

NieT No: WBSEDCL/SPGD/ Jungle Sundari Karmanagari - II/Solar PV and BESS
Project /2026-27/NIT-89 Date - 12.10.2026

TENDER DOCUMENT

For

Design, Engineering, Procurement, Supply, Installation, Construction, Testing and Commissioning including warrantee obligation, Operation and Maintenance for twelve (12) years of a 50 MW (AC) Solar PV Power Plant and 10 MW / 40 MWh Battery Energy Storage System (BESS) located at Jungle Sundari Karmanagari - II, Raghunathpur Block - II, Mouza - Raibandh-42, in Purulia District, West Bengal



WEST BENGAL STATE ELECTRICITY DISTRIBUTION COMPANY LIMITED
(A Govt. of West Bengal Enterprise)
Data Centre Complex, Admin Building, 3rd
Floor, AF Block, Action Area-I, New Town,
West Bengal, Kolkata-700163

TABLE OF CONTENTS

Sl. No.	Item Description	Page No.
1	Section-I (Notice Inviting e-Tender)	3-10
2	Section-III (Instruction to Bidders)	11-22
3	Section-II (General Conditions of Contract)	23-52
4	Section-III (Special Conditions of Contract)	53-62
5	Section-IV (Technical Specification)	63-191
6	Section-V (Forms/Proformas/ Annexures)	192-237

SECTION: I
NOTICE INVITING e-TENDER (NIeT)

West Bengal State Electricity Distribution Company Limited

(A Government of West Bengal Enterprise)

CIN : U40109WB2007SGC113473

Solar Power Generation Department

3rd Floor, Data Centre Complex, Street No. 41,

Action Area-I, New Town, Kolkata – 700 163

Website: www.wbsedcl.in, e-mail: cesolar@wbsedcl.in



West Bengal State Electricity Distribution Company Limited (WBSedCL) intends to develop one no. Grid Connected Ground Mounted Solar PV Power Plant of 50 MW (AC) [Minimum 60 MWp (DC)] capacity along with 10 MW/40 MWh BESS at Jungle Sundari Karmanagari – II in Purulia District of West Bengal. In this connection, the Chief Engineer, Solar Power Generation Department (SPGD), WBSedCL invites e-tender in two parts for the work of "Design, Engineering, Procurement, Supply, Installation, Construction, Testing and Commissioning including warrantee obligation, Operation and Maintenance for twelve (12) years of a 50 MW (AC) Solar PV Power Plant and 10 MW / 40 MWh Battery Energy Storage System (BESS) located at Jungle Sundari Karmanagari – II, Raghunathpur Block - II, Mouza – Raibandh-42, in Purulia District, West Bengal" (on EPC mode) from bona-fide, resourceful and technically eligible developers having experience in execution of similar nature of work as per eligibility criteria as mentioned below in the form of technical and financial proposals containing as mentioned in the tender document.

1. BID DETAILS

Sl. No.	ITEM	DETAILS
1	NieT No.	NieT No: WBSedCL/SPGD/ Jungle Sundari Karmanagari - II /Solar PV and BESS Project /2026-27/NIT-89 Date-12.10.2026
2	Name of work	Design, Engineering, Procurement, Supply, Installation, Construction, Testing and Commissioning including warrantee obligation, Operation and Maintenance for twelve (12) years of a 50 MW (AC) Solar PV Power Plant and 10 MW / 40 MWh Battery Energy Storage System (BESS) located at Jungle Sundari Karmanagari – II, Raghunathpur Block - II, Mouza – Raibandh-42, in Purulia District, West Bengal
3	Tender Fee	NIL
4	Earnest Money	Rs. 5,00,00,000/- (Rupees Five Crore Only)
5	Validity of Earnest Money (in case of Bank Guarantee)	06 (six) months from the date of opening of Technical Bid and with a claim period of another 03 (three) months.
6	Time of completion of work	550 Days
7	Validity of offer	180 (One Hundred and Eighty) days from the date of opening of Technical Bid.

Handwritten signature and date:
12/10/2026

2. PROJECT DETAILS

SL No.	ITEM	DETAILS
1	Capacity of the Solar PV Power Plant	50 MW (AC)/ Min. 60 MWp DC
2	Capacity of BESS	10 MW/40 MWh
3	Location	Jungle Sundari Karmanagari – II, Raghunathpur Block - II, Mouza – Raibandh-42, in Purulia District, West Bengal
4	J.L. No. & Plot No.	J.L. No. 42, L.R. Plot No. 10
5	District	Purulia
6	State	West Bengal
7	Site Latitude	23.583934° N
8	Site longitude	86.562925° E
9	Nearest Railway Station	Purulia Railway Station. Distance between Railway station and project site is 45 KM

3. KEY- DATES FOR E-TENDERING

Sl. No.	Activity	Date & Time
1	Publishing Date	12.10.2026 at 04:00 PM
2	Document Download start date	12.10.2026 at 04:30 PM
3	Last date & time of submission of queries if any for pre-bid meeting	28.10.2026 up to 12:00 PM
4	Date & time of Pre-bid Meeting	28.10.2026 at 2:00 PM
5	Start date & time of Bid submission (online)	30.10.2026 at 04:00 PM
6	End date of Bid submission (online)	17.11.2026 up to 04:00 PM
7	Last Date and time of physical submission of offline EMD	18.11.2026 up to 01:00 PM
8	Technical Bid opening date & time	19.11.2026 at 04:00 PM
9	Financial Bid opening date	To be notified after evaluation of Technical Bids

4. ELIGIBILITY CRITERIA FOR PARTICIPATION IN THE BIDDING PROCESS:

4.1 General

This Invitation for Bids, issued by WBSEDCL is open to sole proprietorship firm/Partnership firm/ LLP and Company (ies) incorporated in India as per Company Act, 1956/2013 (with amendment from time to time), barring those bidders, which have been placed under Holiday Listing and the term/ duration of such listing has not yet expired.

A Bidder shall not have a conflict of interest. Any Bidders found to be having a conflict of interest shall be disqualified. The bidder may be considered to have conflict of interest with one or more parties in this bidding process, if:

- i. They have a controlling partner in common,
- ii. They receive or have received any direct or indirect subsidy from any of them; or
- iii. They have the same legal representative for purpose of this bid; or
- iv. They have a relationship with each other, directly or through common third parties, that puts them in position to have access to information about or influence on the bid of another Bidder, or influence the decisions of the Employer regarding this bidding process; or
- v. A bidder submits more than one bid in the bidding process, either individually [including bid submitted as agent / authorized representative on behalf of one or more manufacturer(s) or through Licensee – Licensor route, wherever permitted as per the provision of Qualification requirement for Bidders] or as partner in a joint venture, except for alternative offers permitted under Invitation to Bid. This results in disqualification of all such bids. However, this does not limit the participation of a Bidder as a sub-contractor in another Bid, or of a firm as a sub-contractor in more than one bid; or
- vi. A Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specification of the materials and services/works that are subject of the bid, or
- vii. The Bidder, directly or indirectly shall not be a dependent agency of the WBSEDCL.

This bidding is open to any manufacturer or erector or integrator who provides satisfactory evidence concerning the following that he:

- i. is a qualified manufacturer or erector who supply, erect, testing and commission of the type specified and has adequate technical knowledge and practical experience;
- ii. does not anticipate change in the ownership during the proposed period of work (if such a change is anticipated, the scope and effect thereof shall be defined);
- iii. has adequate financial stability and status to meet the financial obligation pursuant to the scope of the works;
- iv. has adequate field services organization to provide the necessary field erection and management services required to successfully erect, test and commission the equipment as required by the Specifications and Documents; and
- v. has established quality assurance systems and organization designed to achieve high levels of equipment reliability, both during his manufacturing and field installation activities.

The bidder must submit Certificate of Incorporation/ Registration of Company/Trade license, GST Registration (GSTIN), PAN Card, Labor License, Electrical Contractor License, PF Registration, Employees' State Insurance Registration and Professional Tax Registration as per the applicability.

A power of attorney, duly notarized, indicating that the person(s) signing the bid has (ve) the authority to sign the bid and thus that the bid is binding upon the Bidder during full period of its validity.

The above stated requirements are a minimum and WBSEDCL reserves the right to request for

any additional information and also reserves the right to reject the Proposal of any Bidder, if in the opinion of Employer, the qualification data is incomplete or the Bidder is found not qualified to satisfactorily perform the Contract.

4.2 Technical Eligibility Criteria

(a) Work Experience – Grid-Connected Solar PV Projects

The Bidder shall have successfully executed contract(s) involving the planning, design and engineering, manufacture/procurement, supply, installation, testing and commissioning of Grid-Connected Solar PV Power Projects, meeting at least one of the following criteria:

- One (01) project of 25 MW AC capacity or higher; or
- Two (02) projects, each of 15 MW AC capacity or higher; or
- Three (03) projects, each of 10 MW AC capacity or higher.

The aforesaid projects shall have been satisfactorily executed during the preceding five (05) years up to the Bid Submission Start Date. For the purpose of determining project capacity, the AC capacity of the Solar PV Power Plant shall be considered.

(b) Work Experience – Grid-Interactive Battery Energy Storage Systems (BESS)

The Bidder must have supplied, installed, and commissioned grid-connected BESS containers, including PCS, EMS, and associated Balance of System, with a cumulative installed capacity of at least 20 MWh, out of which at least one (01) BESS installation shall have a rated power capacity of 2 MW or higher.

The aforesaid project shall have been satisfactorily executed during the preceding five (05) years up to the Bid Submission Start Date.

- (c) The referred 4.2 (a) Solar PV plant(s) must have been in successful operation for at least 01 year preceding bid submission start date.
- (d) The referred 4.2 (b) BESS plant(s) must have been in successful operation for at least 06 months preceding bid submission start date.
- (e) The bidder should furnish documentary evidences of satisfactory performances of the said works/projects by way of submission of completion and performance certificates issued by the purchaser (Plant/Substation Owner) up to the Bid submission start date.
- (f) The certification by the bidder for his own work shall not be acceptable.
- (g) Bids may also be submitted by joint venture firm /consortium (having not more than two partners with one partner as lead partner) with requisite technical qualification of the Members of the JV as mentioned below:
 - A. Each member of the JV/Consortium shall individually satisfy at least one of the technical experience requirements specified under Clause 4.2(a) or Clause 4.2(b) above; and
 - B. At least one of the members of the JV/Consortium shall mandatorily satisfy the technical experience requirement specified under Clause 4.2(b) above relating to Grid-Interactive BESS.
- (h) Bidder should submit, in support to the above, the list of works/projects completed/commissioned along with their work order/ LOI and the successful

dm

12/10/2016

commissioning/completion certificates from the purchaser/ employer.

- (i) The bidder should submit a list of contracts of similar nature presently under execution giving details of client, completion time, scope and value of work.
- (j) A list of key professionals is to be furnished by the bidder as the Project Team Structure for the proposed work mentioning their experience and qualification.
- (k) The bidder shall have to possess Electrical Contractors License issued by statutory Authority in Central/State Level. In case of JV/Consortium Bidders, lead member should have the said license for participating in the Tender. A copy of the License shall have to be uploaded in the specified folder of the e-tender and also to be furnished along with the Bid hard copy.
- (l) Bid submitted by a joint venture/consortium having not more than 2 (two) partners with one partner as lead partner, as per stipulated Qualification Requirements in Clause no. 4 of NIE T shall comply with the following requirements:
 - One of the partners shall be authorized by the other member of the JV/Consortium, for performing key role in execution of the contract and shall be designated as Lead Member; this authorization shall be evidenced by submitting with the bid a Power of Attorney signed by legally authorized signatories as per Proforma-3.
 - The bid shall be signed by the authorized representative of the Lead Member.
 - The lead partner shall be authorized to incur liabilities and receive instructions for and on behalf of any and all partners of the joint venture, and the entire execution of the contract, including payment, shall be done exclusively with the leader, provided otherwise requested by the joint venture and agreed between the Employer and the leader.
 - All partners of the joint venture/Consortium shall be liable jointly and severally for the execution of the contract in accordance with the contract terms.
 - A Joint Venture/Consortium Agreement entered into by the partners shall be submitted with the bid as per Proforma-2, including inter-alia delineation of responsibilities and obligations of each partner appended thereto, notwithstanding the joint and several liabilities.
 - The Joint Venture/Consortium Agreement should indicate precisely the responsibility of all members of JV/Consortium in respect of planning, design, manufacturing, supply, installation, commissioning and training.
 - All members of JV/ Consortium should have active participation in execution during the currency of the contract. This should not be varied/modified subsequently without prior approval of WBSEDCL; and
 - In order for a joint venture / Consortium to qualify, each of its partners must meet the minimum criteria listed in the Qualification Requirement for the Bidder in Clause no.4 of NIE T for an individual Bidder for the component of the contract they are designated to perform. Failure to comply with those requirements will result in rejection of the joint venture bid.
- A firm can be a partner in only one joint venture/Consortium; bids submitted by joint ventures/Consortium including the same firm as partner will be rejected.

