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 Company. However, the Contractor shall render all necessary help to TVNL whenever required, free of charge.

6.32.8 The Contractor has to provide the necessary testing reports to TVNL as and when required.

6.32.9 Neither the waiving of inspection nor acceptance after inspection by TVNL shall, in anyway, absolve the Contractor of the responsibility of supplying the plant and equipment strictly in accordance with specifications and drawings etc.

6.33 Authorized Test Centres

6.33.1 The PV modules, inverters, transformers, panels, wires, etc. deployed in the power plants shall have valid test certificates for their qualification as per the above specified IEC/ BIS Standards by one of the NABL Accredited Test Centres in India. In case of module or other equipment for which such Test facilities may not exist in India, test certificates from reputed ILAC Member Labs abroad will be acceptable.

6.34 Delivery of Equipment

6.34.1 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 Company from time to time regarding the transit of the plant and material.

6.34.2 Notification of delivery or dispatch regarding each and every consignment shall be made to the Company 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.

6.34.3 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 the Insurance company. It should take immediate steps to repair the damaged apparatus or replacement there to.

6.35 Liabilities during Transit

6.35.1 The Contractor shall be responsible for loss, damages, or depreciation to goods or of plant, equipment, and machineries up to delivery at the Site.

6.36 Deduction from Contact Price

6.36.1 All costs, claims, damages or expenses, which the Company may have paid for which the Contractor is liable, will be deducted by the Company from deposited bank guarantees or from any money due or which becomes due to him under this Contract, or any contract are being executed elsewhere with the Company.

6.36.2 Any sum of money due and payable to the Contractor, as per the Contract Agreement, may be appropriated by the Company and set off against any claim of the Company, for the payment of a sum of money arising out of or under any other contract made by the Contractor with the Company. It is an agreed term of the Contract that the sum of money, withheld or obtained under this clause by the Company, will be kept withhold or retained as such by the Company 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 duly notified as such to the Contractor.

6.37 Terms of Payment

6.37.1 The Company shall pay the Contractor in the following manner for the supply of material and at the following time for achieving the respective milestones:

Sr.	Payment Milestones	Amount
	Supply Payment Milestone	
1.	Upon complete delivery of the Module Mounting Structure (MMS) at Site	5% of Supply Contract Price
2.	Upon Complete Delivery of Inverters at Site and Erection of MMS Column Post	5% of Supply Contact Price
2.	Upon delivery and acceptance of all PV modules at site and Erection of Module Mounting Structure	40% of Supply Contact Price
3.	Upon complete delivery of Balance of Systems including Cable, Junction Boxes/String Monitoring Box, Transformers, SCADA, all HT/LT Panels etc. at site and installation of PV Modules	20% of Supply Contact Price
4.	Upon achieving Completion of the Facilities	20% of Supply Contact Price
5.	Upon achieving Commissioning of the Plant and Successful Operational Acceptance Test	10% of Supply Contact Price
	Works Payment Milestone	
6.	Upon erection of Module Mounting Structure at site	10% of Works Contract Price
7.	Upon installation of inverters at site	15% of Works Contract Price
8.	Upon installation of all PV modules at site	30% of Works Contract Price
9.	Upon installation of complete Balance of System (BOS) (i.e. structures, cables, Junction Boxes/String Monitoring Box, SCADA, transformers, all HT/LT Panels, electrical, civil, etc.)	20% of Works Contract Price
10.	Upon successful Commissioning of the Project	15% of Works Contract Price
11.	Upon Completion of the Facilities and Successful Operational Acceptance Test	10% of Works Contract Price

8.	On successful Operation and Maintenance of the Solar Power Plant on monthly basis for each year till 10 years	Year 1: Year 2: Year 3: Year 4: Year 5: Year 6: Year 7: Year 8: Year 9: Year 10:

a. Out of the total contract price, 70% shall allocated for supply, while the remaining 30% shall be allocated for works.
b. All the PG test periods, and O&M periods will start from the date of the successful operational acceptance test.
c. Payment related to O&M shall be released only after completion of all the facilities.
d. In case, all the facilities are completed after the successful completion of PG test, Payment related to the performance guarantee shall be released after that only.

- EPC Contract Value "EPC Contract Price" (including taxes) quoted by the Contractor in its Financial Proposal.
- All supply of equipment shall be considered for payment on a pro-rata basis of 10 FMW.
- Bidder has to submit all the invoices related to the project and O&M are to concern_____. The copy of project-related invoices are to be submitted to_____.
- All the project-related supplies are addressed to _____.

Note: The payment for delivery of modules and other systems shall be released proportionately on a monthly basis for a minimum of 10 MW lot size. However, schedule of dispatch of materials shall be as per the approval of TVNL.

6.38 Payments

6.38.1 Subject to any deduction which the Company may be 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:

a) All payments shall be made in Indian Rupees, unless otherwise specified in the LoI/ Work Order /Contract Agreement. All payments shall be made based on the actual measurement for the quantified items as per the schedule of works.

b) The Contractor shall submit the bill/invoice for the work executed showing separately GST and any other statutory levies in the bill/invoice.

- All taxes and deductions shall be applicable as per prevailing income tax and other statutory rules and provisions in force.
- Payment shall be released by the through RTGS/NEFT.

6.39 Warranty/Guarantee

6.39.1 The Plant shall perform as per the Guaranteed Performance indicated by the Bidder in its Financial Proposal.

6.39.2 PV modules used in grid connected solar power plants must be warranted for peak output power at Standard Testing Condition (STC), which shall not be less than 90% at the end of ten (10) years and not less than 80% at the end of twenty-five (25) years.

6.39.3 The modules shall be warranted for at least 25 years for failures due to material defects and workmanship.

6.39.4 The mechanical structures, electrical works, all plant equipment and components and overall workmanship of the grid solar power plants shall be warranted for a minimum of 5 years.

6.39.5 The Contractor shall 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.

6.39.6 The warranty / guarantee period shall be as follows:

a) Solar PV Modules: Modules shall be warranted for a minimum period of 25 years in the Bidder's detailed Warranty/ Guarantee certificate. Same shall be furnished with its Bid.

b) Power Conditioning Units (PCUs) / Inverters: PCUs /Inverters shall be warranted for the guarantee period provided by the original equipment manufacturer. Same shall be furnished with its Bid.

c) Transformers, associated switchgear, and others: Bidder shall furnish in detail its warranties/ guarantees for these items.

6.39.7 During the period of Warranty/ Guarantee, the Contractor shall remain liable to replace any defective parts, that become defective in the Plant, of its own manufacture or that of its Subcontractors, 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 Contractor's works at the expense of the Contractor unless otherwise arranged.

6.39.8 At the end of the Guarantee period, the Contractor's liability shall cease. In respect of goods not covered above, TVNL shall be entitled to the benefit of such Guarantee given to the Contractor by the original Contractor or manufacturer of such goods.

6.39.9 During the Operation and Maintenance and Guarantee period, the Contractor shall be responsible for any defects in the work due to faulty workmanship or due to the 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 TVNL within a reasonable time as may be considered from the date of receipt of such intimation from TVNL, failing which TVNL shall take up rectification work at the risk and cost of the Contractor.

6.39.10 Material Warranty:

Material Warranty is defined as: The manufacturer should warrant the Solar Module(s) to be free from the defects and/or failures specified below for a period not less than ten (10) years from the date of sale to the Solar Power Company:

- Defects and/or failures due to manufacturing defects and/or failures due to materials, including PID defect.
- Non-conformity to specifications due to faulty manufacturing and/or inspection processes.

  If the solar Module(s) fails to conform to this warranty, the manufacturer will repair or replace the solar module(s), at TVNL's sole option.

a) Performance Warranty:

The manufacturer should warrant the output of Solar Module(s) for at least 90% of its rated power at the end of 10 years and 80% of its rated power at the end of 25 years from the date of receipt of modules on Site.

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

6.40 Arbitration:

6.40.1 All matters, questions, disputes, differences and/or claims arising out of and/or concerning, and/or in connection with, and/or in consequence of, and /or relating to any contract, whether or not obligations of either or both the Certifying agency and the Corporation under that contract be subsisting at the time of such dispute and whether or not the contract has been terminated or purported to be terminated or completed, shall be referred to the sole arbitration of MD, TVNL or an officer appointed by MD, TVNL as his nominee. The award of the Arbitrator shall be final and binding on both parties to the contract.

6.40.2 The objection that the Arbitrator has to deal with matters, to which the contract relates, in the course of his duties or, he has expressed his views on any or all of the matters in dispute or difference, shall not be considered as a valid objection.

6.40.3 The Arbitrator may, from time to time, with the consent of the parties to the contract, enlarge the time for making the award. The venue of the arbitration shall be Ranchi.

6.40.4 All questions, disputes, or differences, whatever which may at any time arise between the parties to this contract in connection with the contract or any matter arising out of or in relation thereto shall be reported to MD, TVNL and provision of Clause 6.40 shall be applied as updated time to time.

6.41 Court of Competent Jurisdiction:

6.41.1 The Courts of Ranchi for TVNL shall have exclusive jurisdiction in all matters arising under the Contract.

6.42 Law and Procedure:

6.42.1 The law which is to apply to the Contract and under which the Contract is to be construed shall be Indian Law.

6.43 Construction of Contract:

6.43.1 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.

6.44 Notices

6.44.1 For all purposes of the Contract, including arbitration there under, the address of the Contractor mentioned in the Bid shall be the address to which all communications addressed 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 acknowledgment due to TVNL. The Contractor shall be solely responsible for the consequence of an omission to notify change of address in the manner aforesaid.

6.44.2 Any communication or notice on behalf of the Company in relation to the Contract Agreement may be issued to the Contractor by the Company 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.

6.44.3 Instructions or notices to the Contractor and notices from the Contractor to TVNL are recorded in a minute and signed by the authorized representatives of both TVNL and the Contractor. Such notice or instruction shall be valid notice of instruction for the purpose of the Contract.

6.45 Final Bill:

6.45.1 The Final EPC Bill relating to the Contract shall be prepared only after the Performance Guaranteed Test of the plant has been observed as under Appendix 16: Procedure for Performance Testing and it will include the adjustments of all claims against the Contractor by the Company and awarded in its favour by the arbitrator up to the date of preparation of the final bill.

6.45.2 The Operation and Maintenance shall be comprehensive. The maintenance service provided shall ensure the project functioning of the Solar PV system as a whole and the Power Evacuation System to the extent covered in the Contract. All preventive/routine maintenance and breakdown/corrective maintenance required for ensuring maximum uptime shall have to be provided. Accordingly, the Comprehensive Operation and Maintenance shall have two distinct components as described below:

6.45.3 Preventive / Routine 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 Routine for Transformers and associated switch gears also shall be included.

6.45.4 Breakdown / Corrective maintenance: Whenever a fault has occurred, the Contractor has to attend to rectify the fault, and the fault must be rectified within 24 hrs time from the time of occurrence of fault, failing which the Contractor will be penalized as per terms and conditions under Performance Guarantee and under Warranty.

6.45.5 The Contractor may ensure adequate insurance of Solar PV systems against robbery, theft and acts of God such as natural calamities, floods etc.

6.45.6 The date of the Comprehensive Operation and Maintenance Contract period shall begin on the date of demonstration of guaranteed annual CUF. Detailed scope of comprehensive operation and maintenance has been described in Chapter 5 of this document. However, the operation of the Power Plant means the operation of the system as per the bidding schedule and workmanship in order to keep the project trouble-free free, covering the guarantee period.

6.46 Degradation of Solar Modules

6.46.1 The Contractor should warrant for the output of each Solar Module(s) for at least 90% of its actual rated capacity at Standard Testing Conditions after an initial 10 years and 80% of its rated capacity after 25 years upon commissioning of the Plant.

6.46.2 The derating of the module should not be more than 0.5% in any year except for the first year of operation, which should be limited to 3.00%.

6.46.3 If, Module(s) fail(s) to exhibit such power output, the Contractor will either:

i. Deliver additional PV Module(s) to replace the loss of power output with no change in the area of land used;

<or>

ii. Repair or replace the existing PV Module(s) with no change in area of land used;

<or>

iii. Compensate TVNL with an amount equivalent to the loss of revenue from the date of audit to 25th years which shall be calculated based on Net Present Value of amount of loss of revenues from the date of audit to 25th years discounted at the rate of TVNL's cost of capital.

6.46.4 The Company will specifically do the audit of solar PV modules by third-party at any point of the operation period and in case the Contractor fails to demonstrate the value as per the maximum degradation allowed. Then the Contractor shall compensate as per the Clause no. 6.46.3.

6.47 Risk Purchase

6.47.1 If the Contractor fails, on receipt of the LoI/ WO, to take up the work within a reasonable period or leave the work Site after partial execution of the work, TVNL shall have the liberty to get the work done through another agency at the Contractor's own risk and additional cost if any. If the situation, so warrants, to compel TVNL to cancel the LoA placed on the Contractor, it shall be liable to compensate the loss or damage, which TVNL may sustain due to reasons of failure on the Contractor's part to execute the work in time.

6.48 Confidential Information:

6.48.1 TVNL and the Contractor shall keep confidential and shall not, without the written consent of the other Party hereto, divulge to any third party any documents, data or other information furnished directly or indirectly by the other Party hereto in connection with the Contract, whether such information has been furnished prior to, during or following termination of the Contract. Notwithstanding the above, the Contractor may furnish to its Subcontractor(s) such documents, data, and other information it receives from TVNL to the extent required for the Subcontractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this Clause 6.48.

6.48.2 Notwithstanding the generality of the foregoing Clause 6.48.1, all maps, plans, drawings, specifications, schemes and the subject matter contained therein and all other information given to the Contractor, by the Company in connection with the performance of the Contract shall be held confidential by the Contractor and shall remain the property of the Company and shall not be used or disclosed to third parties by the Contractor for any purpose other than for which they have been supplied or prepared. The Contractor may disclose to third parties, upon execution of secrecy agreements satisfactory to the Company, such part of the drawings, specifications, or information if such disclosure is necessary for the performance of the Contract.

6.48.3 Maps, layouts, and photographs of the unit/integrated plant, including its surrounding region showing vital installation for national security shall not be published or disclosed to third parties or taken out of the country without prior written approval of the Company and upon execution of secrecy agreements satisfactory to the Company with such third parties prior to disclosure.

6.48.4 Title to secret processes, if any, developed by the Contractor on an exclusive basis and employed in the design of the unit shall remain with the Contractor. The Company shall hold in confidence such process and shall not disclose such processes to the third parties without prior approval of the Contractor and execution by such third parties of secrecy agreements satisfactory to the Contractor prior to disclosure.

6.48.5 Technical specifications, drawings, flow sheets, norms, calculations, diagrams, interpretations of the test results, schematics, layouts, and such other information which the Contractor has supplied to the Company under the Contract shall be passed on to the Company. The Company shall have the right to use these for construction erection, start-up, commissioning, operation, maintenance, modifications and/ or expansion of the unit, including for the manufacture of spare parts.

6.48.6 The obligation of a party under this Clause 6.48, however, shall not apply to that information which:

a. Now or hereafter enters the public domain through no fault of that Party,

b. can be proven to have been possessed by that Party at the time of disclosure and which was not previously obtained, directly or indirectly, from the other Party hereto, or

c. otherwise lawfully becomes available to that Party from a third party that has no obligation of Confidentiality.

6.48.7 The above provisions of this Clause 6.48 shall not in any way modify any undertaking of Confidentiality given by either of the Parties hereto prior to the date of the Contract in respect of the Facilities or any part thereof.

6.48.8 The provisions of this Clause 6.48 shall survive Termination, for whatever reason, of the Contract.

6.49 Warranties

6.49.1 Contractor Warranties

Contractor warrants to Owner with respect to the Performance of Work that (i) all equipment and materials supplied will be new, free from lien and free from defective workmanship and (ii) the design and engineering of the Solar Plant shall be free from deficiencies. If Owner notifies Contractor in Writing with adequate detail of any defects with respect to (i) above or deficiencies with respect to (ii) above in the PV Solar Plant discovered during the applicable Warranty Period therefor, Contractor shall (a) re-perform any of the work hereunder to correct any errors, omissions, defects or deficiencies in the Solar Plant, and (b) in the case of any defective equipment or materials, at Contractor's option either repair or replace at its Cost.

6.49.2 Product Warranty Period

i. 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.
ii. The mechanical structures, electrical works and overall workmanship of the Solar Power Plant must be warranted for a minimum of 5 (five) years from the date of commencement of the O&M.
iii. Inverter shall be warranted for the period of minimum 5 (Five) years from the date of commencement of the O&M.
iv. Inverter duty Transformers (IDT) shall be warranted for the period of minimum 5 (five) years from the date of commencement of the O&M.
v. Solar PV Modules shall be warranted for the period of minimum 10 (ten) years from the date of commissioning.
vi. During the period of Warranty, 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.
vii. If any defects not remedied within a reasonable time, the TVNL may proceed to do work at the Contractor's risk and cost, but without prejudice to other rights, which the TVNL may have against the Contractor in respect of such defects.

----End of Section---

7 Special Terms and Conditions

7.1 Definition

7.1.1 The General Terms and Conditions as well as the Special Terms and Conditions of the Tender are complementary to each other, and wherever there is a conflict, the Special Terms and Conditions shall prevail.

7.2 Objectives of the Project

7.2.1 The main objective of this project is "Design, Engineering, Procurement and Supply, Construction, Testing and Commissioning of 50 MW (AC) Solar Photovoltaic Grid- connected Power Plant using Photovoltaic technology of the associated ten (5+5) years Operation and Maintenance of the same on turnkey basis at Tenughat Vidyut Nigam Limited, Lalpania, in the State of Jharkhand".

7.3 Compliance with JUSNL/TVNL/CEIG Guidelines

7.3.1 The Bidders and Contractor shall make themselves fully aware of and comply with the norms and guidelines provided by JUSNL/TVNL/CEIG if any, towards the Project.

7.3.2 The Contractor shall ensure that the Project shall comply with all the norms and guidelines of JUSNL/TVNL/CEIG if any, and subsequent clarifications or amendments issued from time to time. The Contractor is required to refer the compliance documents of JUSNL/TVNL/CEIG if any, for necessary compliances of JUSNL/TVNL/CEIG requirements.

7.3.3 In case of any conflict between the compliance of JUSNL/TVNL/CEIG and this Tender or any aspect of the Project, the Contractor shall immediately notify TVNL for clarity.

7.3.4 Any changes in the Tender or the Contract including but not limited to the Scope of Work, Guarantees and Warranties to comply with the guidelines or provisions of the Scheme under which this project is being executed shall have no bearing on the EPC Contract Price and O&M Contract Price.

7.4 Project Site

7.4.1 Details of the Project Site will be as per the Annexure1: Details of Plant Location.

7.5 Scope of Service

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

a. Transportation, unloading, receiving and 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 operation, feeding power to the local internal grid.

7.6 Training of TVNL's Personnel

7.6.1 The Bidder shall provide training on Plant operations and maintenance to three (3) teams of 5-10 personnel each (Engineers and Technician/Operators) of TVNL as and when requested by TVNL.

7.7 Mode of Execution

7.7.1 The entire work shall be executed on turnkey basis. 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 operation(s) required for completion of the project, shall be deemed to have been included in the scope of this work, and the Contractor shall supply, install the same without any extra cost.

7.8 Programme of Work

7.8.1 The Contractor shall submit the programme of work within 15 days from the date of receipt of the Letter of Intent. The programme shall include a Bar Chart indicating there in the starting position and completion date of each of them major items of work.

7.9 Starting of Work

7.9.1 The Contractor shall be required to start the work within 15 (fifteen) days from the date of issue of Letter of Intent and shall, thereof, report to TVNL accordingly.

7.10 Completion Schedule

7.10.1 The time of completion and Commissioning of the Plant as per Tender Notice thereafter 10 years of O&M Contract from the date of commissioning of the plant.

7.10.2 The Contractor shall inform TVNL at least fifteen (15) days advanced preliminary written notice and at least seven (7) days advanced final written notice of the date on which it intends to synchronize the Power Project to the Grid System.

7.10.3 The Contractor shall prepare the completion schedule accordingly and inconformity 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.

7.10.4 The Contractor shall provide the power evacuation schedule as and when required or asked by any Central or State Government agency(s).

7.11 Site Inspection and Basis of Bid

7.11.1 The volume and quantity of work indicated in the schedule of works may vary. The Contractor should visit the Site before quoting the rate for civil works. After taking into consideration all aspects of the site, condition of soil etc., the Contractor should quote for civil works. No extra claim will be entertained at post bidding stage. The foundation design of the module mounting structure and the building shall have to be approved by TVNL. In case of any defects arising in the building during the guarantee period, the Contractor shall have to rectify the same at its own cost.

7.12 Price Escalation

7.12.1 The rate(s) quoted against the work shall remain firm during the entire Contract period.

7.13 Taxes and Duties

7.13.1 The price quoted shall be inclusive of all applicable taxes, duties, and levies as applicable (as per the format of the Financial Proposal), which shall be paid on the production of documentary evidences for the same.

7.13.2 Bidders shall quote the rates as well as taxes and duties based on the concessional exemption in the same that can be availed by the Bidder.

7.13.3 Statutory variations in the tax shall be permitted as follows:

(A) Statutory variations during the original contractual completion period:

i. If any increase takes place in taxes and duties due to statutory variation, then TVNL shall admit the same on the production of documentary evidence.

ii. If any decrease takes place in taxes and duties due to statutory variation, the same shall be passed on to TVNL, or TVNL shall admit the decreased rate of taxes and duties while making the payment.

(B) Statutory variations beyond the original contractual completion period:

i. If the reasons for the extension of the contractual completion period is attributable solely to TVNL, the provisions of (A) (i) above shall apply.

ii. If the reasons for the extension of the contractual completion period are attributable to Bidder, then:

a) If any increase takes place in taxes and duties due to statutory variation, then TVNL shall not admit the same; however, TVNL shall admit the taxes and duties at the rate prevailing during payment of the last invoice raised during the original contract completion period.

b) If any decrease takes place in taxes and duties due to statutory variation, the same shall be passed on to TVNL or TVNL shall admit the decreased rate of taxes and duties while making the payment.

7.13.4 Variation on account of the exchange rate will not be payable. No statutory variation shall be payable by TVNL on the input items. i.e., raw materials etc.

7.13.5 No statutory variation shall be admitted if the excise duty becomes payable because of exceeding of the prescribed limits for turnover of the Bidder.

7.14 Procurement of Materials

7.14.1 The Contractor shall procure all necessary materials required for the project work and arrange to store them properly. Test certificates in accordance with the specifications are to be furnished by the Contractor to TVNL for approval in respect of the materials procured by the Contractor. All the procured material shall be newly manufactured by OEM for this project and as per specifications defined in this tender. Any refurbished/renewed material will not be acceptable.

7.15 Samples

7.15.1 Apart from adhering to the special provision made in the specification regarding the submission of samples, the Contractor shall, within fifteen (15) days of its receipt of the Letter of Intent, provide to TVNL samples as per the directive of TVNL 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 prepared at the Site, a detailed literature/test certificate of the same shall be provided instead. TVNL shall check the samples and give his comments and/or approval to the same.

7.16 Notice of Operation

7.16.1 The Contractor shall not carry out important operations without the consent in writing of TVNL or his representative. For carrying out such important activity, the Contractor shall intimate to TVNL at least seventy-two (72) hours before starting the job.

7.17 Rejection of Materials

7.17.1 TVNL's decision regarding the quality of the material and workmanship will be final. The Contractors, at its own cost and risk without any compensation, shall immediately remove any material rejected by the Project Manager or Engineer-in-Charge from the Site of work.

7.18 Water and Power Supply during Construction

7.18.1 The TVNL shall provide a single-point connection for the temporary Power Supply at the site for construction purposes at free of cost.

7.18.2 The TVNL shall also provide a single-point connection for the temporary water tapping at the site for construction purposes at free of cost.

7.18.3 TVNL shall not provide a facility for the storage of materials and accommodation for labourers at the site. The Contractor shall make his own arrangement for the same.

7.19 Labour Engagement

7.19.1 The Contractor shall be responsible for providing all wages and allied benefits to its labours engaged for the execution of the project work and to carry out Operation and Maintenance service. The Contractor shall remain liable to the authorities concerned for compliance with the respective existing rules and regulations of the government for this purpose and shall remain liable for any contravention thereof.

7.19.2 Strict adherence of various applicable labour laws like the Factories Act, Minimum Wages Act, ESI Act, Payment of Wages Act, the Workman's Compensation Act, EPF Act, Contractor Labour (Regulation and Abolition) Act, 1970 and all other statutory requirements as amended from time to time to the entire satisfaction of Central/State Govt. Authorities shall be the responsibility of the Contractor, and he shall have to make good loss, if any, suffered by TVNL on account of default in this regard by the Contractor.

7.19.3 65% of the jobs that will be created due to the projected in the supervisory and managerial cadres and 75% of the jobs that will be created in other cadres due to the project shall be filled in by employing the local persons. The expression "local person" shall mean a person domiciled in Jharkhand state for a minimum period of 15 years prior to applying for employment to the bidder.

7.19.4 The contractor is encouraged to use local manpower as per the local statutory (labour) requirement, if any.

7.20 Handing over-Taking over

7.20.1 The Project shall be taken over by TVNL upon successful completion of all tasks to be performed at Site(s) on equipment supplied, installed, erected and Commissioned by the Contractor in accordance with the provision of this Tender. During handing over complete Project work, the Contractor shall submit the following for consideration for final payment:

a) All as- Built Drawings;

b) Detailed Engineering Document with detailed specifications, schematic drawing, circuit drawing and test results, manuals for all deliverable items, Operation, Maintenance and Safety Instruction Manual and other information about the project;

c) Bill of material; and

d) Inventory of spares at project Site.

e) Copies of all warranties/guarantees.

7.20.2 Immediately after taking over the complete Plant, the same will be handed over to the Contractor for Operation and Maintenance for a period as mentioned in the Tender.