4.3 Financial Eligibility Criteria

- (a) Legal Constitution & Statutory Compliance: The bidder must be a legally established entity in India, namely: Sole Proprietorship, Registered Partnership Firm (Partnership Act, 1932), Limited Liability Partnership (LLP Act, 2008), Company incorporated under the Companies Act, 1956/2013, or a Statutory Body. To ensure statutory and regulatory compliance, the bidder shall submit valid and up-to-date copies of: Trade License, Certificate of Incorporation/Registration, PAN, PF Registration, ESI

Registration, Profession Tax Enrolment Certificate, GSTIN, Labour License, Contractor License, as applicable.

- (b) **Audit Reports:** The bidder shall submit Financial Statements for the last three (3) financial years: 2023-24, 2024-25 & 2025-26.

Companies: Audited Financial Statements

Proprietorships/Partnership Firms: Tax Audit Reports

If audited financial statements for FY 2025-26 are not finalized, Provisional Financial Statements certified by an Independent Auditor shall be accepted.

- (c) **Tax Compliance:** The bidder shall submit Income Tax Returns (ITRs) and GST Returns for the immediate preceding financial years.
- (d) **Minimum Average Annual Turnover (MAAT):** The bidder must have a MAAT of **at least Rs. 75 Crore**, computed over the preceding three (3) financial years.
- (e) **Working Capital Requirement:** The bidder must have minimum Working Capital equivalent to **Rs. 75 Crore**, based on the immediately preceding financial year.

Working Capital = Current Assets + Sanctioned Funded Credit Limits – Current Liabilities

To ensure verifiability, the bidder shall submit a Bank Certificate from a Scheduled Commercial Bank indicating sanctioned funded and non-funded credit limits as on the Balance Sheet date.

If Fixed Deposits (FDs) are classified as Current Assets, then details such as FD number, maturity date, and lien/hypothecation status must be certified by the Auditor/CA.

- (f) **Positive Net Worth:** The bidder must have positive Net Worth in each of the last three (3) financial years.

Net Worth = Paid-up Capital + Free Reserves – (Accumulated Losses + Intangible Assets). Revaluation reserves shall not be considered.

Common Applicability Note for Clauses (d), (e) & (f): Where financial figures under MAAT, Working Capital, or Net Worth are unclear, inconsistent, or not conclusively established from the submitted financial statements, WBSEDCL may seek clarifications in the form of certificates issued by a Statutory Auditor/Chartered Accountant with UDIN. This requirement shall apply uniformly to Clauses (d), (e) and (f). Wherever the bidder submits Auditor/CA-certified financial statements or certificates, the same must include UDIN for verification, failing which WBSEDCL reserves the right to seek clarification or additional documents.

- (g) **Valid Statutory Registrations:** The bidder shall submit valid statutory registration documents including: Trade License, Certificate of Incorporation/Registration, PAN, PF Registration, Profession Tax Enrolment, GSTIN, etc., as applicable.
- (h) **For the purpose of this particular bid, bidder shall meet the following minimum commercial criteria in past 5 (Five) years up to the Bid submission start date.**

(i) Financial Credential

1. Experience of having successfully executed a **single completed project** in the Power Sector with a contract value of not less than **Rs. 125 Crores**, actually applied for in the bidding process.

Or

2. Experience of having successfully executed **two completed project** in the Power Sector with a contract value of not less than **Rs. 100 Crores**, actually applied for in the bidding process.

Or

3. Experience of having successfully executed **three completed project** in the Power Sector with a contract value of not less than **Rs. 75 Crores**, actually applied for in the bidding process.

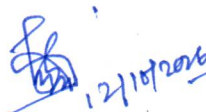
- (j) In the case of a Joint Venture (JV)/Consortium, both the Lead Member and the Partner Member shall individually comply with the Financial Eligibility Criteria stipulated under Clauses 4.3(a), (b), (c), (f) and (g) above. Further, the Lead Member shall meet **80%** of the stipulated requirements under Clauses 4.3(d), (e) and (i), whereas the Partner Member shall meet at least **20%** of the stipulated requirements under the aforesaid Clauses.

5. All other information as well as terms and conditions, which are not covered above, will be available in Instructions to Bidders, General Conditions of Contract, Special Conditions of Contract, Technical Specification and specimen Proforma of this tender.
6. The bidder or their duly authorized representative should attend the Pre-bid Meeting at the stipulated date and time as mentioned in the Key date's schedule.
7. WBSEDCL is not bound to accept the lowest tender and reserves the right to cancel any or all the tenders unilaterally without assigning any reason what-so-ever. The decision of the Tender Inviting Authority will be final and binding on all concerned and no challenge against such decision will be entertained. In any circumstance, cost of the bidding will not be reimbursed/ returned by the Tender Inviting Authority.
8. All the important correspondence must be done through declared authorized email id with original scanned copy of documents/letter in company's letter head/pad. However hard copies should reach our office through post/ by hand from your end.

9. Any further information related to this tender may be obtained from the following office:

Office of the Chief Engineer
Solar Power Generation Department,
West Bengal State Electricity Distribution Company Limited (WBSEDCL) 3rd Floor, Data Centre
Complex, Street No. 41, Action Area-I, New Town,
Kolkata - 700 163.

Website : www.wbsedcl.in
Contact Tel. Nos. : +91 9230961800
Email id : cesolar@wbsedcl.in


Chief Engineer

Solar Power Generation Department

SECTION: II
INSTRUCTION TO BIDDERS (ITB)

1. NAME OF THE WORK

Design, Engineering, Procurement, Supply, Installation, Construction, Testing and Commissioning including warrantee obligation, Operation and Maintenance for twelve (12) years of a 50 MW (AC) Solar PV Power Plant and 10 MW / 40 MWh Battery Energy Storage System (BESS) located at Jungle Sundari Karmanagari – II, Raghunathpur Block - II, Mouza – Raibandh-42, in Purulia District, West Bengal.

2. REGISTRATION OF BIDDER

Any Bidder willing to take part in the process of e-tendering will have to be enrolled and registered with the Government e-Procurement System. Through logging in to <https://wbtennders.gov.in>, the contractor has to go for the e-Tendering link as given on the web portal.

3. DIGITAL SIGNATURE CERTIFICATE (DSC)

Bidders willing to take part in the process of e- tendering are required to obtain Class 2 or Class 3 Digital Signature Certificate (DSC) in the name of person who will sign the tender, from any authorized Certifying Authority (CA) under the Controller of Certification Agencies (CCA), Govt of India. The bidders are required to register the fact of possessing the Digital Signature Certificates through the Registration System available in the website. Tenders shall be submitted online and intending bidders should download the tender documents from the website stated above, directly with the help of the DSC. This is the only mode of collection of tender documents. Details of submission procedure are given below.

4. TENDER FEE

No fee is applicable for purchasing this tender document for the e-tender.

5. SITE VISIT

The bidders are advised that they must visit the proposed site of installation and get themselves conversant with the actual site condition prior to submission of the bids. The bidder may visit the proposed site during the presence of the officials of WBSEDCL giving prior information in writing or through e-mail to this office.

6. PROCESS TO BE CONFIDENTIAL

After the public opening of bids information relating to the examination, clarification, evaluation of comparison of Bids and recommendations concerning the award of contract shall not be disclosed to bidders or other person not officially concerned with such process until the Award of the Contract to the successful bidder has been announced.

Any effort by a bidder to influence WBSEDCL in the process of examination, clarification evaluation and comparison of Bids, and in decisions concerning the Award of contract may result in the rejection of his Bid.

7. CLARIFICATION OF BIDDING DOCUMENTS & PRE-BID MEETING

7.1 The bidder shall be deemed to have carefully examined the Bidding Document and also to have been satisfied him as to the nature and character of the system to be supplied and installed against the contract, and all relevant matters & details should there be any discrepancy or, obscurity in the meaning of any of these clauses of the e-Tender documents or if there be any query of the intending Bidder, the Bidder shall set forth such discrepancies, doubt, obscurity or queries and submit the same through our email-id [:cesolar@wbtedcl.in](mailto:cesolar@wbtedcl.in) or physically at Solar Power Generation Department (SPGD), 3rd Floor, Data Centre Complex, Street No. 41, Action Area-I, New Town, Kolkata

– 700 163 before scheduled Pre-Bid meeting for necessary clarification by WBSEDCL & further action in this regard.

7.2 To assist in the examination evaluation and comparison of Bids, WBSEDCL may ask the bidder individually for a clarification of his Bid including break up of unit rates. The request for clarification and the responses shall be in writing or via email but no change in the price or substance of the Bid shall be sought, offered or permitted except as required to confirm the correction of arithmetical errors discovered by WBSEDCL during the evaluation of the Bids in accordance with clause no. 20 of ITB.

7.3 The Pre-bid meeting will be held on scheduled date and time as mentioned in the NIT at the following venue:

**Office of the Chief Engineer Solar Power Generation Department (SPGD)
3rd Floor, Data Centre Complex, Street No. 41, Action Area-I
New Town, Kolkata – 700 163**

7.4 Non-attendance at Pre-Bid discussion will not be a cause for disqualification of bidders. The clarification given in the Pre-Bid discussion shall be final and binding on the bidder, being a part the original Bid Documents.

8. DEVIATION

This tender is a 'No Deviation' tender. However, request for any deviation by the bidder (s) vides their queries prior to pre-bid meeting, if tenable, will be informed in the Pre Bid meeting. Proforma-04 shall be filled and submitted by the bidder.

9. AMENDMENT OF BIDDING DOCUMENTS

The Tender Inviting Authority reserves the right to modify, amend or supplement this Tender Document. Any corrigendum, notification concerned to this NIT will be published in the e-tender portal <https://wbtennders.gov.in> . The bidders are advised to follow the website regularly for such corrigendum, notification etc.

10. LANGUAGE OF THE BID

The offer prepared by the bidder and all correspondence and documents relating to the bid exchanged by the bidder and WBSEDCL shall be written in English. The desired documents and any other document submitted by the bidder shall be written in English.

11. PROCEDURE OF SUBMISSION OF BIDS

Bids are to be submitted online through the website <https://wbtennders.gov.in>. All the documents uploaded by the Tender Inviting Authority form an integral part of the tender document. Bidders are required to upload the entire tender document along with the other required documents through the above website within the stipulated date and time as given in the NIT.

The bid shall comprise of two parts and to be submitted simultaneously – One is Technical Proposal and other is Financial Proposal.

The bidders need to download the documents, fill up the particulars in the designated cell and upload the same in PDF in the designated location of the Technical Bid.

The bidders need to download the Price Bid & Price Break up Pro forma as attached with this document, fill up the same and upload that document in the designated location of the Financial Bid.

All The documents uploaded should be digitally signed using Digital Signature Certificate (DSC). Bidders should take note of all the addendum/corrigendum related to the bid and upload the latest documents as part of the bid.

TECHNICAL PROPOSAL

(A.1) Statutory Cover:

a) To be submitted in “Drafts” folder

- i. Tender Fee: NIL
- ii. Earnest Money Deposit (EMD):

Scanned copy of the Bank Guarantee against Earnest Money Deposit (EMD), in favour of WEST BENGAL STATE ELECTRICITY DISTRIBUTION COMPANY LIMITED payable at Kolkata or documentary evidence of Online Bank Fund Transfer Statement for deposition of Earnest Money as prescribed in clause no. 15 of ITB.

b) To be submitted in “Annexure” folder

- i. Application for Tender (*Vide Proforma – 1*)

c) To be submitted in “NIT” folder

- i. Notice Inviting Tender (NIT)
- ii. Addenda /Corrigenda/Pre-Bid response (if published) duly signed with stamp.