7.20.3 Handing over will be done only after the Completion of Facilities and a successful Operational Acceptance Test.

7.21 Termination on the death of Contractor

7.21.1 Without prejudice to any of the rights or remedies under this contract, if the Contractor dies, the Engineer-in-Charge on behalf of TVNL shall have the option of terminating the Contract without compensation to the Contractor.

7.22 Retired Government Servant Taking to Contract

7.22.1 No engineer of gazette rank or other gazette officer employed in engineering or administrative duties in the Engineering Department of the Company is allowed to work as a contractor for a period of two years of his retirement from the Company's service without the previous permission of the Company. This contract is liable to be cancelled if either the contractor or any of his employees is found at any time to be a person who had not obtained the permission of the Company as aforesaid before submission of the tender or engagement in the contractor's service as the case may be.

7.23 EPF

7.23.1 The contractor will deduct and deposit EPF of his labour staff/worker as applicable from time to time in his own EPF A/c code and then produce a photocopy of documentary evidence of EPF Challan with each R.A. Bill for the concerned period.

7.24 Miscellaneous:

7.24.1 The project manager appointed by the EPC contractor shall not be replaced without the prior written approval of TVNL.

7.24.2 Any project manager or member of the Contractor at the Site shall be replaced within a period of forty-eight (48) hours of intimation by TVNL without assigning any reason thereof.

7.24.3 The Contractor shall take care of all statutory, local clearance, approvals, etc.

7.24.4 All warranties on the equipment shall be in the name of TVNL with reference to Clause No.6.39.

7.24.5 The Contractor shall be responsible for claiming and retaining any subsidy and shall quote only the final price and the responsibility of Project registration/applications etc. shall lie with the Bidder only. In no case, TVNL is responsible for providing any additional amount other than the EPC Contract Price and O&M Contract Price.

7.24.6 The Contractor shall provide arrangements for water drainage, which shall be appropriately arranged for dispersion/ evacuation as per the local statutory norms without causing any local inconvenience or hindrance.

7.24.7 The design philosophy and related specifications mentioned in this Tender are to be treated as baseline specifications. The Contractor may further improve the design of the Plant through minor modifications and execute the same contingent on TVNL's approval of the new design or specification.

7.24.8 Based on reviewing the Project, if the progress is below expectation as judged based on TVNL's discretion, then TVNL shall reduce the Scope of the Contractor in part or full and assign the same to other contractor(s) at the risk and cost of the existing Contractor.

7.24.9 The Contractor shall continue to provide all the monitoring services, licenses, software, and access to all information (real-time or stored) that shall be used during the O&M Contract period by the Contractor to TVNL at the time of handover at no extra cost to TVNL for the rest of the life of the Plant.

7.24.10 The Contractor shall construct a dedicated site office including tables, chairs, functional power outlets, light, fan air conditioner, etc., for at least eight (8) people to host TVNL's employees or authorized representatives at the time of construction of the Plant.

7.24.11 Provision for installing any additional monitoring equipment to facilitate online transfer of data shall be provided by the Contractor at the request of TVNL.

7.25 Works, goods, services and incidentals

The works, services and incidentals under the scope of this contract shall be to the account of the Contractor. The Contractor and the staff thereof shall consult the Executive Engineer In-charge as and when required for execution of the works under this contract.

--End of Section—

Appendix 1: Format for bank Guarantee

EMD BANK GUARANTEE FORMAT FOR TENDER /RFP No.

(BANK GUARANTEE ON NON-JUDICIAL STAMP PAPER OF APPROPRIATE VALUE)

WHEREAS M/s. _____

(Name and Address of the Firm) having their registered Office at _____- (Address of the Firm's registered Office) (hereinafter called the Tenderer) wish to participate in the Tender No. _____for_____of (supply / Erection / Supply and Erection / Work) of _____(Name of the material / equipment / work) for _____Tenughat Vidyut Nigam Limited and Whereas a Bank Guarantee for (herein after called the "Beneficiary") Rs._____ (Amount of EMD) valid till_____ (mention here date of validity of this Guarantee which will be **6 (Six)** months beyond initial validity of Tender's offer), is required to **be submitted by the Tenderer along with the bid.**

We, _____(Name of the Bank and address of the Branch giving the Bank Guarantee) having our registered Office at_____(Address of Bank's registered Office) hereby give this Bank Guarantee No. _____ dated_____and hereby agree unequivocally and unconditionally to pay immediately on demand in writing from the Tenughat Vidyut Nigam Limited or any Officer authorized by it in this behalf any amount not exceeding Rs._____(Amount of EMD) (Rupees_____) (in words) to the said Tenughat Vidyut Nigam Limited on behalf of the Tenderer.

We,_____(Name of the Bank) also agree that withdrawal of the tender or part thereof by the Tenderer within its validity or non-submission of Security Deposit by the Tenderer within one month from the date of tender or a part thereof has been accepted by the Tenughat Vidyut Nigam Limited would constitute a default on the part of the Tenderer and that this Bank Guarantee is liable to be invoked and encashed within its validity by the Beneficiary in case of any occurrence of

a default on the part of the Tenderer and that the encashed amount is liable to be forfeited by the Beneficiary.

This agreement shall be valid and binding on this Bank up to and inclusive of _____ (mention here the date of validity of Bank Guarantee) and shall not be terminated by notice or by Guarantor change in the constitution of the Bank or the Firm of Tenderer or by any reason whatsoever and our liability hereunder shall not be impaired or discharged by any extension of time or variations or alterations made, given, conceded with or without our knowledge or consent by or between the Tenderer and the Tenughat Vidyut Nigam Limited.

NOT WITHSTANDING anything contained hereinbefore our liability under this Guarantee is restricted to Rs. _____ (amount of EMD) (Rupees _____ (in words). Our Guarantee shall remain in force till_____(date of validity of the Guarantee). Unless demands or claims under this Bank Guarantee are made to us in writing on or before_____ (Date should be 1 month after the above validity period of BG), all rights of Beneficiary under this Bank Guarantee shall be forfeited and we shall be released and discharged from all liabilities there under.

Place:
Date:

Please mention here complete Postal Address of the Bank with Branch Code, and Fax Nos.

Signature of the Bank's authorized Signatory with Official Seal.

NAME OF DESIGNATED BANKS:

As per list of Banks in Schedule

INSTRUCTIONS FOR FURNISHING BANK GUARANTEE

1. The Bank Guarantee by Bidders will be given on non-judicial stamp paper as per stamp duty applicable at the place where the tender has emanated. The non-judicial stamp paper should be in name of the issuing bank.
2. The Bank Guarantee by Bidder will be given from Nationalized/Scheduled bank as per Appendix - 17 only.
3. This bank guarantee/ all further communication relating to the bank guarantee should be forwarded to TVNL , Jharkhand only.
4. The full address along with the Telex/Fax no. and email address of the issuing bank to be mentioned.

Appendix 2: Format for Covering Letter

To,

Electrical Superintending Engineer (Solar Project)

Tenughat Vidyut Nigam Limited,

JUPMI Building Premises in ABD Area, Ranchi Smart City,

P.O & P.S - Dhurwa, Dist. : Ranchi, Jharkhand, 834004

Sub: Submission of the Tender Document No._____, dated_____.

Dear Sir,

We, the undersigned, have considered and complied with the "Instructions to Bidders" and have accepted the terms stipulated in the Tender Document No. (NIT No.): 02/Solar/EPC/TVNL/RAN/2025-26.

The Scope of Work to be offered by us shall include but not be limited to “Design, Engineering, Procurement, Supply, Construction, Commissioning and Comprehensive Operation & Maintenance for 10 (5+5) years of 50 MW (AC) Solar Photovoltaic Grid Connected Power Plants using PV technology at Tenughat Thermal Power Station (TTPS), Lalpania, District: Bokaro in the State of Jharkhand”.

In full cognizance and compliance with these aforesaid conditions and the regulations of local government authorities, we the undersigned do hereby offer our Bid and agree for the following:

i. The work covered under the Bid shall be completed to the entire satisfaction of yourselves or your representative in conformity with the Tender Document at the prices accompanying this Bid.
ii. The Project shall be handed over installed, interconnected, tested, commissioned, and modified and we shall achieve commissioning in not later than One Hundred and Eighty (180) days from the date of issue of LoA.
iii. I/We further certify that regarding matters relating to security and integrity of the country, we or any of our Associates have not been charge-sheeted by any agency of the Government or convicted by a Court of Law.
iv. I/ We hereby irrevocably waive any right or remedy which we may have at any stage at law or howsoever otherwise arising to challenge or question any decision taken by TVNL in connection with the selection of Applicants, selection of the Bidder, or in connection with the selection/ bidding process itself, in respect of the above-mentioned Project and the terms and implementation thereof.
v. We agree to keep the bidding valid for acceptance for a period of 180 days from the opening the Price Bid and the Bid shall not be withdrawn on or after the opening of bidding till the expiry of this period or any extension thereof.

(Sign and Seal of Bidder)

vi. We also acknowledge and accept that you shall not pay for any discontinuance or low performance rate resulting from malfunction of / or inadequacy of our equipment, instruments, or personnel.

vii. We further represent that we have familiarized ourselves with all the terms and provisions of the various parts of the bidding documents and that in making our Bid, we do not rely upon any representation made by any agent or employee of yourselves in respect of the terms of the bidding documents or the nature of the performance of the works.

Yours Sincerely,

Signature: _____

In the capacity of: _____

Duly authorized to sign Tenders for and on behalf of (Name and Address)

_____

_____

_____

Witness_____

Appendix 3: Format of details for Bidder

1.
   a) Name:
   b) Country of incorporation:
   c) Address of the corporate headquarters and its branch office(s), if any, in India:
   d) Date of incorporation and/ or commencement of business:
2. Brief description of company including details of its main lines of business and proposed role and responsibilities in this Project:
3. Details of individual(s) who will serve as the point of contact/ communication for company:
   a) Name:
   b) Designation:
   c) Company:
   d) Address:
   e) Telephone Number:
   f) E-Mail Address:
   g) Fax Number:
4. Particulars of the Authorised Signatory of the Bidder:
   a) Name:
   b) Designation:
   c) Address:
   d) Phone Number:
   e) Fax Number:

Appendix 4: Format of Details of Similar Technical Experience

INSTRUCTIONS:

A. The Bidder shall indicate similar EPC experience of grid-connected solar photovoltaic projects herein.
B. The Bidder shall duly attach the Letter of Award (LOA) from the Client, Commissioning Certificate, and Certificate of Satisfactory Completion of Work from the Client.
C. Projects without sufficient documentary evidence of execution, commissioning, and completion as per the discretion of TVNL shall not be considered towards technical evaluation of the Bidder.
D. The Bidder may indicate more than five (5) projects.

Sr.	Name of Client (With name and contact information of Contact Person)	PV Project AC/ DC Capacity (in MW)	For Official Use Only		
			LOA attached?	Completion Certificate attached?	Charging Certificate attached?
1.			Yes/ No	Yes/ No	Yes/ No
2.			Yes/ No	Yes/ No	Yes/ No
3.			Yes/ No	Yes/ No	Yes/ No
4.			Yes/ No	Yes/ No	Yes/ No
5.			Yes/ No	Yes/ No	Yes/ No

Appendix 5: Format of Details of Qualified Technical Staff

Sr. No.	Name	Relevant Qualification	Additional Certifications	Total Years of Relevant Experience	Remarks
1.					
2.					
3.					
4.					
5.					
6.					

Note: *Kindly submit copies of resumes and appropriate certifications with this sheet.*

Additional sheets may be used to provide accurate information.

Appendix 6: Format of Disclosure of PV Technology Used

PV MODULE	
Type	
Manufacturer	
Model Number	
Module Capacity	..... W
No. of Cells per Module	
No. of Modules	
PV INVERTER	
Type	Select One: • Central Inverter • String Inverter
Configuration	Select One: • Independent Operation • Master-Slave Operation Other, Please specify.....
Manufacturer	
Model Number	
Inverter Capacity	..... kW
Number of Inverters	
MODULE TRACKING	
Type	Select One: • Fixed Type • 1-Axis Seasonal Type

Appendix 7: Format of Project Execution Plan

I. Division of Scope of Work

Discipline/ Equipment	Basic Engineering	Design/ Detailed Engineering	Procurement	Supply	Project Management	Construction/ Fabrication/ Installation	Commissioning

NOTES: 1. Bidder shall clearly indicate the agency which will carry our each activity and the location of activity.

2. In case any activity is proposed with back-up consultant, Bidder shall clearly indicate role of back-up consultant

3. Bidder to identify major equipment / items and discipline

II. Detailed Project Schedule

Sr.	Activity	Start Date	End Date
1.	Issue of LoI/ WO	Zero Date	
2.			
3.			

NOTES: 1. The Bidder shall ensure that the entire work is completed on or before 7th March 2016.