Note: Bidders are to keep track of all the Addendum / Corrigendum issued with a particular tender and upload all the above digitally signed along with the NIT. Tenders submitted without the Addendum / Corrigendum will be treated as informal and liable to be rejected.

d) To be submitted in “Forms” folder

- i. Check List (*Vide Form – I*)
- ii. Summary statement of average annual turnover / yearly audit report (*Vide Form – V*) for a period of the last three financial years, certified by the Auditor appointed under Companies Act, 2013. In case the bidder is not a company, certificate of Tax Auditor may be submitted.
- iii. Statement of orders executed during last five years (*Vide Form -VI*)
- iv. Pro-forma for undertaking to be submitted by the Bidders (*Vide Form – IV*)
- v. Format of Letter of Bid (*Vide Form – III*)

(Only downloaded copies of the above documents are to be uploaded, virus scanned and digitally signed by the bidder)

Note: Tenders will be summarily rejected if any item in the statutory cover is missing.

(A.2) Non-Statutory Cover (My Document)

i. Company Details:

- Proof of Company Incorporation / Trade Licence
- Power of Attorney, duly notarized, indicating that the person(s) signing the bid

has (ve) the authority to sign.

ii. Certificates:

- 1) PAN Card details.
- 2) Professional Tax (PT) Registration.
- 3) GST Registration Certificate (GSTIN).
- 4) PF registration certificate.
- 5) ESI Certificate.
- 6) Labour License Certificate.
- 7) Electrical Contractors License.

iii. Financial Information:

- 1) Income Tax Returns (ITRs) and GST Returns (where applicable) for the preceding three (03) Financial Years.
- 2) Proforma for Evidence of Access to or Availability of Credit / Facilities (*Vide Proforma - 7*)

iv. Credential:

Copy of the Order(s)/LOA (s)/Contract Agreement(s) issued by the purchaser (plant owner), Completion Certificates, Commissioning Reports, and satisfactory performance of the work shall be submitted in support of minimum eligibility criteria as per Clause no. 4 of NleT.

v. Declaration:

- 1) List of Orders in hand
(*The bidder shall submit the list of orders in hand mentioning the order value to be executed within one year from the date of submission of bid*)
- 2) Declaration for Net Minimum Guaranteed Generation (*Vide Proforma - 5*)
- 3) Bill of Material (*Vide Proforma - 9*)
- 4) List of key personnel available and proposed to be engaged for the project mentioning their experience and qualification
- 5) Others: Any other documents (Proforma- 2 & 3 regarding JV eligibility and any other document if found necessary).

Note:

- Failure of submission of any of the above mentioned document(s) as stated in (A.1) & (A.2) above and as per applicability will render the bid liable to be summarily rejected for both statutory and non-statutory cover.
- The execution of work shall be treated as complete execution of contract, not partial execution of contract.
- The documents uploaded should be digitally signed using the Digital Signature Certificate (DSC).

FINANCIAL PROPOSAL

The financial proposal should contain the following documents in one cover (folder).

Bill of Quantities (BOQ)

The financial proposal will contain Price Bid and Price Break- up respectively in the document. The bidder should fill up the documents by their respective cell and upload

given in Proforma-A, B, C, D, E and F.

Note:

- The bidder must furnish information in the specified Pro-forma with their offer. If information are not furnished in desired format or in stipulated copies, the offer of respective bidder may be treated as non responsive and may be considered as ineligible and the bidder shall have no claim whatsoever, on this account.
- The documents uploaded should be digitally signed using the Digital Signature Certificate (DSC).

12. SUBMISSION OF ORIGINAL COPIES OF DOCUMENTS OF EARNEST MONEY DEPOSIT AND HARD COPIES OF UPLOADED DOCUMENTS:

- Mode of Payment:** EMD must be submitted as described in Clause no.-15 of ITB.
- Procedure of Submission:** All the documents shall be submitted to the place of submission mentioned below as per following instruction:
 - ❖ **Envelope 1:** Shall contain Acknowledgement of successful transfer of fund from beneficiary bank or Original copies of Bank Guarantee (BG) as Earnest Money Deposit (EMD) i.e., Form-I (Checklist).
 - ❖ **Envelope 2:** Shall contain rest of the documents except Price Bid mentioned in the Form-I (Checklist) maintaining proper sequence.
 - ❖ **Envelope 3:** Shall contain both the above envelopes mentioning the title on the envelope.
- Place of submission:** The original copies of Acknowledgement or BG, towards Earnest Money shall be submitted in the following office:

Solar Power Generation Department (SPGD), 3rd Floor, Data Centre Complex, Street No. 41, Action Area-I, New Town, Kolkata – 700 163.

Time of submission: The original Bank Guarantee/ Acknowledgement against Earnest Money Deposit (EMD) must be submitted physically at the office of the Chief Engineer, Solar Power Generation Department (SPGD), WBSEDCL, under sealed cover super- scribing the name of the work with NIeT no., name of the bidder etc. within the scheduled date & time as specified in the NIeT.

If the bidder fails to submit the original copies within the due date and time his tender will not be opened and his bid will be rejected.

13. DISQUALIFICATION / INELIGIBILITY OF BIDDERS

Even though the bidders meet the qualifying criteria, they shall be disqualified if they

- have been involved in the corrupt / fraudulent / collusive / coercive practices and/or,
- have made misleading or false representation(s) in the forms, statements and attachments submitted in proof of the qualification requirements and/or,
- have found to be guilty in formation of cartel for submitting their bids and/or,
- have any Record of poor performance such as abandoning the works, serious litigation history, or financial failures etc. (basis of assessment of suitability shall be decided by WBSEDCL based on the parameters laid down by him on these issues) and/or,
- Have been declared ineligible for poor performance/failure issued by the Govt. of India/State Govt. Dept./PSUs/SNAs and other Statutory Organizations etc.

14. TIME SCHEDULE

The basic consideration and the essence of the Contract shall be the strict adherence to the time schedule specified in the bidding document and incorporated in the contract for the proposed services.

15. EARNEST MONEY

An Earnest money for bidding shall have to be submitted as per following:

EMD: Rs. 5,00,00,000 /- (Rupees Five Crore only)

For payment of EMD following payment options are available through online mode:

- i. Net-banking through Payment Gateway
- ii. RTGS/NEFT payment: On selection of RTGS/NEFT as the payment mode, the e - Procurement portal will show a pre-filled challan having the details to process RTGS/NEFT transaction. The bidder will print the challan and use the pre-filled information to make RTGS/NEFT payment using his bank account. Once the payment is made, the bidder will come back to the e- Procurement portal to continue the bidding process after expiry of a reasonable time to enable the RTGS/NEFT process to be completed.
- iii. Submission of EMD through BG: For submission of EMD in the form of BG, bidders will have to opt for EMD Exemption in e-tender portal and upload scanned copy of BG in the EMD exemption document upload section. Physical copy of BG shall be submitted at the office of tender inviting authority as per respective clauses of NIT.

EMD amount can be paid either in online mode or submitted through Bank Guarantee (BG) in full. Partial payment through online mode and remaining submission through BG is not allowed.

Bank details for purchasing of BG is given below:

Bank Name: State Bank of India, Bank Branch: Bikash Bhaban G.O.C.,
Account Name: WBSEDCL, Account Number: 36548991592
IFSC Code: SBIN0007816.

General Instructions for Online Payment:

- The bidder will have to mandatorily pay through Net-banking facility once Net- banking mode is opted for payment.
- Status of NEFT/RTGS payment through Challan for a bid may take time for bank settlement which is updated in 24 Hrs. (approx.). As such bidders opting to pay through NEFT/RTGS mode shall make payment well before 24Hrs, to avoid any complicity.
- The bank account used for payment of EMD by the bidders shall be maintained operative until the completion of tendering process. All refunds will be made mandatorily to the Bank A/c from which the payment of EMD has been initiated.

Refund/Settlement of EMD Amount:

- For unsuccessful bidders, EMD amount submitted against the tender shall be refunded automatically, through an automated process, by NIC portal on receipt of updated status of any bid.
- For successful bidders, EMD will be refunded from WBSEDCL authority after completion of tendering process and following due procedures.
- The bank account used for payment of EMD by the bidders shall be maintained operative

until the completion of tendering process. All refunds will be made mandatorily to the Bank A/c from which the payment of EMD has been initiated.

For any queries related to payments and refunds, bidders will have to communicate with ICICI Customer Support, viz, 033-40267512/13 since payment gateway facility used by E-tender portal is maintained by ICICI.

Successful bidder(s) shall have to mandatorily create vendor id through WBSEDCL Web Portal Vendor Corner, if not created earlier.

No interest shall be claimable on Earnest Money Deposit.

The bid security amount (EMD) shall be released to the successful bidder after receiving Performance Security/Contract Performance from the contractor within the stipulated date mentioned in the Letter of Award (LOA). But the EMD of the unsuccessful bidders will be returned within Forty-Five (45) days after finalization of this contract for which a request letter has to be initiated by the concerned unsuccessful bidders to the Chief Engineer Solar Power Generation Department (SPGD), 3rd Floor, Data Centre Complex, Street No. 41, Action Area-I, New Town, Kolkata – 700 163. In case, WBSEDCL cancel the Tender on his own for any reason, the EMD submitted by the bidders will be returned without any interest subsequently, for which a request letter has to be initiated by the authorized tender applicant.

16. FORFEITURE OF EMD

EMD shall be forfeited, if

- a) The Bidder modifies/withdraws the Bid after Bid opening and during the period of Bid Validity and/or,
- b) The bidder has been found practicing corrupt or fraudulent or collusive or coercive practices during bidding process and/or,
- c) The bidder has been found guilty of Formation of Cartel.
- d) The successful bidder fails within the specified time limit to Sign the Contract Agreement and/or,
- e) The successful bidder fails within the specified time limit to submit the Contract performance/Performance security.
- f) The successful bidder fails to submit unconditional Acceptance of LOA within the specified time limit.

17. PRICE REVISION

Revision/withdrawal of price bid after opening of Techno-commercial bid will not be entertained, under any circumstances until and unless it is sought for. In case it is asked by the tendering authority, the mode of communication too should strictly be followed by the bidder as specified in Writing by WBSEDCL.

18. VALIDITY OF OFFER

The offer against tender should remain valid for a minimum period of 180 days from the next day of opening of Technical Bid. However, WBSEDCL may, on the merit of case, request extension of validity of the offer for a further suitable period without any change in terms & conditions of the offer.

19. DETERMINATION OF RESPONSIVENESS

- i. Prior to be detailed evaluation of Bids, WBSEDCL will determine whether each Bid is substantially responsive to the requirements of the bidding documents.
- ii. For the purposes of this Clause, a substantially responsive Bid is one which conforms

to all the Terms, Conditions and Specifications of the bidding documents without immaterial deviation or reservation. A material deviation or reservation is one which affected in any substantial way the scope quality or performance of the works, or which limits in any way the responsibilities or liabilities of the Bidders or any right of the Owner as required in the Bidding documents and the rectification of which deviation or reservation would affect unfairly the competitive position of other bidders presenting substantially responsive Bids.

- iii. If a Bid is not substantially responsive to the requirements of the bidding documents it will be rejected by WBSEDCL and may not subsequently be made responsive by the bidder having corrected or withdrawn the nonconforming deviation or reservation.
- iv. Although details presented in this Tender have been compiled with all reasonable care, it is Bidder's responsibility to satisfy itself that the information / documents are adequate and that there is no conflict between various documents / stipulations. No dispute or claims shall be entertained on this account. Bid proposal preparation is the responsibility of the bidder and no relief or consideration can be given for errors and omissions.