2. All Start Dates and End Dates to be indicated with respect to the Zero Date, e.g. +3 Days.

3. The Bidder may use as many lines as required to satisfactorily provide the detailed project schedule.

SIGNATURE OF BIDDER ----------

NAME ----------

DESIGNATION ----------

COMPANY SEAL and DATE ----------

Appendix 8: Format of Declaration of Compliance

Date:

To,
Electrical Superintending Engineer (Solar Project)
Tenughat Vidyut Nigam Limited,
JUPMI Building Premises in ABD Area, Ranchi Smart City,
P.O & P.S - Dhurwa, Dist. : Ranchi, Jharkhand, 834004

Sub: Declaration of Compliance for the "Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand. ".

Dear Sir,

This is to certify that I, _____, am the duly authorized signatory appointed on behalf of my organization to submit this Bid. The authorization letter is attached herewith. I agree to all the terms and conditions set forth in this Tender Document.

If awarded the job, the Scope of Work shall also conform to the terms and conditions, as well as specifications indicated in the Tender Document and as finally indicated by the Evaluation Committee.

I further certify that all the information provided in this document is accurate to the best of my knowledge.

Signature: _____ Designation: _____

Name: _____ Organization: _____

Address: _____

_____ Email: _____

Phone: _____

(Sign and Seal of Bidder)

Appendix 9: Format of No Deviation Certificate

Date:

To,
Electrical Superintending Engineer (Solar Project)
Tenughat Vidyut Nigam Limited,
JUPMI Building Premises in ABD Area, Ranchi Smart City,
P.O & P.S - Dhurwa, Dist. : Ranchi, Jharkhand, 834004

Sub: No Deviation Certificate regarding "Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand. "

Dear Sir,

We,_____
(Bidder's name), confirm our acceptance to all terms and conditions mentioned in the Tender Document, and all subsequent clarifications and amendments, in totality and withdraw all deviations raised by us, if any.

_____
SEAL AND SIGNATURE OF BIDDER

Date: _____

Appendix 10: Format of Declaration on Bidder's Relation to Directors

Date:

To,

Electrical Superintending Engineer (Solar Project)
Tenughat Vidyut Nigam Limited,
JUPMI Building Premises in ABD Area, Ranchi Smart City,
P.O & P.S - Dhurwa, Dist. : Ranchi, Jharkhand, 834004

Sub: Declaration of relationship with Directors/any other employee/associates.

Dear Sir,

This has reference to our proposed Bid regarding Tender for "Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand. " and for the purpose of Section 297/299 of the Companies Act 1956, we certify that to the best of my/our knowledge:

i. I am not a relative of any Director of TVNL or;
ii. We are not a firm in which a Directors of TVNL or its relative is a partner;
iii. I am not a partner in a firm in which a Directors of TVNL or, or its relative is a partner;
iv. We are not a private company in which a Director of TVNL or is a member or director;
v. We are not a company in which Directors of TVNL hold more than 2% of the paid-up share capital of our company or vice-versa.

_____
Authorised Signatory of the Contracting Party

Place: Date:

Appendix 11: Format of Power of Attorney as Authorized Signatory

(On a non-judicial stamp paper of appropriate value)

Know all men by these presents, we, _____ (name of the firm and address of the registered office) do hereby irrevocably constitute, nominate, appoint and authorise Mr. / Ms_____ (Name)_____ , son/daughter/wife of _____and presently residing at_____, who is presently employed with us and holding the position of_____, as our true and lawful attorney (hereinafter referred to as the "Attorney") to do in our name and on our behalf, all such acts, deeds and things as are necessary or required in connection with or incidental to submission of our Bid for the "Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand. "

Pursuant to the Tender Document no._____dated_____issued by Tenughat Vidyut Nigam Limited ("TVNL"), including but not limited to signing and submission of all applications, Bids and other documents and writings, participate in Bidders' and other conferences and providing information / responses to the Company, representing us in all matters before the Company, signing and execution of all contracts including the Contract Agreement and undertakings consequent to acceptance of our Bid, and generally dealing with the Company in all matters in connection with or relating to or arising out of our Bid for the said Project and/or upon award thereof to us and/or till the entering into of the Contract Agreement with TVNL.

AND we hereby agree to ratify and confirm and do hereby ratify and confirm all acts, deeds and things done or caused to be done by our said Attorney pursuant to and in exercise of the powers conferred by this Power of Attorney and that all acts, deeds and things done by our said Attorney in exercise of the powers hereby conferred shall and shall always be deemed to have been done by us.

IN WITNESS WHEREOF WE, _____, THE ABOVE-NAMED PRINCIPAL HAVE EXECUTED THIS POWER OF ATTORNEY ON THIS _____DAY OF _____, 20 _____

For……..

(Sign and Seal of Bidder)

(Signature, name, designation and address) Witnesses:

1.

2.

Accepted Notarised

(Signature, name, designation and address of the Attorney)

Notes:

i. The mode of execution of the Power of Attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and when it is so required, the same should be under common seal affixed in accordance with the required procedure.

ii. Wherever required, the Bidder should submit for verification the extract of the charter documents and documents such as a board or shareholders resolution/ power of attorney in favour of the person executing this Power of Attorney for the delegation of power hereunder on behalf of the Bidder.

iii. For a Power of Attorney executed and issued overseas, the document will also have to be legalised by the Indian Embassy and notarised in the jurisdiction where the Power of Attorney is being issued. However, the Power of Attorney provided by Bidders from countries that have signed the Hague Legislation Convention, 1961 are not required to be legalised by the Indian Embassy if it carries a conforming Apostille certificate.

Appendix 12: Format of Summary of Audited Financial Statements

To,

The Electrical Superintending Engineer (Solar Project)
Tenughat Vidyut Nigam Limited,
JUPMI Building Premises in ABD Area, Ranchi Smart City,
P.O & P.S - Dhurwa, Dist. : Ranchi, Jharkhand, 834004

Sub: Summary of Financial Statement

Ref: Request for Proposal for Bid for "Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand. "

Dear Sir,

This is to certify that..... *[Insert name of Bidder]* (the "Bidder") having its Registered Office at ..... *[Insert Registered Address of the Bidder]* with PAN No. ..... *[Insert PAN No. of the Bidder]* is in the business of ..... *[briefly Insert the nature of the business]*, has recorded the following turnovers and net worth:

Financial Year	Turnover (in INR)	Net Worth (in INR)	For Official Use Only Audited Statement Attached?
2022-23			Yes / No
2021-22			Yes / No
2020-21			Yes / No

All figures indicated herein are arrived from the Audit Reports of the Bidder duly submitted to the Income Tax Department.

All figures indicated herein are calculated as per the guidelines mentioned in the Tender.

[Official seal of the Chartered Accountant] Sincerely Yours,
.....
[Insert Name of the Chartered Accountant]
[Insert address and contact information
of the Chartered Accountant]

Date: [Insert Date]

Place: [Insert Place]

NOTES:

A. If the Bidder is seeking financial qualification based on the financial standing of the Parent Company, then a similar certificate summarizing the financial statement of the Parent Company shall be attached by the Bidder as a part of the Bid.
B. All audited statements to be attached by the Bidder as a part of the Bid.

Appendix 13: Format of Authorization by Parent Company

[On the Official Letterhead of the Parent Company]

[Reference No.]

From: [Name of Parent Company]

[Address of Parent Company]

[Date]

To,

Electrical Superintending Engineer (Solar Project)
Tenughat Vidyut Nigam Limited,
JUPMI Building Premises in ABD Area, Ranchi Smart City,
P.O & P.S - Dhurwa, Dist. : Ranchi, Jharkhand, 834004

Sub: Authorization of use of financial capability by Parent TVNL.

Ref: Request for Proposal for Bid for "Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand. ".

Dear Sir,

a. With reference to the abovementioned Tender, we confirm that we hold ..... [Insert percentage of share held in words] percent ([Insert percentage of share held in figures] %) share in M/s. ..... [Insert Name of the Bidder].
b. We confirm that M/s. ..... [Insert Name of the Bidder] is authorized by us to use our financial capability for meeting the financial criteria as specified in the Tender, meeting all the provisions including but not limited to terms and conditions of the Tender and undertaking the Scope of Work as defined in the Tender.
c. We further confirm that we shall by jointly and severely be held responsible for the performance of M/s. ..... [Insert Name of the Bidder] as per the various provisions including but not limited to the terms and conditions in undertaking the Scope of Work as defined in the Tender.

(Sign and Seal of Bidder)

d. Our financial summary is attached as a part of the Bid submitted by ..... [Insert Name of the Bidder] as per the appropriate format indicated in the Tender.

For and on behalf of..... [Insert Name of Parent Company]

[Signature and Stamp of any Whole-Time Director]

Name: [Insert name of the Whole-Time Director]

Place: [Insert Place]

Date: [Insert Date]

[NOTE:

A. The Authorization of use of financial capability by Parent Company shall be supported by a specific Board Resolution of the Parent Company satisfactorily conveying the same.]

Appendix 14: Format of Financial Proposal

To, Date:

Electrical Superintending Engineer (Solar Project)
Tenughat Vidyut Nigam Limited,
JUPMI Building Premises in ABD Area, Ranchi Smart City,
P.O & P.S - Dhurwa, Dist. : Ranchi, Jharkhand, 834004

Sub: Financial Proposal for Bid for "Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand. "

Dear Sir,

I,_____,
present the Financial Proposal for the Bid for "Selection of EPC Contractor for Design, Engineering, Procurement, Supply, Construction, Commissioning on Turnkey Basis and Comprehensive Operation & Maintenance for 10 (5+5) Years of 50 MW Grid-Connected Solar Photovoltaic Power Plants at TTPS, Lalpania, Dist: Bokaro, State: Jharkhand. " on EPC basis through the Tender No. _____dated _____, confirming that:

i. I agree to all the terms and conditions set forth in this Tender Document. If awarded the Project, the implementation of the Project shall also conform to the terms and conditions, as well as specifications indicated in the Tender Document and as finally indicated by the Evaluation Committee.
ii. Rates quoted in this Bid is for destination prices inclusive of all taxes (unless stated otherwise), levies, duties, packing, forwarding, freight, insurance, loading, unloading, supply, installation, commissioning, and any/all charges for successful Engineering, Supply and Installation, Construction, Comprehensive Operation and Maintenance of "Project" at the Site. The break-up of taxes considered are also furnished in price bid.
iii. Rates quoted in this Bid are INCLUSIVE of taxes and duties. The statutory variation in taxes shall be admissible in accordance with the Clause no. 7.13 Taxes and duties of Tender Document. Under no circumstances shall escalation in the prices of this Tender Document be entertained.
iv. The details quoted herein stand valid for at least six months from the date of opening of the Price Bid.

(Sign and Seal of Bidder)

A. TABLE: Price Quote for EPC Contract for 50 MW (AC) Solar Photovoltaic Grid Connected Power Plants using PV technology at Tenughat Thermal Power Station (TTPS), Lalpania, District: Bokaro

Sr. No.	Item	Unit rate/ 50 MW (AC) (without taxes and duties)	Freight and transportation	Duties (if applicable)	Goods and Services Tax	Final Rate For 50 MW (AC) SPV Plant
		(A)	(B)	(C)	(D)	(E)= (A+B+C+D)
		(In Rs.)	(In Rs.)	(In Rs.)	(In Rs.)	(In Rs.)
1	PV Modules					
2	Inverters					
3	Supply of Balance of System includes all equipment, materials, spares, accessories, MMS etc. excluding 1and2 above					
4	Civil work					
5	General work including erection, commissioning, testing etc. of entire plant including MMS excluding 4 above					
6	Power Evacuation work					
7= (1+2+3+4+5+6)	**Total**					

"EPC Contract Price" quoted by the Bidder (in Words) (=TOTAL of Final Rate for 50 MW (AC) SPV Plant, Column (E)	

Note:

1. EPC cost without taxes and duties shall be considered for evaluation of bid.
2. No variation due to change in forex rate shall be admissible.
3. Payment shall be made in Indian National Rupees (INR) only. Bidder(s) has to quote their rate in INR only.
4. Arithmetical errors will be rectified on the following basis: If there is a discrepancy between words and figures, the amount written in words will prevail.
5. The Successful Bidder shall submit a Billing Breakup Unit (BBU) & HSN Code for TVNL approval.
6. The Bidder shall ensure that Composite supply of goods along with the supply of construction services of the solar power plant: 70% of the value is considered as supply of goods and taxed at 12% of GST. Balance 30% of the contract value is considered as supply of services and taxed at a standard tax rate of service which is 18%.

B. Table: Price Quote for O&M Contract & NEEGG for 50 MW (AC) Solar Photovoltaic Grid Connected Power Plants at Tenughat Thermal Power Station (TTPS), Lalpania, District: Bokaro

Sr. No.	Head	Annual Rate for Comprehensive O&M (each year "O&M Contract Price") (A)	Taxes & Duties (B)	O&M charges including taxes ('C) = (A+B)	Discounting factor for NPV @ 10.81 % (D)	NPV of O&M charges (E) = (C x D)	NEEGG (F)
		(In Rs.)	(In Rs.)	(In Rs.)		(In Rs.)	(kWh)
1.	O & M for **First Year.**						
2.	O & M for **Second Year.**						
3.	O & M for **Third Year.**						
4.	O & M for **Fourth Year.**						
5.	O & M for **Fifth Year.**						
6.	O & M for **Sixth Year.**						
7.	O & M for **Seventh Year.**						
8.	O & M for **Eighth Year.**						
9.	O & M for **Ninth Year.**						
10.	O & M for **Tenth Year.**						
11.	**TOTAL (In Figures)**						
12.	**TOTAL Rate for Comprehensive O&M including all taxes " Total O&M Contract Price" (In Words) –(As per Column 11C)**						
13.	**Total NEEGG (in words) – (As per Column 11F)**						

All applicable taxes including Goods and Service tax and any surcharge or cess thereon are included in the quoted number.