20. CORRECTION OF ERRORS

Bids determined to be subsequently responsive will be checked by WBSEDCL for any arithmetic errors in computation and summation. Errors will be corrected by WBSEDCL as follows:

- (a) Where there is discrepancy between amount in figures and in words, the amount quoted in figures will govern.
- (b) Where there is discrepancy between the unit rate and the total amount derived from the multiplication of the unit rate and the quantity, the unit rate as quoted will govern unless in the opinion of WBSEDCL there is an obviously gross misplacement of the decimal point in the unit rate in which event the total amount as quoted will govern and the unit rate will be corrected.

The Bidder should ensure that the prices furnished in various price schedules are consistent with each other. In the case of any inconsistency in the prices furnished in the price schedules WBSEDCL shall be entitled to consider the highest price for the purpose of evaluation and use the lowest of the prices in this schedule for the purpose of Letter of Award (LOA).

The amount stated in the Bid form will be adjusted by WBSEDCL in accordance with the above procedure for the correction of errors and shall be considered as binding upon the Bidder, if the bidder does not accept the corrected amount of Bid, his Bid will be rejected and the Bid Guarantee forfeited.

21. OPENING AND EVALUATION OF TENDER

Opening of Technical Proposal

- i. Technical proposals will be opened by the Tender Inviting Authority or his authorized representative electronically from the website stated above, using their Digital Signature Certificate.
- ii. Technical proposals for those tenders, whose EMD have been received, will only be opened. Proposals corresponding to which original copy of BG/Online transaction receipt towards EMD has not been received, will not be opened and will stand rejected.
- iii. Statutory Cover (vide Clause 11.A.1) will be opened first and if found in order, Non-

statutory Cover (vide Clause 11.A.2) will be opened. If there is any deficiency in the Statutory Documents, the tender will summarily be rejected.

- iv. Decrypted (transformed into readable formats) documents of the Statutory and Non-statutory Covers will be downloaded for the purpose of evaluation.
- v. If the information furnished by the bidder in objective manner is not confirmed by the uploaded documents then the bidder will be out rightly rejected for Price Bid opening. The documents related to the furnished online information based on which the evaluation takes place will only be considered. If the bidder uploads any other document, it will be given no cognizance.

Technical Evaluation of Tender

- i. While evaluation, the Tender Inviting Authority or his authorized representative may summon the bidders and seek clarification / information or additional documents or original hardcopy of any of the documents already submitted and if the same cannot be produced within the stipulated time frame, their proposals will be liable for rejection.
- ii. The summary list of bidders, whose bids will be found techno- commercially eligible, will be uploaded in the web portals. Date of opening of financial bid will be intimated to the techno-commercially qualified bidders.

7.2 Opening and Evaluation of Financial Proposal

- i. Financial proposals of the bidders declared techno-commercially eligible, will be opened electronically by the Tender Inviting Authority from the web portal stated above on the prescribed date.
- ii. After opening of the financial proposal the preliminary summary result containing inter-alia, name of bidders and the rates quoted by them will be uploaded.
- iii. The Tender Inviting Authority may ask any of the bidders to submit analysis to justify the rate quoted by that bidder.
- iv. Bids determined to be subsequently responsive will be checked by WBSEDCL for any arithmetic errors in computation and summation. Errors will be corrected by WBSEDCL as follows:
 - (a) Where there is discrepancy between amount in figures and in words, the amount quoted in figures shall be considered.
 - (b) Where there is discrepancy between the unit rate and the total amount derived from the multiplication of the unit rate and the quantity, the unit rate as quoted shall be considered.
- v. Conditional discounts/ rebates, if any, offered by the bidders shall not be taken in to consideration for evaluation.
- vi. The discounted price in Price bid-C & F shall be considered for evaluation purpose only and shall have no relation with the contract price. The contract price shall be finalized based on actual rate quoted subject to bid responsiveness and bid correction.
- vii. Revision/withdrawal of Financial Proposal by the bidder after opening of Technical Proposal of the tender will not be allowed if it is not sought by the Tender Inviting Authority.

22. APPLICATION FOR TENDER

The bidder should submit the Application for Tender as per Proforma: 1 attached with this tender

document. Not submitting the Proforma will cause for rejection of the respective bid.

23. AWARD CRITERIA

WBSEDCL will accept the lowest valid bid, evaluated based on the Financial Proposals, for awarding of the Contract. However the Tender Inviting Authority does not bind himself to do so and reserves the right to reject any or all the tenders for valid reasons.

24. LETTER OF AWARD

Solar Power Generation Department (SPGD), WBSEDCL will place Letter of Award (LOA) to the successful bidder to convey the decision of the tender inviting authority before the expiration of the period of validity of the offer, if the whole tender is not cancelled / postponed by the Chief Engineer, Solar Power Generation Department (SPGD), WBSEDCL.

The contractor should submit the contract agreement, Bank Guarantee for Performance Security and any other document as desired within the stipulated date as mentioned in the said LOA, failing which the job may subject to be cancelled and EMD of the successful bidder will be forfeited.

Notwithstanding anything stated elsewhere in the bid documents, the Contract to be entered into will be treated as a divisible Supply, Civil construction, Erection & Commissioning Contract and Comprehensive O & M Contract initially for 12 (Twelve) years.

25. CURRENCIES OF BID

The unit rate and the price of each item given as per the BoQ shall be quoted by bidder only in Indian Rupees.

26. CONTRACT AGREEMENT

The contractor (successful bidder) shall have to be entered into a Contract Agreement with West Bengal State Electricity Distribution Company Limited (WBSEDCL) within 21 days from the date of issuance of Letter of Award (LOA) for the proper fulfillment of the contract as per Proforma: 11. All Documents/ Correspondences relevant to this tender evolved during the tendering process and firming up of the Contract and during execution of the work will form part of the agreement. The successful bidder shall have to submit a copy of the whole tender document duly signed and stamped by the authorized representative of the successful bidder.

27. INDEMNITY BOND

The contractor (successful bidder) shall have to produce Indemnity Bond as per Proforma: 12 within 21 days from the date of issuance of Letter of Award (LOA) to the Chief Engineer, Solar Power Generation Department (SPGD), WBSEDCL.

28. RIGHT TO ACCEPT OR REJECT ANY OR ALL OFFERS

The Chief Engineer, Solar Power Generation Department (SPGD), WBSEDCL reserves the right to reject any or all the offers without assigning any reason whatsoever.

If the successful bidder does not enter into Contract Agreement and/or submit the performance security/contract performance and/or Indemnity Bond within stipulated time as mentioned above, his EMD will be forfeited and the job may subject to be cancelled.

29. CONTRACT PRICE

Contract price is quoted price plus applicable GST and inclusive of all other charges.

SECTION: III
GENERAL CONDITIONS OF CONTRACT (GCC)

DEFINITION OF TERMS:

Unless the context otherwise requires, the following terms whenever used in this document have the respective meaning:

- i. The **'Company'/'Employer'/'Department'** shall mean the WEST BENGAL STATE ELECTRICITY DISTRIBUTION COMPANY LTD. (WBSEDCL), having its Office at Vidyut Bhavan, Block-DJ, Sector-II, Kolkata – 700091 and shall include its successors and assigns.
- ii. The **'Engineer-in-Charge'** shall mean the Engineer designated by the Company for the purpose of this contract. He will authorize the Controlling Officer and Supervising Officer for carrying out the work.
- iii. **'Company's representative'** shall mean any person or persons of consulting firm appointed and remunerated by the Company to supervise, inspect, test and examine workmanship and materials of the work under this scope.
- iv. The **'Contractor'** shall mean the Bidder who will be awarded with the contract by the Company and shall include the contractor's executor's administrators, successors and permitted assignees.
- v. The **'Sub-Contractor'** shall mean the person named in the Contract for any part of the works or any person to whom any part of the contract has been sublet by the contractor with the consent in writing of the Engineer and will include the legal representatives, successors and permitted assigns of such persons.
- vi. **'Equipment/materials'** shall mean and include all type of construction equipment & materials etc. required for true and satisfactory completion of the work under this contract.
- vii. **'Workmanship'** shall mean the method/manner in which the jobs of the different items, whether included in the schedule or not but are required for true & satisfactory completion of the work under this contract, are executed.
- viii. **'General conditions'** shall mean all the clauses of General conditions of the proposed contract stated hereinafter. The specification shall mean the specification annexed to or issued with the General Conditions and shall include the schedule and drawings attached thereto.
- ix. The term **'Services'** shall mean all works to be undertaken by the contractor as laid down under the head "scope of work" or elsewhere in the specification enclosed. When the words "approved", "subject to Approval". "As directed", "Accepted", "Permitted" etc. are used, the approval, judgment, direction etc. are understood to be a function of Company.
- x. **'Day'** means a calendar day beginning and ending midnight.
- xi. **'Month'/'Calendar month'** means not only the period from the first of a particular month, but also any period between a date in a particular month, and the date previous to the corresponding date in subsequent month unless specifically stated otherwise.
- xii. **'Week'** means seven consecutive calendar days.
- xiii. **'Writing'** shall include any manuscript, type written, printed or other statement reproduced in any visible form.

- xiv. The work **'Site'** shall mean the site of proposed work as detailed in the specification or any other place where the work is to be executed under the contract.
- xv. **'Date of Commencement'** shall mean the date of date of issuance of LOA / date of actual handing over of site whichever is later.
- xvi. **'Date of Completion'** shall mean the date of final completion of the project in all respect.
- xvii. **'Specifications'** shall mean collectively all the terms and stipulations contained in this document including the conditions of contract, technical provisions and attachments thereto and list of corrections and amendments.
- xviii. **'Drawings'** means collectively all the accompanying general drawings as well as all detailed drawings, which may be used from time to time or desired by WBSEDCL.
- xix. **'Approval'** shall mean the written approval of WBSEDCL and/the statutory authorities, wherever such authorities are specified by any codes or otherwise.
- xx. **'Manufacturer'** shall refer to the party proposing to design/engineering and construct in complete or in part a particular job/work at their works/premises.
- xxi. **'Labourer'** shall mean all categories of labour engaged by the Contractor, his sub-contractors and his piece workers for work in connection with the execution of the worked covered by the specifications. All these labourers will be deemed to be employed primarily by the Contractor.
- xxii. **'Plant'/'Equipment'/'Stores'** means and include plant and machineries to be provided under the contract.
- xxiii. **'Delivery of Plant'/'Delivery of Equipment'** shall be deemed to take place on delivery of the plant/equipment in accordance with the terms of the contract complete in all respect after approval by WBSEDCL.
- xxiv. **'Tests on Completion'** shall mean all such tests as are prescribed by the specification to be made by the Contractor to the satisfaction of WBSEDCL before the plant and equipment are taken over by WBSEDCL and this also includes those tests not specifically mentioned in the specification but required under various BIS codes and relevant Electricity Acts and Rules.
- xxv. **'Commissioning'** shall mean the satisfactory, continuous and uninterrupted operation of the equipment/work as specified after all necessary initial tests, checks and adjustments required at site for a period of at least 30 (thirty) days to the satisfaction of WBSEDCL.
- xxvi. **'Urgent Works'** shall mean any urgent measures, which in opinion of the Engineer-in-Charge, become necessary at the time of execution and/or during the progress of work to obviate any risk of damage to the structure, or required to accelerate the progress of work or which become necessary for security or for any other/reason WBSEDCL may deem expedient.
- xxvii. **"Joint Venture (JV)/Consortium"** shall refer to a group of Entities that has collectively submitted the Bid in accordance with the provisions of this Tender.
- xxviii. **"Lead Entity of the JV/Consortium" or "Lead Entity" or "Parent Company"** shall mean an entity which represents the JV, with relation to the project.

1.NAME OF THE WORK

Design, Engineering, Procurement, Supply, Installation, Construction, Testing and Commissioning including warrantee obligation, Operation and Maintenance for twelve (12) years of a 50 MW (AC) Solar PV Power Plant and 10 MW / 40 MWh Battery Energy Storage System (BESS) located at Jungle Sundari Karmanagari – II, Raghunathpur Block - II, Mouza – Raibandh-42, in Purulia District, West Bengal.

2. SCOPE OF WORK

Scope of work of each solar PV plant includes Design, Engineering, Manufacture/ Procurement, Supply of equipment and materials; testing at manufacturers works, inspection, packing and forwarding, unloading and safe storage at site, associated civil works including site development, services, permits, installation and incidentals, erection, testing and commissioning, Comprehensive O&M for 12 years with Warrantee obligation of 50 MW (AC) Solar PV Power Plant and 10 MW / 40 MWh Battery Energy Storage System (BESS) with associated equipment and materials at Project site. The equipment and materials Solar PV Power Plant and BESS with associated system shall include but not be limited to the following equipment and sub-systems:

- a) Contractor shall at his own cost carry out site survey, soil investigation, measurement of soil resistivity, and other relevant parameters required for design of the system.
- b) Contractor shall prepare and submit the Detailed Design Report along with Project Master Plan to WBSEDCL which must contain site meteorological data considered with necessary supporting documents, calculations for annual energy generation for Solar PV Plant, Despatchable Energy for BESS, schedule of site works, detailed specifications of each equipment and works (as mentioned in the technical specification chapter of the tender document), all necessary drawings and associated calculations for selection of different equipment for the plant based on the site location and relevant code of practice.

The Detailed Design Report shall also contain necessary test certificates and approvals as per relevant standard and practice for all the equipment, catalogues, quality assurance etc.

Bill of Quantity (BOQ) for each job including tools and spares, quality control procedures on materials & works and other conditions of contract prior to the execution of the work shall also be a part of the Detailed Design Report.

The contractor needs to submit their Detailed Design Report to WBSEDCL within the time specified in the 'Time Schedule' of the Letter of Award (LOA) and the design of the Solar PV plant shall be verified with the PVSYST Software of premium version and Solar GIS Software which will be provided by the contractor.

The contractor shall submit 03 (three) sets of the Draft Detailed Design/Drawing Report along with editable soft cop in a compact disk for approval.

After finalization of the same by WBSEDCL, the contractor shall submit six (6) sets of the finalized Detailed Design Report along with editable soft copy in a compact disk to carry out further course of action.

- c) The contractor should develop the land profile as per the approved land development drawings.
- d) The contractor shall supply all materials and equipment required for erection, testing & commissioning of the plant. The supply of materials shall also include transportation, loading and unloading at work site.
- e) Timely procurement and transportation to site in properly packed condition of all equipment, materials and miscellaneous item required to complete the project.
- f) Contractor shall arrange proper storage at site for the equipment and materials at his own

cost and risk. The complete system shall be under the custody of the contractor till successful commissioning and handing over the plant to WBSEDCL. WBSEDCL in no case shall be held responsible for any loss/damage/theft of materials/equipment; so long those shall continue to remain under the custody of the contractor.

- g) The contractor shall carry out all necessary civil works for the power plant which include but not limited to the installation of PV array mounting structure & foundations, BESS Container & foundations, boundary wall, fencing & gates, construction of internal inspection path ways, access road, electrical control room and a small office block, switch yard foundations and other details, watch tower, high mast lighting, security room, utility services as required, cable trench, Deep Tube Well and drinking water system, water supply & drainage system required for utility services and cleaning of PV modules etc.
- h) The equipment and materials for Solar PV Power Plant shall include but not limited to the following:
 - i. Solar PV Modules;
 - ii. Array Junction Box;
 - iii. Solar Inverters;
 - iv. Multi Winding Inverter Duty Transformers;
 - v. Cables and conductor;
 - vi. Station Auxiliary Transformer;
 - vii. LT DB;
 - viii. DC Battery, Battery charging equipment & DCDB;
 - ix. Protection system;
 - x. Earthing system;
 - xi. Control, monitoring and data acquisition system (SCADA);
 - xii. CT/VT operated HT Import-Export TVM of 0.2s class meters (Main and Check meter) with all necessary accessories as per CEA Metering Regulation 2006 as amended time to time and state metering code.
 - xiii. Illumination system;
 - xiv. Fire protection system;
 - xv. Ventilation system;
 - xvi. Air Conditioning system;
 - xvii. Module cleaning arrangement;
 - xviii. Drinking water system;
 - xix. Weather station;
 - xx. Communication system;
 - xxi. Recommended spares;
 - xxii. Required Tools and Tackles;
 - xxiii. Approach Road, Internal Road & Inspection pathways
 - xxiv. Control rooms and 33 KV Switchyard
 - xxv. EPC contractor shall arrange the outgoing bay with necessary equipment/ protection system and metering system for evacuation power and registering Net Minimum Guaranteed Generation. However, 33 KV Transmission Line from the Point of Coupling (PoC) of the Solar PV Power Plant to 33KV or 132KV evacuation substation will be arranged by WBSEDCL.
 - xxvi. 33 KV Indoor C & R Panel and Outdoor VCB.
 - xxvii. Drainage system
 - xxviii. Boundary Wall & Fencing
 - xxix. Cable Trench
 - xxx. Required number of signage (Project Name Plate and caution as per IS);
 - xxxi. Supply of Spares as per enclosed list.
 - xxxii. Project Documents (required no. of sets) etc.
 - xxxiii. Any other items required.
- i) The equipment and materials for BESS Plant shall include but not limited to the following:
 - i. Battery Containers
 - ii. Racks along with Batteries

- iii. Container Liquid Cooling System
 - iv. Drainage System
 - v. Battery Management System (BMS)
 - vi. Power Conditioning System (PCS)
 - vii. Energy Management System (EMS)
 - viii. LT & HT Cables
 - ix. LT Switchgear
 - x. Multi Winding Inverter Duty Transformers;
 - xi. HT Switchgear
 - xii. CT/VT
 - xiii. Fire Protection System
 - xiv. Recommended Spares
- j) Installation, testing and commissioning of 50 MW (AC) Solar PV Power Plant and 10 MW / 40 MWh Battery Energy Storage System (BESS) located at Jungle Sundari Karmanagari – II, Raghunathpur Block - II, Mouza – Raibandh-42, in Purulia District, West Bengal as per the approved time schedule.
- 12 (Twelve) years comprehensive operation & maintenance of the plant shall also be in the scope of work. Deployment of supervisor and adequate skilled personnel with appropriate voltage grade electrical workmanship license for round the clock plant operation shall be in scope of the operation and maintenance.
- Deployment of adequate security personnel (minimum 1 no. of armed security guard and 3 nos. of security personnel in each of the three shifts) shall be a scope of the operation and maintenance.
- k) Geo-tagging of Major Equipments including but not limited to Solar Inverters, IDTs, BESS Containers, PCS etc is in the scope of the contractor.
- l) The contractor needs to submit 03 (three) sets of comprehensive user's manual and 02 (two) sets of Operation and Maintenance format book suitably useable for 144 months.
- The scope of maintenance shall include supply of spare parts, replacement of all damaged equipment and accessories with new one within the price of yearly maintenance charge. The down time of PV system and BESS should not be more than 72 hours (03 days).
- PTZ (Pan-Tilt Zoom) outdoor camera as per requirement shall be deployed to cover the entire plant with night vision and central monitoring through 40"LED monitor/TV for surveillance during construction as well as after commissioning of the plant. PTZ cameras & 40" LED monitor shall be provided for monitoring the plant prior to the final commissioning of the plant.
- The contractor shall arrange sufficient transportation arrangement (24X7) for the operation and maintenance purpose.
- m) Provision of Safety items like hand gloves, shock treatment charts, rubber mats, danger/caution boards etc. shall be a part of scope of works. The contractor shall adhere to safety practices during erection, commissioning and subsequent operation and maintenance of the system including fire prevention.
- n) The contractor needs to clean all the debris from the site before final commissioning of the plant.
- o) Any other items not specifically mentioned in the technical specification and/ scope of work but which are required for successful completion and satisfactory operation of the solar power plant are deemed to be included in the scope of work/specification.
- p) The contractor should submit the total system warranty as per clause no. 27 of GCC in a 100 Rs. Non-judicial Stamp Paper (Proforma for the same should be approved by WBSEDCL) duly indemnified at the time of submission of completion report.

3. CONTROLLING OFFICER'S DECISION

Controlling Officer's decision is final in respect of all matters which are left to the decision of the Controlling Officer including the granting or with-holding of certificates.

If, in the opinion of the contractor, a decision made by the Controlling Officer is not in accordance with the meaning and intent of the contract, the contractor may file with the Controlling Officer, within 07 (seven) days after receipt of the decision, a written objection to the decision. Failure to file an objection within the allotted time will be considered as an acceptance of the Controlling Officer's decision and the decision shall become final and binding.

4. COMMENCEMENT & COMPLETION TIME

Date of commencement should be reckoned from the date of issuance of LOA/ date of actual handing over of site whichever is later.

The whole work (including finalization of Detailed Design Drawings & Reports, Site execution work, trial run and PR test for Solar PV Plant and PGT test for BESS Plant) must be completed within 550 (Five Hundred Fifty) days from the date of commencement.

A detailed time schedule for the site work has to be prepared and submitted by the contractor with the Detailed Design Report.

All works under the contract must be completed by period of completion mentioned in tender document while portions of work as per programme settled in consultation with the Controlling Officer shall be completed by the date stipulated in the said programme. It is to be noted that time is the essence of the contract and any default on the part of the contractor to complete the work within the stipulated date/dates aforesaid or within the time as may be extended in writing by the Controlling Officer subject to the payment of liquidated damages, the Company shall have the right, without prejudice to any other clauses, to terminate contract forthwith and to take possession of the balance work/materials and have the same allotted to any other agency and the contractor shall be liable to compensate the loss that may be occasioned to the Company on that account. Any letter in writing by the Controlling Officer shall be treated as conclusive on behalf of the Company.

5. SUBMISSION OF DETAILED DESIGN REPORT

The contractor shall submit 03 (three) sets of the Draft Detailed Design Drawings & Reports including master plan along with editable soft copy in a compact disk for approval.

Draft Detailed design report shall contain all requisite documents as mentioned in the 'Scope of Work'. The contractor should submit the same within 21 (twenty one) days from the date of issuance of 'Letter of Award'.

The contractor shall submit 6 (six) sets of the finalized Detailed Design Drawings & Reports along with editable soft copy in a compact disk to the Chief Engineer, Solar Power Generation Department (SPGD), WBSEDCL.

The contractor shall submit 6 (six) sets as-built drawing after final completion of the project.

6. SCHEDULE OF WORK

Before actual commencement of the work, the contractor shall submit a time bound schedule for approval of the Controlling Officer who have the authority to make additional alteration, and substitution of such programme including modification and time to time as decided by the department and contractor shall strictly follow such modified schedule for timely completion of the work.

7. VARIATION, ADDITIONS AND OMISSIONS

The Contractor shall not modify the work except under direction in writing by the WBSEDCL. The work will be executed as lump-sum contract. However, WBSEDCL reserves the right to vary the capacity of projects up to $\pm 10\%$ (plus or minus ten percent) on pro rata basis. Contract will be executed accordingly on such capacity variation.

However, any item(s) not included in the schedule or specification but required for completion of the work shall have to be carried out/supplied without any extra price. While submitting the offer the bidder shall consider price of those items and may indicate separately as additional deliverable items.

8. CONFIDENTIALITY

The Contractor, or any entity affiliated with the Contractor, shall not disclose to any unauthorized person any information and/or data that may be supplied to him/her by the WBSEDCL or by any other organization, under the directions of the WBSEDCL. All such documents shall be the property of the WBSEDCL or any information that may have come to his/her knowledge directly or indirectly by virtue of the assignment.

9. DEPARTMENTAL MATERIAL

Departmental material shall not be issued to the contractor for the work except under special circumstances. For Import- Export metering system, the contractor shall communicate with the Distribution Testing Department (DTD), WBSEDCL for necessary approval.

10. FORCE MAJEURE

Force Majeure means any circumstances beyond the control of the parties, including but not limited to:

- a. War and other hostilities, (whether war be declared or not), invasion, act of foreign enemies, requisition or embargo.
- b. Rebellion, revolution, insurrection, military power and civil war.
- c. Riot, commotion or disorder, except where solely restricted to employees of the Contractor or of his sub-contractors.
- d. Earthquake, flood, cyclone and such other natural disaster affecting Contractor's work.

WBSEDCL shall neither be responsible nor be liable to bear any compensation for any interruption of work in the site, except, due to the above force majeure condition.