Signature: _____ Designation: _____

Name: _____

Address: _____ _____

Seal of Organization:

Email _____ Phone: _____

Appendix 15: Bid Evaluation Criteria (BEC)

The Evaluated Bid Value (EBV) shall be calculated using the following parameters: Parameters Quoted by the Bidder:

i. Quoted EPC Contract Price,
ii. Quoted Annual Net Electrical Energy Generation Guarantee (NEEGG) at the metering point of the Plant for each year during the O&M period (of 10years),
iii. Quoted O&M Contract Price for each year during the O&M period (of 10years),

Parameters assumed constant for evaluation of each Bidder:

iv. Discount Factor of 10.81% annually.

The Evaluated Bid Value (EBV) shall be calculated using the abovementioned parameters as follows:

Step 1		**Quoted EPC Contract Price at the zeroth (0th) year**
Step 2		Net Present Value (NPV) of 10 years of O&M Cost quoted by the Bidder
Step 3	ADD	EPC Contract Price and NPV of O&M for 10 years
Step 4		Summation of quoted NEEGG for 10 years
Step 5	DIVIDE	(Sum of EPC Contract Price and NPV of each year O&M Contract Price for 10 years) by (Summation of quoted NEEGG for 10 years) i.e. *(Step3/Step4)*

The Evaluated Bid Value (EBV) shall be the Net Value as calculated above.

Evaluated Bid Value (EBV) =

$$\frac{\textbf{EPC Cost + NPV of each year O\&M Contract Price of 10 years}}{\textbf{∑NEEGG of 10 years}}$$

The Evaluated Bid Value (EBV) shall be the Net Present Value (NPV) as calculated above.

EXAMPLE:

The following example will further clarify the methodology of comparison:

Note: Figures quoted by Bid der are in Box.

Figures Quoted by Bidder 1					Derived/ Evaluated Figures	
EPC Price	:	Rs.	**250**	Crore		
Year			NEEGG	O&M Cost		
			(in kWh)	(Rs.)		
0			NA	NA		
1			85,000,000	25,000,000		
2			84,575,000	25,000,000		
3			84,152,125	25,000,000		
4			83,731,364	25,000,000		
5			83,312,708	25,000,000		
6			82,896,144	25,000,000		
7			82,481,663	25,000,000		
8			82,069,255	25,000,000		
9			81,658,909	25,000,000	**NPV of each year O&M Contract Price for the Project (in Rs.)**	148,411,192
10			81,250,614	25,000,000		
Total			831,127,782	250,000,000	**EBV (in Rs/ kWh) without Land Cost**	**3.19**

Figures Quoted by Bidder 2					Derived/ Evaluated Figures
EPC Price	:	Rs.	**244**	Crore	
Year			NEEGG	O&M Cost	
			(in kWh)	(Rs.)	
0			NA	NA	
1			80,000,000	20,000,000	

2			79,600,000	21,144,000		
3			79,202,000	22,353,437		
4			78,805,990	23,632,053		
5			78,411,960	24,983,807		
6			78,019,900	26,412,881		
7			77,629,801	27,923,697		
8			77,241,652	29,520,933		
9			76,855,443	31,209,530	**NPV of each year O&M Contract Price for the Project (in Rs.)**	147,403,162
10			76,471,166	32,994,715		
Total			782,237,913	260,175,053	**EBV (in Rs/ kWh) without Land Cost**	**3.31**

esult:

- EBV in Rs/kWh of Bidder 1 is Rs.3.19 per kWh.
- EBV in Rs/kWh of Bidder 2 is Rs. 3.31 per kWh.
- EBV of Bidder 2 is higher than Bidder 1.
- Hence, Bidder 1 would be preferred as the Successful Bidder compared to Bidder 2. Bidder with lower EBV in Rs. /kWh shall be L-1 and Bidder higher than that shall be the L-2 and so on.

Appendix 16: Procedure for Performance Testing

Part A: Solar PV power plant Net power generation

1. The Contractor shall quote the 'Net Electrical Energy Generation Guarantee" for annual basis considering the Reference Global Average Radiation indicated in this Tender.
2. The Contractor shall demonstrate "Actual Delivered Energy" at metering point as compared to the 'Base NEEGG' for every year from the date of starting of O&M Period.
3. The quoted NEEGG as in Table no. 14 B in Appendix 14 for any year shall be permitted with maximum 0.5 % degradation factor in previous year generation.
4. The quoted NEEGG will be used for the calculating CUF.
5. The Bidder shall clearly mention the technology used i.e. fixed tilt or seasonal tracker as per Table given in Appendix 6.

Operational Acceptance Test Procedure

Performance Ratio (PR) - Test Procedure

1. Performance Ratio as determined through the PR Test Procedure specified here should not be less than 0.75 for Operational Acceptance Test.
2. The Performance Ratio Test to prove the guaranteed performance parameters of the power plant shall be conducted at site by the Contractor in presence of the Company. The Contractor's Engineer shall make the plant ready to conduct such tests. The Operational Acceptance Test shall be commenced, within a period of one (1) month after successful Commissioning and, there will be continuous monitoring of the performance for 30 days. Any extension of time beyond the above one (1) month shall be mutually agreed upon. These tests shall be binding on both the parties to the contract to determine compliance of the equipment with the guaranteed performance parameters. This monitoring will be performed on the site under the supervision of the Company/ Company's engineer.
3. The test will consist of guaranteeing the correct operation of the plant over 30 days, by the way of the efficiency rate (performance ratio) based on the reading of the energy produced and delivered to the grid and the average incident solar radiation.
4. PR shall be demonstrated against the installed DC Capacity.
5. The Efficiency or performance ratio (PR) of the PV Plant is calculated as follows (according to IEC 61724)

Performance Ratio (PR) = YA / YR

Where;

YA = Final (actual measured) PV system yield in kilo-watt hours at the point of measurement during the testing period, and

YR = Reference yield calculated as the product of the insolation on the plane of the collector (i.e., PV modules) in kWh/ m2 during the testing period and the installed DC capacity of the plant in kW.

Monitoring System for PR Verification

The following instrumentation will be used to determine the Solar Plant Performance:

- Power Meter at the delivery point.
- Power Meter for each inverter for reference only.
- One nos. calibrated pyranometer to determine irradiance on the plane of array (with a target measurement uncertainty of ± 2).
- One nos. calibrated pyranometer to determine irradiance on horizontal plane (with a target measurement uncertainty of ± 2)
- Two nos. thermocouples to measure module temperature with a measurement uncertainty of ±1 °C.
- Shielded ventilated thermocouple with a measurement accuracy of ±1°C.
- An anemometer mounted on a 10m mast to measure wind speed (without additional shadowing on modules).
- Data measurement shall be witnessed in the format mutually agreed before the start of PR test by the employer and the contractor jointly for the said period.
- The Contractor shall show the specified PR for Operational Acceptance.

Part C: The procedure for Performance Guarantee Test (PGT) - cum- Final Acceptance Test- shall be as follows:

1. A weather station with a calibrated pyranometer shall be installed by the Contractor at the location mutually agreed by the Contractor and TVNL. The test report for the calibration shall be submitted by the Contractor for approval by TVNL. The calibration should be traceable to a national/international laboratory. The output of this pyranometer for shall be logged in the SCADA system.
2. In case the pyranometer is found to be working erratically then immediately the Contractor shall take necessary steps to rectify and/or recalibrate the instrument to the satisfaction of TVNL. However, for the dispute period for which such error has occurred and until the instrument is recalibrated to the satisfaction of TVNL, data from any one of the following lists of sources as decided by TVNL will be used:
    i. A separate pyranometer installed by the Company near the site, if available
    ii. Average of two closest solar power projects, as identified by TVNL.
    iii. Nearest MNRE weather station

3. "Actual Delivered Energy" from the plant supplied by the Contractor shall be noted for every month and summed up for entire year. For this purpose, the net delivered energy at the metering point shall be taken into account.
4. The measured value of energy at step (3) shall be compared with 'Base NEEGG' and hence with 'Base CUF' value. "Base NEEGG/CUF" for a month is calculated by using the NEEGG quoted in the offer by the Contractor adjusted with a correction factor to take into account the actual average global solar radiation measured by the calibrated pyranometer for that year.
5. Further, if the plant is not able to achieve the calculated Base NEEGG/CUF during PGT and O&M period and there is a shortfall in energy generation, then the Contractor shall be penalized as per relevant Clause of the Tender.
6. The Contractor shall share with TVNL all the radiation, generation, etc. parameters details and all other factors necessary for TVNL to corroborate the estimate. TVNL has the right to cross verify data submitted by the Contractor by all possible means/sources.

Following factors may be noted for computing the Base NEEGG/ CUF:

1. Effect due to variation of meteorological parameters e.g., ambient temperature, wind speed, humidity etc. shall not be considered.
2. Generation loss due to grid outage (or power evacuation system which is not in the scope of the Contractor): The measured global solar radiation of the period of the outage of the power evacuation system shall be excluded to calculate average global solar radiation for the period of PGT and O&M.
3. Effect due to variation in annual insolation shall only be considered for computing the Base NEEGG/ CUF.

   Solar Radiation:

   a. Ideally, actual measurement of solar radiation at the site is desirable for estimating the projected power output since solar energy is the raw material for power generation. It may be noted that the annual average solar radiation measurement even for 1-2 years is not sufficient.
   b. World over, an average radiation value for at least 8-10 years is used for solar power project designing since climatic variations are quite wide year-to-year. Under such a situation, the prevailing practice world over is to develop software which uses satellite measured solar radiation and matches it with the actual ground measured data for the particular site where actual data has been obtained for many years.
   c. There are radiation data from reputed agencies like Meteonorm and NASA are available. The derived values for reference are tabulated below:

Month	GHI Global Horizontal Irradiance (kWh/m2/ Month)
January	117.8
February	123.3

March	163.4
April	171.2
May	179.0
June	147.0
July	129.5
August	130.2
September	126.7
October	128.2
November	117.2
December	104.8
Total	**1,638.0**

(Source: Meteonorm)

The above radiation data shall be used by the Bidder to calculate NEEGG. This radiation data is for evaluation purpose. However, for every year actual radiation shall be considered to calculate the NEEGG by the Bidder.

Illustration:
If the GHI of a year is more or less, then the reference GHI then NEEGG will be calculated as follows:
NEEGG = (Actual GHI x NEEGG guaranteed by contractor on reference GHI)/ (Reference GHI)

NEEGG guaranteed by Contractor = 8,86,53,000 KWh

Reference GHI= 1638 KWh/m^2 per annum

For Example:

Case A: for higher irradiation	Case B: for lower irradiation
If Actual GHI = 1700 kWh/m2 per annum, then NEEGG will be: NEEGG = (1700 x 8,86,53,000)/ 1638 NEEGG = 9,20,08,608 KWh/ Annum	If Actual GHI = 1600 kWh/m2 per annum, then NEEGG will be: NEEGG = (1600x 8,57,28,665)/ 1638 NEEGG = 8,65,96,336 KWh/ Annum

Appendix 17: List of Bank (For Bank Guarantee)

Bank Guarantee from the following Banks will be acceptable.

Sr. No	List of Banks
(1)	All Nationalized Banks

- The Bank Guarantee submitted should have the clear one-time validity in all respect and up to the completion period. If by any reason the contract period is extended, bidder shall undertake to renew the Bank Guarantee at least one month before the expiry of the validity failing which TVNL will be at liberty to encash the same.

Appendix 18: Format of SD Cum Performance Bank Guarantee

[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]

Ref.: _____ Bank Guarantee No.: _____

Date: _____

FORMAT OF BANK GUARANTEE FOR SD CUM PERFORMANCE BANK GUARANTEE.

We, Bank of _____hereby agree unequivocally and unconditionally to pay immediately on demand in writing from the Tenughat Vidyut Nigam Limited or any Officer authorized by it in this behalf any amount up to and not exceeding Rs _____(in words) _____to the said Tenughat Vidyut Nigam Limited on behalf of M/s. _____(Contractor's Name) who have entered in to contract for the supply / works specified below.

LOI / A/T No _____ dtd. _____

This agreement shall be valid and binding on this Bank up to inclusive of _____and shall not be terminable by notice or by change in the constitution of the Bank or the firm of Consultant or by any other reasons whatsoever and our liability hereunder shall not be impaired or discharged by any extension of time or variations or alterations made, given conceded or agree, with or without our knowledge or consent by or between parties to the said within written contract.

NOTWITHSTANDING anything contained herein before our liability under this guarantee is restricted to Rs. _____ (Rupees _____).

Our guarantee shall remain in force until _____ (date of validity of Guarantee). Unless demands or claims under this Bank Guarantee are made to us in writing on or before ---------- (date should be 1 month after the above validity period of BG), all rights of Beneficiary under this Bank Guarantee shall be forfeited and we shall be released and discharged from all liabilities there under.

Place:

Date:

(Please mention here complete Postal Address of Bank with Branch Code, Telephone and Fax Nos.)

Signature of the Bank's authorized Signatory with official seal

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INSTRUCTIONS FOR FURNISHING PERFORMANCE BANK GUARANTEE

i. The Bank Guarantee by Bidders will be given on non-judicial stamp paper as per stamp duty applicable at the place where the tender has emanated. The non-judicial stamp paper should be in name of the issuing bank.
ii. The Bank Guarantee by Bidder will be given from bank as per Appendix -17 only.
iii. This bank guarantee/ all further communication relating to the bank guarantee should be forwarded to TVNL, Jharkhand only.
iv. The full address along with the Telex/Fax No. and email address of the issuing bank to be mentioned

Appendix 19: Format for O&M Bank Guarantee

[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]

Ref.: _____ Bank Guarantee No.:_____
Date: _____

To,

The
Electrical Superintending Engineer, Solar Project
Tenughat Vidyut Nigam Limited,
JUPMI Building Premises in ABD Area, Ranchi Smart City,
P.O & P.S - Dhurwa, Dist. : Ranchi, Jharkhand, 834004

Dear Sir,

WHEREAS ……. [*Insert name of the Contractor*] with address ……. [*Insert address of the Contractor*] having its registered office at ……. [Insert address of the Contractor] (hereinafter, the "Bidder") wishes to participate in Tender document No. _____issued by Tenughat Vidyut Nigam Limited ("TVNL") (hereinafter, the "Beneficiary") for Operation and Management of Performance of Solar Power Project.

And WHEREAS a Bank Guarantee for Rupees [……] valid till ……. [*Insert date for 10 years from the date of commissioning]* is required to be submitted by the Contractor as per the terms and conditions of the Tender.

We, ……. [*Insert name of the Bank and address of the Branch giving the Bank Guarantee*] having our registered office at ……. [*Insert address of the registered office of the Bank*] hereby give this Bank Guarantee No. ……. [*Insert Bank Guarantee number*] dated ……. [*Insert the date of the Bank Guarantee*], and hereby agree unequivocally and unconditionally to pay immediately on demand in writing from the Beneficiary any officer authorized by it in this behalf any amount not exceeding Rupees [……] to the said Beneficiary on behalf of the Bidder.

We ……. [*Insert name of the Bank*] also agree that withdrawal of the Bid or part thereof by the Bidder within its validity or non-submission of further O&M Performance Bank Guarantee by the Bidder within the stipulated time of the Letter of Intent to the Bidder or any violation to the relevant terms stipulated in the Tender would constitute a default on the part of the Bidder and that this Bank Guarantee is liable to be invoked and encashed within its validity by the Beneficiary in case of any occurrence of a default on the part of the Bidder and that the encashed amount is liable to be forfeited by the Beneficiary.

This agreement shall be valid and binding on this Bank up to and inclusive of ……. [*Insert the date of validity of the Bank*] and shall not be terminable by notice or by Guarantor change in the constitution of the Bank or the firm of the Bidder Or by any reason whatsoever and our liability hereunder shall not be impaired or discharged by any extension of time or variations or alternations made, given, conceded with or without our knowledge or consent by or between the Bidder and the Beneficiary.

NOTWITHSTANDING anything contained hereinbefore, our liability under this guarantee is restricted to Rupees …… (Insert the Amount). Our Guarantee shall remain in force till ……. [*Insert date*]. Unless demands or claims under this Bank Guarantee are made to us in writing on or before ……. [Insert date], all rights of the Beneficiary under this Bank Guarantee shall be forfeited and we shall be released and discharged from all liabilities there under.

[Insert the address of the Bank with complete postal branch code, telephone and fax numbers, and official round seal of the Bank]

[Insert signature of the Bank's Authorized Signatory]

Attested:

…… [Signature] (Notary Public)

Place: ……. Date:…….

INSTRUCTIONS FOR FURNISHING BANK GUARANTEE

1. The Bank Guarantee by Bidders will be given on non-judicial stamp paper as per stamp duty applicable at the place where the tender has emanated. The non-judicial stamp paper should be in name of the issuing bank.
2. The Bank Guarantee by Bidder will be given from bank only given in Appendix-17.
3. This bank guarantee/ all further communication relating to the bank guarantee should be forwarded to _____, Jharkhand.
4. The full address along with the Telex/Fax No. and email address of the issuing bank to be mentioned.

Appendix 20: Format of Agreement between TVNL and the Contractor

This agreement is made at RANCHI the ----------day of ----------in the Christian year Two thousand -------- between ----------(herein after referred to as "THE CONTRACTOR" which expression shall unless excluded by or repugnant to the contract include its successors or permitted assigns) of the one part and the Tenughat Vidyut Nigam Limited having their Head Office at JUPMI Building Premises in ABD Area, Ranchi Smart City, P.O & P.S - Dhurwa, Dist. : Ranchi, Jharkhand, 834004 (hereinafter called "The TVNL" which expression shall unless excluded by or repugnant to the context include its successors or assigns) of the other part.

WHEREAS the aforesaid TVNL has accepted the tender of the aforesaid contractors for ---------- ---------- as per TVNL's Order No.---------- ----------hereinafter called "the Works" and more particularly described enumerated or referred to in the specification, terms and conditions prescribed in the Order letter, covering letter and other letters and schedule of price which for the purpose of identification have been signed by Shri -- ----------on behalf of the Contractors and by ----------on behalf of the TVNL a list whereof is made out in the Schedule hereunder written and all of which said documents are deemed to form part of this contract and included in the expression " the Works" wherever herein used, upon the terms and subject to the conditions hereinafter mentioned.

AND WHEREAS THE TVNL has accepted the tender of the contractors for the construction of the said works for the sum of Rs. ----------(Rupees: ----------

----------) upon the terms and subject to the conditions herein mentioned.

NOW THIS AGREEMENT WITNESSES AND IT IS HEREBY AGREED AND DECLARED THAT:–

a. The contractors shall do and perform all works and things in this contract mentioned and described or which are implied therein or there from respectively or are reasonably necessary for the completion of the works as mentioned and at the times, in the manner and subject to the terms, conditions and stipulations contained in this contract, and in consideration of the due provision, executions, construction and completion of the works agreed to by the contractors as aforesaid, the TVNL doth hereby covenant with the contractor to pay all the sums of money as and when they become due and payable to the contractors under the provisions of the contract. Such payments to be made at such times and in such manner as is provided by the contract.
b. The conditions and covenants stipulated herein before in this contract are subject to and without prejudice to the rights of the TVNL to enforce penalty for delays and / or any other rights whatsoever including the right to reject and cancel on default or breach by the contractors of the conditions and the covenants as stipulated in the general conditions, specifications, forms, or tender schedule, drawing, etc., attached with TVNL's Order No.----------.

The contract value, extent of supply delivery dates, specifications, and other relevant matters may be altered by mutual agreement and if so altered shall not be deemed or construed to mean or apply to affect or alter other terms and conditions of the contract and the general conditions and the contract so altered or revised shall be and shall always be deemed to have been subject to and without prejudice to said stipulation.

SCHEDULE

List of documents forming part of the contract:

1) Important Dates and Amounts
2) Instructions to Bidders;
3) Submission of Bid;
4) Scope of Work;
5) General Conditions of Contract;
6) Special Conditions of Contract;
7) Appendices referred to in this Tender Document ("the Tender");
8) Any amendments, notices and documents issued by TVNL in relation to this Bid Document/this Contract.
9) ……..
10) ……

In witness whereof the parties hereto have set their hands and seals this day and month year first above written.

1. Signed, Sealed and delivered by: (Signature with Name, Designation and official seal)

   for and on behalf of M/s._____ in the presence of name, Full Address and Signatures.: i).

ii).

2. Signed, Sealed and Delivered by:

   (Signature with Name, Designation and official seal)

   For and on behalf of Tenughat Vidyut Nigam Limited,
   JUPMI Building Premises in ABD Area, Ranchi Smart City, P.O & P.S - Dhurwa, Dist. : Ranchi, Jharkhand, 834004.

In the presence of Name, Full Address and Signature:

i)

Appendix 21: SOLVENCY CERTIFICATE

(Bank Letter Head)

SOLVENCY CERTIFICATE

BANK NAME/BANK SEAL

BRANCH: …

DATE:……..

To,

……

……

……

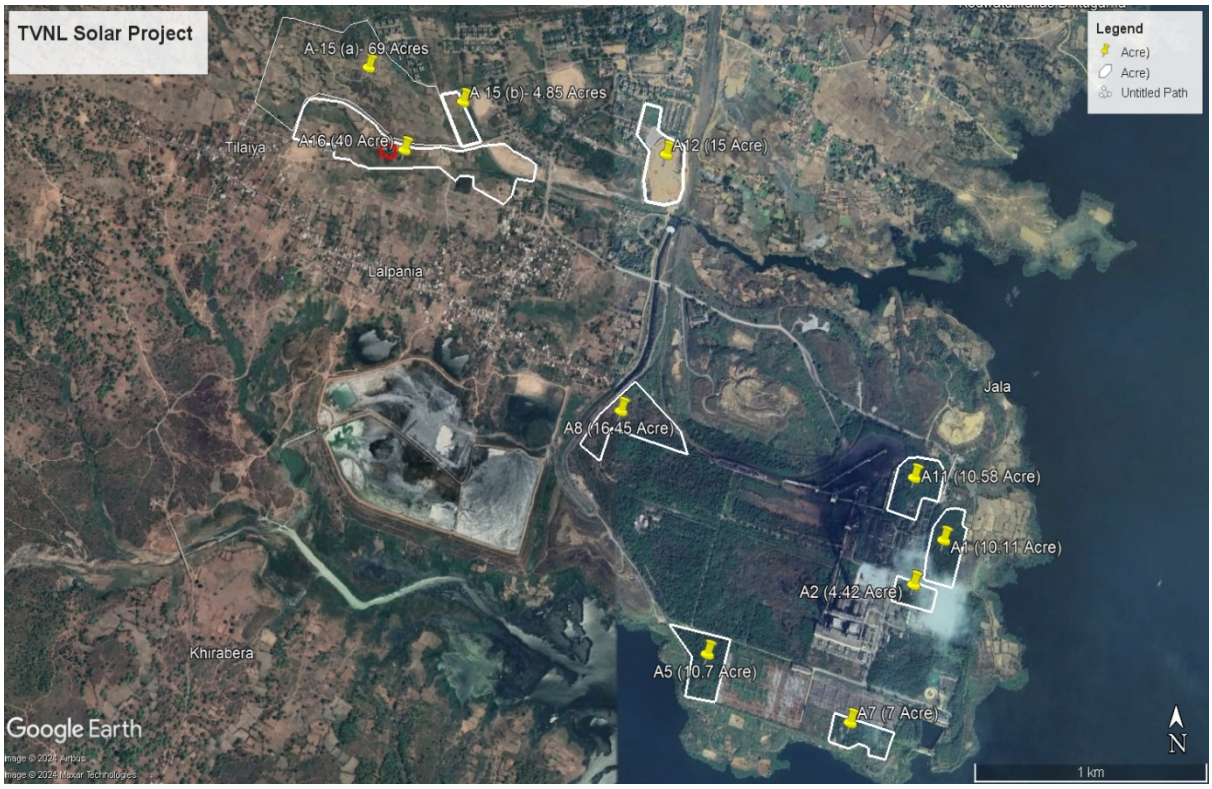
This is to certify that to the best of our knowledge and information that Mr/Mrs/Ms/Company Name/Firm Name…… a customer of our bank having Account type …… and Number…….. is respectable and can be treated solvent up to a sum…… of Rs…… (Rupees……Only).

Branch Manager

Sign

Seal of Bank

Annexure 1: Details of Plant Location



Coordinates:

Latitude: 23.727743N,

Longitude: 85.765547E

---End of Section---

Annexure 2: Mandatory Spares

Sr.	Description	Quantity
	PV Module	
1	SPV Module	0.5% of total supply
2	MC-4 connector (Including Y - connector if used)	0.5% of total supply
	String Combiner Box	
1	String Combiner Box with its accessories such SPD,Fues and other components	0.5% of total supply
	PCU	
1	Complete IGBT stacks assembly with drivers for 1 inverter	1 Set
2	Surge protection devices for 1 inverter	4 Sets
3	Fuse (each type and rating) for 1 inverter	4 Sets
4	Fuse Holder (each type and rating) for 1 inverter	4 Sets
5	Power supply SMPS set for 1 inverter	1 Set
6	Control card – each type and rating for 1 inverter	2 Sets
7	Tripping and Closing coil of ACB of AC side, for 1 inverter	3 Sets
8	Cooling Fan (each Type and rating) for 1 inverter	2 Sets
9	Power Conditioning Unit	1 Sets
	INVERTER TRANSFORMER and POWER TRANSFORMER	
1	Buchholz relay	1 Set
2	OTI and WTI complete	1 Set.
3	MOG	1 Set.
4	Valve (each type)	1 No.
5	Silica gel breather	1 Set.
6	Bushing and Support insulator (each type)	1 No.