Upon the occurrence of any situation of Force Majeure, the Contractor shall endeavor to continue to perform his obligations under the Contract so far as reasonably practicable. The Contractor shall notify within a week in written to the controlling officer of the steps he proposes to take including any reasonable alternative means for performance which is not prevented by Force Majeure. The Contractor shall not take any such steps unless directed to do so by the controlling officer.

11. EXTENSION OF TIME

An extension of time without imposition of Liquidated Damage (LD), may be granted for delay in execution of work provided there is no fault whatsoever on the part of the contractor. Such extension may only be granted on the basis of application to be submitted within the schedule date of completion by the contractor who has to establish that the extension of time required by him is not due to his fault.

The Contractor may claim an extension of the Time for Completion if he is or will be delayed in completing the Works by any of the following causes:

- a. Extra or additional work ordered in writing by WBSEDCL.
- b. Suspension of work ordered in writing.
- c. Delay by any other Contractor engaged by WBSEDCL, affecting this Contract.
- d. Delay in handover of site by WBSEDCL
- e. Force Majeure.

The Contractor shall give notice to WBSEDCL of his intention to make a claim for an extension of time within 15 days of the occurrence of any of the above cause(s). The notice shall be followed as soon as possible by the claim with full supporting details. WBSEDCL shall after verification allow the Contractor for updating of the programme chart as facts may justify.

12. GUARANTEED PERFORMANCE OF PROJECT

A. GUARANTEED PERFORMANCE OF SOLAR PV PLANT

NET MINIMUM GUARANTEED GENERATION (NMGG)

Bidders shall have to ensure Net Minimum Guaranteed Generation of **78 MU/year** for the first year after final commissioning and at a reducing rate of 0.8 % per year for subsequent years of plant life. Initially, the above Guarantee shall be required for the 12 years of O&M period. The same guarantee shall continue for extended O & M period, if agreed on mutual terms & conditions. The bidder shall design their plant to achieve the Net Minimum Guaranteed Generation.

The Generated energy will be measured at the Outgoing feeder of the switchyard of the Solar PV Power Plant i.e. the Net Minimum Guaranteed Generation will be calculated after considering the Auxiliary Load. As the solar PV power plant will be grid connected type, grid outage will be considered as 12 hours as (6 am to 6 pm) for calculating NMGG. No relaxation in NMGG will be considered for any other losses occurred in the system.

Methodology for calculation of allowable generation shortfall limit with reference to NMGG (G1) shall be as follows:

$$G2 = (H2/H1) \times G1 \times MCF$$

Where,

- $MCF = \text{Module Correction Factor for performance degradation} = [1 - (N-1) \times 0.008]$
(Where N= Years of Operation)
- Net Minimum Guaranteed Generation as per Bid Document =G1
- Reference Global Horizontal Insolation (H1) = (Annual GHI as per Meteonorm 7.1 or above + Annual GHI as per Solar GIS)/2
- Measured Global Horizontal Insolation at site during the O&M period= H2, which shall be validated annually from any relevant Third-Party Government Department or Institutions like NISE / NABL etc. The cost should be borne by the working vendor and calibration should be witnessed jointly by WBSEDCL, Vendor and third-party govt. institution engaged for this purpose. All charges for validation of instrument is to be borne by EPC Contractor.
- Modified NMGG during the O&M period=G2

The bidder shall submit a declaration for the Net Minimum Guaranteed Generation (G1) with their bid (Proforma 5). Non-submission of the said document will entail for disqualification of the bidder.

B. GUARANTEED PERFORMANCE OF BESS

MWh rating (dispatchable Capacity at Point of Interconnection) at project Site	40 MWh (dispatchable capacity) Dispatchable at the beginning of life (i.e. at the time of COD) and minimum dispatchable throughput capacity at the end of each year of operation (as a % of Capacity at Beginning of Life/CoD) as per below:		
	Year	Minimum Dispatchable Energy / State of Health (SoH) of BESS at the start of year (%)	Minimum Dispatchable Energy of BESS at the start of year in MWh in one full cycle
	1	100%	40.00
	2	97.50%	39.00
	3	95.00%	38.03
	4	92.50%	37.08
	5	90.00%	36.15
	6	87.50%	35.25
	7	85.00%	34.37
	8	82.50%	33.50
	9	80.00%	32.67
	10	77.50%	31.85
	11	75.00%	31.06
	12	72.50%	30.28
	Dispatchable capacity at end of Project life (end of 12 year O&M period) shall not be less than 70% of Beginning of Life capacity at any point of time up to End of Battery Life.		
BESS Plant Availability	≥ 95%		
BESS Round Trip ac-dc-ac efficiency at metering point	≥ 83% (including Auxiliary Losses) up to the end of the 12th year from the commencement of the O&M period.		

13. PERFORMANCE SECURITY / CONTRACT PERFORMANCE

A. Project Construction Performance Security

The Contractor shall furnish a Performance Bank Guarantee (PBG) within 15 (fifteen) days from the date of issuance of the Letter of Award (LOA), for an amount equivalent to 10% (ten percent) of the total Contract Price, being the aggregate of the prices quoted under Price Bid (Proforma A, B, C, D, E and F).

In case of a Joint Venture/Consortium, the Lead Member shall furnish, within 15 (fifteen) days from the date of issuance of the LOA, a Performance Bank Guarantee for an amount equivalent to 7% (seven percent) of the total Contract Price, while the Partner Member shall furnish, within the same period, a separate Performance Bank Guarantee for an amount equivalent to 3% (three percent) of the total Contract Price.

The Performance Bank Guarantee(s) shall initially remain valid for a period of 550 (five

hundred and fifty) days, with a claim period of 03 (three) months, and shall be extended, as may be required, until completion of the construction period.

B. Solar PV Plant Guaranteed Generation Security

The Contractor/Lead Member of the Joint Venture/Consortium shall furnish a separate Performance Bank Guarantee, hereinafter referred to as the Solar PV Plant Guaranteed Generation Security, equivalent to 15% (fifteen percent) of the total Contract Price of the Solar PV Plant, being the aggregate of the prices quoted under Price Bid (Proforma A, B and C).

The said Bank Guarantee shall remain valid throughout the 12 (twelve)-years of O&M period, with a claim period of 03 (three) months, and shall secure the Contractor's obligations with respect to the guaranteed minimum annual generation of the Solar PV Plant throughout the said O&M period.

Release of Guaranteed Generation Security:

25% (twenty five percent) of the Guaranteed Generation Security shall be released after completion of the first 02 (two) operational years, subject to the Solar PV Plant achieving the stipulated net Guaranteed Generation value, in GWh/year, during each of the said two operational years.

The remaining 75% (Seventy Five percent) shall be released in annual tranches of 7.50% (Seven point five percent) of the original Guaranteed Generation Security amount at the end of each subsequent operational year, up to completion of the 12-year O&M period, subject to the Solar PV Plant achieving the stipulated net Guaranteed Generation for the respective operational year.

In case of failure of requisite performance in terms of guaranteed generation on part of the Contractor/Lead Member, in either year the relevant penalty clause shall be imposed and the bidder will have to submit full amount of Bank Guarantee covering 15% of the total Contract Price of Solar PV plant (Total of price bid - Proforma A, B and C) during next year.

During the entire O&M period, the aggregated penalty arising out of any shortfall in the Guaranteed Generation shall not exceed 15% (fifteen percent) of the total Contract Price of the Solar PV Plant, being the aggregate of Proforma A, B and C.

C. BESS Performance Security

The Contractor/Lead Member of the Joint Venture/Consortium shall furnish a separate Performance Bank Guarantee, hereinafter referred to as the BESS Performance Security, equivalent to 10% (ten percent) of the total Contract Price of the BESS Plant, being the aggregate of the prices quoted under Price Bid (Proforma D, E and F).

The BESS Performance Security shall remain valid throughout the 12 (twelve)-years of O&M period, with a claim period of 03 (three) months, and shall secure the Contractor's obligations in respect of the guaranteed performance requirements of the BESS Plant throughout the said O&M period, including:

- i. Guaranteed Round-Trip Efficiency (RTE);
- ii. Guaranteed usable capacity, after accounting for cumulative degradation; and
- iii. Guaranteed system availability.

Release of BESS Performance Security:

20% (twenty percent) of the BESS Performance Security shall be released after completion of the first 02 (two) operational years, subject to satisfactory performance of the BESS Plant and successful completion of the applicable annual Performance Guarantee Tests, including RTE, efficiency and usable capacity tests.

The remaining 80% (eighty percent) of the BESS Performance Security shall be released in 10 (ten) equal annual instalments, equivalent to 8% (eight percent) of the original BESS Performance Security amount per year, over the remaining 10 years of the BESS service life, subject to satisfactory performance of the BESS Plant during each corresponding full year of operation.

In case of failure of requisite performance of BESS on part of the Contractor/Lead Member, in either year the relevant penalty clause shall be imposed and the Contractor will have to submit full amount of PBG i.e. 10% of the BESS cost (Total of price Bid- Proforma D, E and F) during next year.

During the entire O&M period, the aggregated penalty arising out of any shortfall in the guaranteed BESS performance shall not exceed 15% (fifteen percent) of the total Contract Price of the BESS Plant, being the aggregate of Proforma D, E and F.

14. FORFEITURE OF PERFORMANCE SECURITY

Performance Security shall be forfeited if,

- a) The successful bidder/JV consortium do not execute the work after placement of Letter of Award (LOA) and/or,
- b) The successful bidder/JV consortium discontinue the work without prior permission of the Chief Engineer, Solar Power Generation Department (SPGD), WBSEDCL and/or,
- c) The successful bidder/JV consortium fails to install/procure the total capacity of the plant as mentioned in the tender document and/or,
- d) The contractor fails to submit a fresh BG 30 (thirty) days prior to expiration of the previous BG against performance security of appropriate amount as per the terms and conditions and/or,
- e) The successful bidder fails to rectify/replace of the defective/damaged equipment(s)/work(s) within the Defect Liability Period.
- f) The contractor fails to perform/neglect the operation and maintenance activity of the plant as per contract.

15. LIQUIDATED DAMAGE

If the Contractor shall fail to complete the total works within the time prescribed herein or extended time for completion, then a sum amounting to 0.143% of the "Contract value of work" for each calendar day of delay will be deducted as liquidated damages for such delay which shall elapse between the time prescribed or extended time as the case may be and the date of completion of the work in each phase, subject to a maximum of ten percent (10%) of the contract price.

The Company may, without prejudice to any, all other method of recovery deducts the amount of such damages from any money in their hand due or which may become due to the contractor. The payment or deduction of such damages shall not relieve the contractor from this obligation to complete the works or from any other of his obligations and liabilities under the contract.

If there is a valid acceptable reason for delay of execution, the Controlling Officer may at his discretion consider lower down of the liquidated damage or even waive the liquidated damage on having written prayer from the contractor along with valid reason.

16. DEFECTIVE MATERIAL

If in the opinion of the Engineer, any of the machineries/equipment/materials etc. brought to the site for use are not of the quality or kind specified in the contract and/or are unfit for the work, he shall be at liberty to order the removal of the said items and the contractor shall remove the same within twenty four (24) hours after notice has been given to him and if he fails to remove them within the time the engineer may cause them to be removed anywhere at the risk of the Contractor and any cost incurred in so doing shall be deducted from the dues to the contractor under the contract. In such case, items as prescribed by the Controlling Officer or his representative are to be substituted immediately.

17. RISK PURCHASE

If the contractor fail, on receipt of the order, to take up the work within reasonable period or leave the work site after partial execution of the work WBSEDCL shall have the liberty to get the work done through other agency at his own risk and additional amount if any. If the situation so warranted to compel WBSEDCL to cancel the order placed on the Contractor, he shall be liable to compensate the loss or damage, which WBSEDCL may sustain due to reasons of failure on his part to execute the work in time.

18. DEFECT LIABILITY PERIOD

The contractor shall provide five (5) years comprehensive warranty from the Taking Over of the Plant, for the entire SPVPP and BESS plant up to the point of interconnection and metering. The Contractor shall warrant the SPVPP project and BESS plant are free from any and all defects including unseen and latent in all project components and workmanship.

The term 'Defect Liability Period' shall mean the period of 05 years (Five years) from the Date of final completion and handing over of the entire project work to WBSEDCL. If any defect against the new executed work is found within the defect liability period the contractor shall be liable to rectify/replace the materials at their own cost and responsibility.

Defects/rectification work so notified shall have to be attended and completed satisfactorily within the specified date or as deemed justified by the Controlling Officer. For faithful & due fulfillment of all obligations, this defect liability period shall be covered by the performance security/contract performance bank guarantee, already submitted by the contractor.

After completion of defect liability period, and on completion of satisfactory rectification of defects, if any, reported within the defect liability period and on receipt of the application from the contractor and considering other factors as per clause no. 29 of GCC, the Controlling Officer of the work shall recommend for amount of the performance security/contract performance to be submitted by the contractor for the next year.

19. SUBLETTING OF CONTRACT

The contractor shall not, without the written consent of the Company, assign or sublet any part thereof, other than for raw materials, or for any part of the work provided that any such consent shall not relieve the contractor from any obligation, duty or responsibility under the contract. In the event of sub-letting of contract or any part thereof is permitted, the fact that such permission has been accorded shall not establish any contractual relationship between the approved Sub-vendor and WBSEDCL of any of his liabilities and obligations under the contract.

20. MANUFACTURER/ SUPPLIERS

The Contractor shall purchase all major equipment and materials from qualified and reputed manufacturers. The Contractor shall ensure that the following minimum qualifying criteria are met by the original equipment manufacturer (OEM) from where the equipment will be purchased.

Sl. No.	Item	Minimum Criteria to be met
1	Solar PV Modules	1) Minimum three years of continuous manufacturing history, globally 2) 1,000 MW global installed capacity 3) 1,000 MW/year manufacturing capacity 4) Modules proposed by the manufacturer shall have a minimum operational track record of one year preferably in the similar climatic conditions.
2	Solar Inverters	1) Minimum five-year continuous manufacturing history 2) At least 500 MW of inverters of same make and technology globally installed and in operation
3	BESS (Including containers, Batteries, BMS, and EMS)	1) Minimum one-year continuous manufacturing history. 2) Minimum 50 MWh grid-interactive BESS installed globally 3) At least one grid interactive BESS 10 MWh at 0.25 C or higher duty cycle or larger successfully in operation for at least 06 months prior to bid submission date.
4	PCS	1) Minimum five-year manufacturing history. 2) Minimum 10 MW cumulative grid-interactive PCS installed globally 3) At least one grid interactive PCS of 4 MW or higher capacity successfully in operation for at least 6 months prior to bid submission date.

Note: In case the successful bidder intend to supply any equipment/material from an OEM which has not supplied similar equipment/material to WBSEDCL earlier, the contractor shall comply with the Circular of the Director (HR), WBSEDCL dated 07.05.2026 (Annexure-II).

21. NOTICES

Unless otherwise stated in the Contract, all notices to be given under the Contract shall be in writing, and shall be sent by personal delivery, Registered post, courier service, facsimile (fax) or Electronic Data Interchange (EDI), e-mail to the address of the relevant party.

Any notice sent by facsimile or EDI shall be confirmed within two (2) days after dispatch by notice sent by airmail post or special courier, except as otherwise specified in the Contract.

Any notice sent by airmail post or special courier shall be deemed (in the absence of evidence of earlier receipt) to have been delivered ten (10) days after dispatch. In proving the fact of dispatch, it shall be sufficient to show that the envelope containing such notice was properly addressed, stamped and conveyed to the postal authorities or courier service for transmission by airmail or special courier.

Either party may change its postal, cable, telex, facsimile or EDI address or addressee for receipt of such notices by ten (10) days' notice to the other party in writing.

Notices shall be deemed to include any approvals, consents, instructions, orders and certificates to be given under the Contract.

22. WBSEDCL'S RIGHT TO TERMINATE CONTRACT & HOLIDAY LISTING

- If the contractor fails to start the work within a month from the date of issue of the work order, the West Bengal State Electricity Distribution Company Limited shall have the right to cancel the work order with forfeiture of earnest money (Converted into initial security) without giving any notice to the contractor. The contractor may be subjected to holiday listing as per company's policy.
- If the contractor neglects, or fails to proceed with the work proportionate to the scheduled time of completion of the work or fails to complete the work within scheduled time for completion or within the extended time approved by West Bengal State Electricity Distribution Company Limited, the West Bengal State Electricity Distribution Company Limited shall have right to terminate the work order after giving notice in writing to the contractor. If the contractor fails after 14 (fourteen) days of such notice, to proceed with the work in the manner notified, West Bengal State Electricity Distribution Company Limited shall terminate the contract and call the contractor to take joint measurement along with the Engineer for the finished portion of work. If the contractor does not appear for joint measurement, ex-party measurement by West Bengal State Electricity Distribution Company Limited will be taken as final.

In that case, WBSEDCL shall take possession of the work, site and engage other agency to complete the work. Extra cost, if incurred, to get the unfinished work done through other agency, will be realized from him from his pending bills and security money. In the contract terminated as above, the contractor shall have no claim for compensation against West Bengal State Electricity Distribution Company Limited for any loss or deterioration of any materials that he may have collected or he may have entered into account of the work.

The contractor may be subject to holiday listing as per company's policy.

23. APPROVAL

Design and Drawing: The contractor shall have to prepare and submit the designs and drawings associated with civil, mechanical and electrical work which includes design of foundation, structure cable sizing, fabrication work, layout design, wiring diagram etc. and obtain approval prior to the execution of work and for this purpose the contractor shall submit Detailed Design Report for obtaining approval from WBSEDCL. The contents of the Detailed Design Report shall be as mentioned in the scope of work (Clause no. 2 of GCC).

Testing and Inspection: Any authorized representative of WBSEDCL shall, at all times, have full access to all parts of the site, places from which natural materials are being obtained, during production, manufacture and construction and be entitled to examine, inspect, measure and test materials and workmanship, and check the progress of manufacture of plant and production of materials/equipment at manufacturer's workshop. No such activity shall relieve the Contractor from any obligation or responsibility. Material Inspection will be carried out after submission of all test reports/certificates and after completion of the manufacturing work, against formal intimation from the contractor. The contractor shall give notice of any material being ready for testing to SPGD, WBSEDCL.

The contractor shall arrange for all the necessary tests required for the project in the premises of the contractor or Sub-contractor and provide assistance, labour, materials, electricity, fuel, stores, calibrated apparatus and instruments as may be necessary to carry out the tests efficiently without any extra charges. If the facilities are inadequate to carry out tests as per standard, the contractor shall have to arrange suitable testing place having all such required facilities and the

cost towards this will be on contractor's account.

The contractor shall also bear all charges towards travelling expenses of the Inspecting Team of the Purchaser or the authorized representatives of the Outside Inspecting agency consisting of at least two (2) persons for to and fro journey by Air from purchaser's Headquarter, including boarding, fooding and lodging at the place of inspection and transit, if any for the purpose of Inspection and Testing.

WBSEDCL, if desired, will visit the contractor's premises/manufacturer's workshop and may proceed with the routine tests. Arrangements for such program shall be done by the contractor. The inspection setup and instruments must be provided by the contractor within the contract value.

The material shall have to be dispatched at site after inspection and clearance from the purchaser.

WBSEDCL, if desired, may test the delivered product (especially solar module) at site from any accredited laboratory of Govt. of India. The result of that test and subsequent decisions taken by the controlling officer will be bound to the contractor.

Rejection: If, as a result of an examination/testing, any plant, materials, design or workmanship is found defective and/or not in accordance with the Contract, WBSEDCL may reject the plant, materials, design or workmanship by giving notice with reasons. The Contractor shall then promptly make good the defect and/or ensure that the rejected/replaced item complies with the Contract.

Materials: Contractor shall obtain prior approval for the materials deliverable under the project from WBSEDCL as mentioned in the technical specification.

24. MODE OF EXECUTION

The Solar PV plant and BESS Plant shall be procured as a complete package. The entire work shall have to be executed on TURNKEY BASIS.

25. SUBMISSION OF PROGRESS REPORT

The contractor shall submit the field progress report weekly to the controlling officer for the work. The contractor needs to get approval of the format of the progress report prior to the execution of the work.

26. INSURANCE

Freight Insurance: The Contractor shall arrange for insurance coverage for the equipment, accessories, materials etc. during transportation & delivery at site till successful handover of the plant.

Execution Insurance: The contractor shall arrange for insurance coverage for the equipment, accessories, materials etc. to be delivered at site till successful commissioning of the plant. As such the bidder shall include the price of such insurance in their price bid as part of the price of work.

Insurance after commissioning of PV Power Plant: : After commissioning and taking over of the plant, comprehensive insurance of the plant covering all risks (Fire & allied perils, theft, earthquake, flood, lightning, public rampage, terrorism, STFI, and others) as required will be on the scope of the EPC contractor for entire period of 12 years of O&M. In the event of any force majeure situation the contractor will rectify the defect and lodge and settle the claim before the Insurance company on behalf of WBSEDCL.

Insurance claim settlement for the company, if any, will be reimbursed to the contractor upon settlement of the claim amount for such restoration work. As such the bidder shall include the price of such insurance in their price bid as part of the price of work.

In case of insurance claims for any damage/loss of the plant, the awarded agency must intimate insurance company as well as WBSEDCL within 48 hrs from the occurrence of the damage of the plant, otherwise accountability will be vested upon the EPC Contractor.

Insurance policy document, premium receipts etc. should be submitted to WBSEDCL.

27. PROJECT WARRANTIES

The SPVPP and BESS plant project shall be implemented through a turnkey EPC contract including O&M and comprehensive warranties of twelve (12) years from the date of successful handover of the plant. Table below specify functional guarantee, minimum requirements and recovery method during defect liability period and O&M period, project component warranty and performance warranty for SPVPP and BESS Plant.

Functional Guarantee	Minimum (or Maximum, as appropriate) Requirement	Recovery
1. Defects Liability Period	Five years for the entire solar PV power plant and BESS plant	Bank Guarantee and O&M Value
2. Project Components Warranty	Guarantees / warranties provided by the OEM beyond the defects liability period, performance warranty period and extended warranties; <ul style="list-style-type: none"> • PV modules = 30 years, • Inverter for 12 Years • BESS for 12 Years • PCS =12 Years 	Bank Guarantee and O&M Value
3. Performance Warranty for SPVPP	Net Minimum Guaranteed Generation for first twelve years of operation	Bank Guarantee and O&M Value
4. BESS plant	Minimum Performance Guarantee of key parameters of BESS Plant RTE Minimum 83% Plant Availability ≥95 % Annual Degradation ≤2.5%	Bank Guarantee and O&M Value

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.

The warrantee period of the complete systems of the Solar PV Power Plant and BESS Plant will be 12 Years from the date of successful handover of the plant. However, the performance guarantee of the PV Module shall be 30 years as per guideline of Ministry of New and Renewable Energy (MNRE), Government of India.

Warrantee period of Inverters & PCS will be 12 years from the date of successful handover of the plant. Consumable items are beyond the scope of Warranty after 12 years (O&M) period.

Solar PV Modules will be guaranteed for 10 (Ten) years for any manufacturing defects.

The contractor shall remain liable to replace any defective parts that may develop in the plant of his own manufacture or that of his sub-contractors under the conditions provided for by the contract under proper use, and arising solely from faulty design, materials or workmanship, provided always that such defective parts as are not, repairable at site and are not essential in the meantime to the maintenance in commercial use of the plant are promptly returned to the contractor's works at the expense of the contractor unless otherwise arranged.

The contractor will submit Warrantee Certificates of the work & spare parts and materials in a 100 Rs. Non-judicial Stamp Paper (Proforma for the same should be approved by WBSEDCL) duly indemnified at the time of submission of completion report. If any defect is found within the warrantee period, contractor will be liable to repair or replace the same at his own cost and risk, within three (72 hours) days from the date of complaint lodged by WBSEDCL.

All the OEM shall sign End User Warranty Agreement directly with WBSEDCL. However, the EPC agency is liable to do all the formalities for Warranty Agreement with End user (WBSEDCL) and claiming the warranty to restore the plant within the stipulated time.

28. OPERATION AND MAINTENANCE

28.1 OPERATION & MAINTENANCE OF SOLAR PV PLANT

Maintenance contract shall be commenced after successful handing over of the plant.