7	Pressure relief device	1 Set.
	Structure	
1	Complete Structure assembly for One Array / String	1 Set
	AC / DC Distribution Boards	
1	Indicating Lamps of each type used	04 Nos.
2	Contactor of each type used	02 Nos.
3	Relay of each type used	01 No.
4	Indicating instruments of each type used	01 No.
5	Circuit Breaker of each type used	01 No.
	Battery Charger	
1	Indicating instruments of each type used	02 Nos.
2	Shunt Resistor of each type used	02 Nos.
3	Complete Thyristor Bridge/Module of each type used	04 Nos.
4	Printed Circuit Cards of each type used	02 Nos.
5	Semi Conducting Type Fast Fuse of each type	06 Nos.
6	Auxiliary Fuse of each type used	05 Nos.
7	Auto Transformer of each type used	01 No.
8	Control transformer of each type and rating	01 No.
	DC Inverter /UPS	
1	Circuit Breaker of each type used	02 Nos.
2	Complete Thyristor Bridge/Module	02 Nos.
3	Printed Circuit Cards – Inverter Control Card and Data Logger Card	02 Nos.
4	Cooling Fan	02 Nos.
	HT Panel	
1	Protection relays of each type used	01 No.
2	Test plugs	01 No.
3	Auxiliary relays of each type used	05 Nos.
4	Circuit breaker trip and closing coils each type	02 Nos.

5	Breaker Position Switch each type and rating	02 Nos
	LT Panel / switchgear	
1	MCCB	01 No.
2	Current transformer each used type	01 No.
3	Coils for tripping and closing	02 Nos
4	Breaker Position Switch each type and rating	02 Nos
	33 kV Switchyard	
1	Surge arrester for 33 KV	2 Nos.
2	Disc Insulators string 33 kV (Each type)	2 Sets
3	Conductor of each type used each type	50 mtr
4	Stringing hardware	01 Set
5	Terminal Connectors on high voltage conductors and equipment's each type	01 Set
6	Complete drive mechanism including motor for disconnector switches	01 No.
7	Trip coils for circuit breakers	01 No.
8	Closing coils for circuit breakers	01 No.
9	Complete set of rupture disc	1 Sets
10	33kV Current transformer of each rating	02 Nos.
11	33kV Voltage transformer of each rating	1 Nos.
12	33kV Post insulator	01 Set
13	33kV Isolator contacts set (Male+Female)	01 Set
14	Maintenance earthing rod for 33kV	01 Set
15	Breaker operating mechanism	01 Set
16	SF6 bottle (To fill SF6 in one complete Circuit breaker)	01 No.

17	Contactors and relays of each type and rating used in circuit breaker and isolator control cubicle / Mechanism box	01 set.
18	Limit switch for the isolator	01 Set
19	33kV Earth switch contact assy.	01 Set (For three pole)
	SCADA System	
1	Each type of electronic modules including CPU	1 No. each type
2	Any type of converter like RS 485 to Ethernet, Serial link converter, MODBUS converter etc.	1 No. each type
3	Network Switch	1 No each type
4	Any other recommended spares by OEM List shall be submitted	
	Cable	
1	DC Cable	1% of total supply
2	AC Cable	1% of total supply
3	Coils for tripping and closing	1% of total supply
4	Communication Cable	1% of total supply
3	Control Cable	1% of total supply
	Fuse	
1	Fuse	10% of total supply
	33 kV line / pole accessories	
1	Line supports, MS Angle, Back Clamp, Top Clamp, Earthing Coil, Insulators	2 Sets
2	Conductor	1 KM
3	Jointing Sleeves, Stay set complete with turn buckles, stay wire, stay insulators, Anti-climbing Devices, Danger Boards	2 Sets

Spares, if used, during the O&M period shall be replenished by the Contractor. All the mandatory spares shall be handed over to the Employer in working condition at the end of O&M period.

Notes:

(1) The suggested spares are the minimum requirement of TVNL. The EPC Contractor shall ensure sufficient spares beyond the suggested spares list to maintain its contractual obligations.

(2) Bidder shall furnish recommended spare list as a part of design/drawing approval stage.

(3) Wherever % indicated in Mandatory spares list, Total installed quantity of each type shall be considered for calculation of % of spare of each type.

(4) For rounding of upper side number shall be considered for quantity of item.

Annexure 3: Approved Makes

Sr.	MATERIALS/ ITEMS	VENDOR / MANUFACTURERS
1.	Cement	Ultratech Sanghi Sidhhi Acc Jaypee Cement Ambuja Opc Jk Lakshmi Cement
2.	Reinforcement Steel Hysd/Tmt Bars Grade Fe 500	Sail Tisco Rinl Thermax Electrothrem
3.	Aluminium Sheets	Hindalco Indal Jindal,
4.	P.V.C PIPES/ CPVC Pipes	FINOLEX SUPREME TRUEBORE
5.	Vitrified Ceramic Tiles	Nitco Rak Brand Or As Specified in Item
6.	Glass	Float Glass: Saint Gobin Modi Glass
7.	Rolling Shutters	Suraj Rolling Shutters Baroda Or Approved Make by Owner,
8.	Bricks	Approved Make by Owner
9.	Flush Doors	Godrej, Falcon Plywood and Indus- Godhra Green Ply Kit Ply
10.	Stainless Steel	SS – 304 Grade from Salem Steel Plant
11.	Water Proofing	App Sheet of Tikidan, Fosroc or Pidilite
12.	Paints	Only Brand Names Given: Berger

		Asian Ici
13.	Sealants	Fosroc Sica
14.	R.C Manhole Cover	Precons Precast Concrete Product Co. Or Equivalent
15.	Hardeners	Fosroc Sica
16.	Plywood Products	Ipm, Novopan Particle Boards, Bhutan Boards, Nuwood Particle Boards
17.	Aluminium Doors, Windows, Partitions	Godrej Indal Jindal
18.	Water Proofing Compounds/Admixtures/ Epoxy Flooring	Material Of Construction Fosroc Sica Pidilite
19.	Paints And Acrylic Distempers, Weatherproof Paints and Exterior Emulsion Paints	Asian Paints Ici Berger.
20.	Door Closers	Everite Make
21.	Metal Cladding System, Sandwich Panel	Tata Blue Scope, Lloyd Insulations (India) Limited, King Span Turkey Sintex
22.	Putty	Birla Asian Berger,
23.	Plasticizer/Admixture	Fosroc Sika,
24.	Acid /Alkali Resisting Paint	Asian Berger
25.	Non-Shrink Grout Material	Fosroc
26.	Gypsum False Ceiling (Gyp Board)	Armstrong

SANITARY AND WATER SUPPLY WORK

SR.	MATERIALS/ ITEMS	VENDOR / MANUFACTURERS
1.	RCC Pipes	Approved Manufacturer Conforming B.I.S. Standard
2.	G.I. Pipe	Tata Medium Class.
3.	G.I. Fittings	"R" Brand
4.	CPVC Pipes	Finolex, Supreme And Any Other Approved Brand
5.	C.P., Fittings	L And K Make
6.	W.C. Pan Wash Basin, Urinals Sink Low Down Flushing Cistern	Eid, Parryware, Hindustan Sanitaryware, Calcutta; Kohler
7.	Stainless Steel Sink with Drain Board	Nirali
8.	Mirrors	Philco, Atul Glass Works, Vallabh Glass Works, Goldenfish
9.	White Glazed and Colour Glazed Ceramic Tiles.	Handr JOHNSON TILES, SPARTEK, NITCO
10.	Glazing Glass.	Modi Float Saint Gobain.

STRUCTURAL STEEL

SR.	MATERIALS/ ITEMS	VENDOR / MANUFACTURERS
1.	Welding Electrodes	Ador, Dandh, Essab
2.	Structural Steel Raw Materials	Tisco, Sail, Jindal, Rinl
3.	Anchor Bars	Bright Bars
4.	Sheeting And Sandwich Panels for Pre-Engineering Work	Tata Blue Scope, Sintex Jindal, Kirby

The list of acceptable makes for equipment / system are as listed below:

Sr.	Description	Vendor Name
1	PCU / Inverter	M/s Sungrow
		M/s EVVO
		M/s Hitachi Hi-Rel Power Electronics Pvt Ltd.
		M/s TMEIC
		Bidder to propose other reputed make based on reference and credentials for approval of TVNL
2	PV Modules	ALMM Approved or as per notification from MNRE regarding PV Modules
3	HT Panel /HT Breaker	Siemens
		L and T
		ABB
		Schneider
		Jyoti
		CGL
4	Control and relay panel	ABB
		Siemens
		Schneider
		Alstom
5	LT Switchgear component (LT switchgear panel shall be CPRI approved vendor)	L and T
		Siemens
		ABB
		Schneider
6	Power Transformer	Voltamp
		Schneider
		CGL
		ABB
		T & R
		ALSTOM
7	Inverter Duty Transformer	Schneider
		Electrotherm
		Voltamp
		ABB

		CGL
		T and R
8	Auxiliary Transformer (Dry Type)	Voltamp
		Kotson
		Danish
		Melcon
9	Solar Cable and DC Cable	M/s LAPP
		M/s Siechem
		M/s KEI Cables
		M/s UniFlex Cables
		M/s Cords Cables
		M/s Apar
		M/s Universal
		M/s KEC
10	AC Cable (Up to 33 kV)	M/s LAPP
		M/s KEI Cables
		M/s Havells
		M/s Universal
		M/s KEC
10	HT termination kits	Raychem
		3M
11	Optical Fiber Cable	Finolex
		D-Link
12	Earthing Pit Materials	Ashlok
		Powertrac
		ERICO
13	SJB	M/s Hensel Electric Pvt Ltd
		M/s Trinity Solar
		M/s Eaton
		M/s ABB
14	Lugs	Dowell
		Comet
		3D
15	Cable Glands	Comet / 3D
16	SCADA System	M/s Rockwell
		M/s Siemens

		M/s Schneider
17	Weather Sensors	a. Pyranometer: i) Keep and Zonen ii) Ingenieurbüro Mencke and Tegtmeyer GmbH b. Wind Sensor: ADOLF THIES Gmbh and Co c. Temperature Measurement: i) Met One Inc ii) Climatronics d. Wind Speed and direction: i) Met One Inc e. Tripod Stand: i) Met One Inc ii) Climatronics For other reputed make – TVNL in charge engineer's approval is required.
18	Batteries	Exide
19	UPS	Hitachi HI-REL
		Eaton
		Emerson
20	Battery Charger	M/s Chhabi Electrical
		M/s. Caldyne
		M/s. HBL Niap power system Ltd
		M/s Servilink
21	Lightning Arrestor (ESE type)	Erico
		Nimbus
		AT, Spain
		Ingesco
		Indelec
22	ABT Energy Meter (subject to approval of DISCOM / Local authority)	SEMS
		EDMI
23	HT Isolator (Upto 33 kV Outdoor Type)	Siemens
		ABB
		CGL
		GR Power switchgear
24	HT CT and PT (Upto 33 kV Oil Filled Type)	ABB
		CGL
		Pragati
		Jyoti
25	LA (Upto 33 kV Outdoor Type)	CGL
		Oblum
		Elpro

26	33kV Cable (subject to approval of DISCOM / Local authority)	M/s Universal (Satna, MP)
		M/s Torrent (Ahmedabad, Gujarat)
		M/s KEI (New Delhi)
		M/s Polycab (Daman, Gujarat)
27	Disc and post insulator	BHEL
		Birla
28	GI structure for the switchyard	Sujana Towers
		Kalpatru Power transmission
		OR Any other Approved vendors of DISCOM OR LOCAL AUTHORITY
29	Insulator hardware	3M
		ITIPL
		Approved vendors of DISCOM OR LOCAL AUTHORITY
30	Clamps and connectors	Klemenn engineering corporation
		Approved vendors of DISCOM OR LOCAL AUTHORITY
31	Numerical Relay	Siemens
		Areva
32	Switch fuse unit	Siemens
		L and T
33	PLCC equipments	ABB
34	Lighting fixture/system	Philips / CGL/Bajaj/Havells
35	CSS (Compact Sub-station)	ABB
		CGL
		Siemens
		Alstom
		Schneider
36	LED Lighting	CGL
		Wipro
		Bajaj
		Panasonic
		Philips
37	MCCB	SIEMENS
		ABB
		Schneider
		L and T
38	RMU (Ring Main Unit)	ABB
		Schneider

		Siemens
		CGL
		L and T
39	Steel Structure for MMS	TISCO
		SAIL
		JINDAL
		RINL
		ESSAR
40	Submersible/Sump Pump	Kirlosker
		KSB
		CGL
		CRI
		Jyoti
41	CCTV Camera and Monitoring System	Sony /Honeywell/Milestone

NOTES:

(1) The final make selected out of the recommended makes listed above shall be subject to the TVNL's approval during detailed Engineering.

(2) Wherever the make is not specified for any other items, the contractor shall submit credential for vendors for relevant items / equipment, out of which TVNL shall decide acceptance of vendor based on review of credentials. This shall have no price implication. TVNL reserves the right to reject the proposed vendor without assigning any reason.

(3) Bidder may suggest /request for approval of Additional vendor with credentials and details for review and approval of TVNL. TVNL may consider the request in case the proposed additional vendor is reputed and meeting the tender specification requirements. TVNL reserves the right to reject the proposed vendor without assigning any reason.

(4) For SCADA system common make of PLC / SCADA system to be select entire plant of the project.

Annexure 4: Operation & Maintenance of 50 MW (AC) SPV Plant

The start of Operation & Maintenance and first year operation shall be considered after successful completion of operational acceptance test or 60 days from date of commissioning of 50MW (AC) whichever is earlier. Part commissioning shall be not accepted. Further all the guarantees related to NEEGG shall also be applicable.

Guideline for Operation and Maintenance (O&M):

O&M Contract shall cover complete Solar PV Power plant and power evacuation system up to inter connection point as specified elsewhere in the Tender. The Contractor to achieve guaranteed Generation in respective O&M year. Further, it is the responsibility of the Contractor to liaison with the following authorities:

a) Liaison with State/Central Government.
b) Liaison with State Power Utilities.
c) Liaison with State Renewable Agency.
d) Liaison with State Chief Electrical Inspector Agency/ CEA/CEI
e) Any other department / agency as may be required.
f) TVNL shall provide required documents.

O&M OF PLANT

i. Comprehensive operation & maintenance of the Solar PV plant including supply of spare parts, consumables, repairs/replacement of any defective equipment etc. shall be performed by the Contractor for a period of 10 years (i.e. 5 + 5 Years).
ii. During O&M period, employer personnel shall have unrestricted entry to the solar plant and Control Room any time. TVNL may depute its personals to associate with O&M activities. The Contractor shall assist them in developing expertise through their day to day O&M activities and all records of maintenance must be maintained by the contractor which can be accessed by employer on demand. These recordings are to be handed over to employer after the O&M period of contract.
iii. During O & M period, all the annual charges related to State Transco/ Discom and SLDC shall be in the Scope of Contractor.
iv. During the O&M period, the Contactor shall be responsible for any defect in the work due to faulty workmanship or due to use of sub-standard material in the work. Any defects in the work during the warrantee period shall there be rectified/replaced by the contractor without any extra cost to the employer within a reasonable time as may be considered from the date of receipt of such intimation from employer failing which employer shall take up rectification work at the risk and cost of contractor.
v. The Contractor shall be responsible for supply of all spare parts, repairs / replacement of any defective equipment(s) including civil works at his own cost as required from time to time during the O&M period.

vi. During O & M period the Contractor shall be responsible for all the activities required for the successful running, optimum energy generation etc. This shall include but not necessarily be limited to following:

vii. Deputation of adequate number of O&M, engineering and supporting personal, security etc. Compliance of rules and regulations defined in tender for manpower.

viii. O&M Contractor shall have to fill at least 65% of post in supervisory and managerial cadres and 80% of posts in other cadres by the local persons. The expression "Local person " shall mean a person domiciled in Jharkhand state for minimum 10 years shall be considered as local person.

ix. Operation part consists of deputing necessary manpower necessary to operate the Solar Photovoltaic Power Plant at the optimum capacity. Operation procedures such as preparation to start, routine operations with safety precautions, monitoring of Solar Power Plant etc. shall be carried out as per the manufacturer's instructions to have trouble free operation of the complete system.

x. Daily work of the operators in the Solar Photovoltaic Power Plant involves cleaning of Modules, logging the voltage, current, power factor, power and energy output of the solar Power Plant, cleaning of vegetation, etc. The operator shall also note down failures, interruption in supply and tripping of different relays, reason for such tripping, duration of such interruption etc.

xi. The Contractor shall demonstrate guaranteed generation as confirmed in respective O&M year. In case the contractor fails to achieve the guaranteed generation, then penalties shall be recovered as defined in this Tender.

xii. Water cleaning of SPV modules. The Contractor shall wash the modules minimum twice in a month and maintain this schedule in its records for the cleaning cycle.

xiii. Housekeeping of complete power plant.

xiv. Reporting the daily energy generation data to TVNL.

xv. Monitoring, controlling, troubleshooting, maintaining of records, registers etc.

xvi. Recording/logging of all the operational parameters (e.g. voltage, current, power factor, energy output, temperature etc.) and preparation of daily/weekly/monthly reports etc. including submission of periodical consolidate plant performance reports to the TVNL.

xvii. Conducting periodical checking, testing, over hauling and preventive action of all equipment in systematic method including regular cleaning of PV modules of the solar PV plant as per OEM guidelines.

xviii. The contractor shall carry out the periodical/plant maintenance as given in the manufacturer's service manual and requirement.

xix. Cleaning including cutting/removing of bushes/vegetation etc. of the complete plant on regular basis and as and when required.

xx. Particular care shall be taken for outdoor equipment to prevent corrosion. Cleaning of the Inverter chamber, junction boxes, cable joints, insulators, HT/LT panel chamber etc. shall also be carried out at every month interval.

xxi. Resistance of the earthing system as well as individual earthing is to be measured and recorded every month. If the earth resistance is more than 3 ohm, suitable action is to be taken to bring down the same.

xxii. According to the recommendations stock of special tools and tackles shall be maintained for Modules, PCU's and other major electrical equipment.

xxiii. Breakdown / Corrective Maintenance: Whenever a fault has occurred, the contractor has to attend to rectify the fault & the fault must be rectified at the earliest time from the time of occurrence of fault.

xxiv. A maintenance record is to be maintained by the contractor to record the regular maintenance work carried out as well as any breakdown maintenance along with the date of maintenance reasons for the breakdowns steps have taken to attend the breakdown duration of the breakdown etc.

xxv. The Schedules will be drawn such that some of the jobs other than breakdown, which may require comparatively long stoppage of the Power Plant, shall be carried out preferably during the non-sun period.

xxvi. The Contractor shall ensure that all safety measures are taken at the site to avoid accidents to his employees or his co-contractor's employees as per prevailing safety rules.

xxvii. 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.

xxviii. Supply of all spares, consumables and fixing / installation of the same including proper storage of tool, tackles & spares.

xxix. The Contractor shall at his own expense provide all amenities to his workmen as per applicable laws and rules.

xxx. 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.

xxxi. 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 Labour (Regulations & Abolishment) Act 1970 or any modification thereof or any other law relating whereto and rules made there under from time to time.

xxxii. Coordinating, on behalf of TVNL, and obtaining renewal of statutory licenses, clearances and approvals from state departments such as State Electricity Supply & Transmission Boards/CEIG/State Renewable Nodal Agency etc.

xxxiii. Compliance of Scheduling and forecasting (if applicable) shall be carried by the successful EPC contractor as per State Electricity Regulatory Commission. Further all the cost for hiring QCA (Qualified Coordinating Agency) for forecasting and scheduling shall be in scope of the Successful EPC contractor.

xxxiv. Penalty due to mismatch in scheduling and forecasting shall be in scope of successful EPC Contractor.

xxxv. Contractor shall keep updating the spares inventory at the site every time there is consumption of spare items towards replacement.

xxxvi. Coordinating with sub-station upon grid failures, line problems etc. and implementing the needful steps to restore the plant to normal operation

xxxvii. Theft incidents: immediate reporting to TVNL, filing FIRs with police stations on behalf of TVNL, coordination for site inspection by insurance companies and clearance of insurance claims, logging of events (date, time) and maintaining records

xxxviii. Proper housekeeping shall be maintained during O&M period by the Contractor.

xxxix. Required security personnel shall be deployed for Plant security, round the clock.

All the civil defects, rectification, repairing, replacement related to civil works shall be in the scope of contractor during the O&M period. The Contactor shall be responsible for rectification of any defect in the civil work and maintain the structure/buildings in good condition with proper maintenance.

The Contractor shall be responsible for the maintenance of each civil works carried out as mentioned below.

1. Buildings Control room premises, Underground water tank includes:
    a. Water tightness of roof and walls.
    b. Painting to the structure either PEB/ RCC Framed structure at regular interval (not more than five years).
    c. Plumbing & Sanitation related defects/replacement.
    d. Chalking / overflow of septic tank and soak pit.
    e. Replacement / repairing of water tank if major/minor leakage observed.
    f. Leakage of water to be attended by suitable crack filler.
    g. Repairing/replacement of doors, windows, ventilators & rolling shutter.
2. Road (Asphalt):
    a. Crack repairing of the road surface.
    b. Pot-holes over the top road surface to be rectify.
    c. Maintenance of shoulders for the rain cuts or damage due to some external reasons.
    d. Re-carpeting of the road surface at every five years interval.
3. Storm water Drainage:
    a. Before and after the monsoon season the storm water drainage shall be maintained & cleaned for smoother flow of storm water.
4. Main Entry gate & Fencing/Boundary:
    a. Maintain the elegance of entry gate with painting as & when required.
    b. Repairing & painting of fencing as & when required.

The above list is not exhaustive but indicative only. Although most of the structures are covered here in, any other system (Civil, Structural and Architectural) required for successful operation and maintenance of the works shall form a part of this contract and shall be deemed to be included in the

scope of works. The scope of Bidder/EPC Contractor is including supply of all required materials, mobilization of labour, and arrangement of required tools tackles and equipment to carry out all above civil maintenance works.

HANDING OVER THE FACILITIES BY EPC CONTRATOR TO TVNL

After expiry of O&M period, the Contractor shall hand over the Facilities to Employer in good operating condition along with requisite tools & tackles and spares etc. The Contractor shall demonstrate functional operations of all the major & critical Plant &Equipment. The spare if consumed during O&M period then same shall be replenished at the time of handing over of facilities.

Disclaimer

i. The information contained in this Tender or amendments, annexure or attachments subsequently provided to Bidders, in documentary or in any other form, by or on behalf of TVNL, any of their employees, consultants or advisors, is provided to Bidders on the terms and conditions set out in this Tender and such other terms and conditions subject to which such information is provided.

ii. This Tender is not an agreement and is neither an offer nor invitation by TVNL to the prospective Bidders or any other person. The purpose of this Tender is to provide interested parties with information that may be useful to them in the formulation of their Bid for qualification pursuant to this Tender. This Tender includes statements, which reflect various assumptions and assessments arrived at by TVNL or their employees or consultants or agents, in relation to the Project. Such assumptions, assessments and statements do not purport to contain all the information that each Bidder may require. This Tender may not be appropriate for all persons, and it is not possible for TVNL, their employees or consultants to consider the investment objectives, financial situation and particular needs of each party who reads or uses this Tender.

iii. The assumptions, assessments, statements, and information contained in this Tender may not be complete, accurate, adequate or correct. Each Bidder should therefore conduct its own investigations and analysis and should check the accuracy, adequacy, correctness, reliability and completeness of the assumptions, assessments, statements, and information contained in this Tender and obtain independent advice from appropriate sources.

iv. Information provided in this Tender to the Bidders is on a wide range of matters, some of which depends upon the interpretation of law. The information given may not be an exhaustive account of statutory requirements and should not be regarded as a complete or authoritative statement of law. TVNL would not bear any responsibility for the accuracy or otherwise for any interpretation or opinion on law expressed herein.

v. TVNL, its employees and consultants make no representation or warranty and shall have no liability to any person, including any Bidder or Bidders, under any law, statute, rules or regulations or tort, principles of restitution or unjust enrichment or otherwise for any loss, damages, cost or expense which may arise from or be incurred or suffered on account of anything contained in this Bid or otherwise, including the accuracy, adequacy, correctness, completeness or reliability of this Tender and any assessment, assumption, statement or information contained therein or deemed to form part of this Tender or arising in any way with prequalification of Bidders for participation in the Bidding process.

vi. TVNL also accepts no liability of any nature whether resulting from negligence or otherwise howsoever caused arising from reliance of any Bidder upon the statements contained in this Tender. TVNL may, in their respective absolute discretion, but without being under any obligation to do so, update, amend or supplement the information, assessment or assumptions contained in this Tender.

vii. The issuance of this Tender does not imply that TVNL is bound to select and shortlist prequalified Bids or to appoint the selected Bidder, as the case may be, for the Project and TVNL reserves the right to reject all or any of the Bid or Bids without assigning any reasons whatsoever.

viii. The Bidder shall bear all its costs associated with or relating to the preparation and submission of its Bid including but not limited to preparation, copying, postage, delivery fees, estimation, travel, and expenses associated with any demonstrations or presentations which may be required by TVNL, or any other costs incurred in connection with or relating to its Bid. All such costs and expenses will remain with the Bidder and TVNL shall not be liable in any manner whatsoever for the same or for any other costs or other expenses incurred by a Bidder in preparation or submission of the Bid regardless of the conduct or outcome of the Bidding process.

Notes.