12 years comprehensive operation & maintenance of the plant shall be in the scope of work. Deployment of adequate skilled personnel with appropriate voltage grade electrical workmanship license for round the clock plant operation shall be a scope of the operation and maintenance. The contractor needs to submit 03 (three) sets of comprehensive user's manual and 02 (two) sets of Operation and Maintenance format book suitably useable for 60 months.

The scope of maintenance shall include supply of spare parts, replacement of all damaged equipment and accessories with new one within the price of yearly maintenance charge.

Time for repair/ replacement of equipment or any works in case of any major failure will be granted by the Controlling Officer considering the type of failure and receiving written prayer from the contractor for the same. But in general, the downtime will be 72 hours.

The period of unavailability of grid & Force Majeure Conditions will not be considered as downtime.

After final commissioning of the plant, arrangement of security (minimum 1 no. of armed security guard and 3 nos. of security personnel in each of the three shifts) shall be a scope of the operation and maintenance.

The contractor shall arrange sufficient transportation arrangement (24X7) for the operation and maintenance purpose.

The maintenance includes Routine and preventive, Breakdown and Capital Maintenance which shall be but not limited to the following:

Routine and preventive maintenance:

This shall include:

- i. Regular cleaning of PV modules.
- ii. Checking & tightening of all electrical connections and mechanical fittings.
- iii. Checking and restoring of earthing system.
- iv. Cleaning of Inverter and other electrical equipment.
- v. Routine maintenance as recommended by the original equipment manufacturer.

The contractor shall be responsible to carry out routine and preventive maintenance and replacement of each and every damaged/faulty component/ equipment of the power plant and he shall provide all labour, material, consumables etc. for routine and preventive maintenance at his own cost.

Breakdown maintenance:

Breakdown maintenance shall mean the maintenance activity including repairs and replacement of any component or equipment of the power plant which is not covered by routine and preventive maintenance and which is required to be carried out as a result of sudden failure/breakdown of that particular component or equipment while the plant is running. The supplier shall be responsible to carry out breakdown maintenance of each and every component of the power plant and he shall provide the required manpower, materials, consumables, components or equipment etc. for breakdown maintenance at his own cost irrespective of the reasons of the breakdown/failure.

Capital maintenance:

Capital Maintenance shall mean the major overhaul of any component or equipment of the power plant which is not covered by routine, preventive and breakdown maintenance which may become necessary on account of excessive wear & tear, aging, which needs repair/replacement. The capital maintenance of power plant and all civil structures shall normally be planned to be carried out on an annual basis. For this purpose, a joint inspection by the supplier and WBSEDCL shall be carried out of all the major components of the power plant, about two months in advance of the annual maintenance period, in order to ascertain as to which components of the power plant require capital maintenance. In this regard the decision of WBSEDCL will be final and binding.

However, if the condition of any plant component warrants its capital maintenance at any other time, a joint inspection of WBSEDCL and supplier shall be carried out immediately on occurrence of such situation and capital maintenance shall be carried out by arranging the shutdown of the plant/part of the plant, if required, in Consultation with concerned authorities. The decision of WBSEDCL shall be final and binding to the contractor.

The capital maintenance also includes painting of mechanical & civil structures etc.

The contractor shall undertake necessary maintenance/troubleshooting work of the Solar PV Power Systems. Down time shall not be more than 72 hours from time of occurrence of such faults. Adequate measures should be taken for prevention of wear and tear of the machines. Solar PV Power System is to be designed to operate with a minimum of maintenance.

The scope of support service provides preventive maintenance as & when necessary within the contract period and break down maintenance in the event of malfunctions, which prevent the operation of the power system or part of it within the stipulated time period & free replacement of spares required for maintenance.

The contractor will provide Spare parts & measuring instruments.

The contractor shall submit the detailed schedule for routine and preventive maintenance before final commissioning of the plant. The contractor shall also submit Detailed Report to WBSEDCL for any capital or breakdown maintenance mentioning the cause of breakdown, actions taken to resolve that issue and preventive measures taken to avoid failure/damage/loss of generation due to similar incidents/accidents in future etc. within 07 (seven) days from the date of

recovery.

The contractor shall engage at least 02 (two) operator having necessary technical knowledge and experience at the plant.

Maintenance Report: Maintenance register / log book must be maintained at site. However, quarterly maintenance and monthly generation report of each location as per format duly approved by WBSEDCL must be submitted by the contractor to WBSEDCL on quarterly basis.

The contractor shall mention the annual operation and maintenance charge separately for Solar PV and BESS Plant as a distinct part in their financial proposal (Proforma: C & F). Annual operation and maintenance charge shall be inclusive of security and transportation arrangement. The contractor shall submit detailed price break up for operation and maintenance work to WBSEDCL before final commissioning of the plant.

The payment shall be made on quarterly basis and the Eligible amount will be due for payment after the certification by the Controlling Officer within 45 (forty-five) days from the end of each quarter subject to satisfactory performance and submission of maintenance report in regular basis as mentioned in Clause no. 28 of GCC. The quarterly amount shall be worked out by the Controlling Officer or his authorized representative by dividing the total quoted Annual Operation and Maintenance Cost for that particular year by 04 (four) i.e. the no. of quarters in a year. Further this quarterly amount payable shall be subject to clause no. 29 of GCC as per discretion of the Controlling Office.

28.2 OPERATION & MAINTENANCE OF BESS PLANT

- The Contractor shall provide BESS system operation and maintenance service support for consecutively Twelve (12) years from the date of COD. This shall be included in the Contract Price and a breakdown of the costs shall be detailed in Contract documents.
- The O&M scope shall include provision of skilled personnel, spare parts, tools, consumables, software updates, monitoring services, and all auxiliary support necessary to maintain uninterrupted plant operation. The Contractor shall be fully responsible for the availability, performance, and safety of the system during this period.
- The purpose of this service agreement is to ensure that the Employer is familiar and well trained with the operation and maintenance of BESS system and equipment and to ensure that the system is managed and operated to perform as specified in Performance Guarantee.
- The Contractor shall develop 12 years operation and maintenance planning proposal together with the tender submission and provide details of proposed operations and maintenance arrangements. The basic scope of services and the 12 years operation and maintenance planning proposal shall include but not limited to:
 - a. Corrective on-site maintenance support
 - b. The tender submission shall include the documentation on Corrective Maintenance Manual.
 - c. The Contractor shall deploy skilled manpower/ technical specialists to the site to resolve any issues, within the shortest possible time.
 - d. On-site scheduled (preventive) maintenance support
- The Contractor shall provide on-site scheduled (preventive) maintenance support for the installed BESS plant. The Contractor shall ensure that the Employer's maintenance personnel to be guided thoroughly and involve them in the maintenance that they are sufficiently competent to carry out maintenance for the BESS.
- The proposed Preventive Maintenance Plan / Schedule shall be submitted and subject to the
- Employer's review and approval. This Preventive Maintenance Plan shall serve as an overall maintenance planning guide for the Contractor and for the Employer. Each piece of equipment shall have its own set of detailed maintenance instructions.
- The Preventive Maintenance Plan shall list, but not limited to, the following information for each item of equipment and for each maintenance action:

- a. Item designation and maintenance activity
 - b. Reference to section in manuals giving details for the work
 - c. Time interval for the activity
 - d. Required time to perform the activity
 - e. Number and qualification of individuals to perform the activity
 - f. Total required man-hours
 - g. Whether or not the activity is performed online or offline
 - h. Spare parts
- The Contractor shall be responsible for all software updates and upgrades as required for the BESS plant.
 - The Contractor shall be responsible for all the warranty and after-sales support as required.
 - The Contractor shall include in the Bid the detailed cost breakdown for each of the services for the twelve (12) years maintenance and service support to the installed BESS plant.
 - In the interest of reducing maintenance costs under this option, the Contractor may propose that certain non-specialised maintenance activities be performed by Employer personnel subjected to Employer's approval. These activities may be excluded from the Contractor's maintenance contract, but must be fully described, including estimated man-hours and frequencies. Such activities shall not include activities which are required for maintaining adherence to the Contractor 's Warranties' terms and conditions.
 - Preventive maintenance shall include on-site visit(s) at minimum every 6 months or according to the periodicity, whichever is more frequent, defined by the manufacturer(s) and the manual(s) of the components of the equipment/system to check proper functioning of all components of the equipment/system including related minor repairs.
 - The Contractor shall ensure that any contaminated water generated from BESS systems, including fire-fighting runoff or leakage scenarios, is properly collected, treated and neutralized using appropriate treatment systems. The treated water shall comply with applicable national environmental regulations prior to discharge into natural streams or environment. Necessary monitoring, testing and documentation of water quality shall be maintained to demonstrate compliance with regulatory requirements.
 - The contractor shall undertake necessary maintenance/troubleshooting work of the BESS Plant. Down time shall not be more than 72 hours from time of occurrence of such faults. Adequate measures should be taken for prevention of wear and tear of the equipments. BESS is to be designed to operate with a minimum of maintenance.

29. PENALTY

Penalty may be imposed to the contractor for any of the following reasons:

1. If the contractor fails to repair/replace any defective material/equipment and/or fails to run the whole SPV and BESS plant satisfactorily for any equipment failure/ operator's fault within the downtime mentioned in clause no. 28 of GCC or the time period granted by the controlling officer after receiving such prayer from the contractor in writing, a sum amounting to two percent (2.00%) of annual operation and maintenance charge for every week or part thereof subject to maximum 15% (fifteen percent) each of O&M contract for both Solar PV and BESS Plant respectively will be deducted from the annual operation and maintenance charge of that particular year.
2. If the Solar PV plant fails to generate the Net Minimum Guaranteed Generation (NMGG) as per clause no. 12 of GCC for that particular year and the plant fails to perform satisfactorily, WBSEDCL will realize the cost of Generation short fall at the average rate of power purchase of WBSEDCL as per the Tariff Order issued by West Bengal Electricity Regulatory Commission (WBERC) for that particular year from the Performance Security

and/ or outstanding dues of the contractor up to 15% (fifteen percent) of the total Contract Price of the Solar PV Plant, being the aggregate of Proforma A, B and C. In such case, the PBG for next year shall be of exact amount of previous years PBG and submitted in accordance to the Cl. 13 of GCC as modified.

3. Shortfall of Annual BESS Availability

If the annual equipment availability for BESS is less than 95% during any year, then Contractor shall compensate the Employer an amount calculated as per the following formula:

$$COM A = \left(\frac{95 - EA}{EA} \right) \times C \times E$$

Where,

COM is Compensation payable to the Employer (WBSEDCL) in rupees

EA is Annual measured BESS availability (in %)

C is equal to **8** (Constant)

E is the calculated energy output at 33 kV metering point from BESS in kWh during the respective year with 95% annual BESS availability and 83% annual Round Trip Efficiency including auxiliary consumption.

4. Penalty for Shortfall of Yearly Round Trip Efficiency

In case measured efficiency of BESS η_{meas_Y} (%) is less than required efficiency of 83% in a particular year, bidder shall be liable to pay penalty for loss in dispatch able energy on account of fall in efficiency which shall be calculated as following formula.

Penalty due to Loss of energy due to for Shortfall of Yearly Round Trip Efficiency (*INR*)

$$COM E = ((83 - \eta_{meas_Y} \%) / \eta_{meas_Y} \%) \times C \times EF$$

Where,

COM E is Compensation payable to the Employer (WBSEDCL) in rupees due to Shortfall of Yearly Round Trip Efficiency

η_{meas_Y} is annual measured BESS round trip efficiency including auxiliary consumption (in %)

C is equal to 8 (Constant)

EF is the calculated energy output at 33 kV metering point from BESS in kWh during the respective year with 83 % annual Round Trip Efficiency including auxiliary consumption.

5. Penalty for Shortfall of Usable Energy Capacity:

The BESS plant shall retain a minimum usable energy capacity of 40 MWh in the first year with a maximum degradation per year as per clause 12 of GCC for the subsequent years. The contractor shall be legally bound for retaining minimum annual usable capacity at the point of interconnection for 12 years of contract period as mentioned in clause 12 of GCC.

Measurement: Capacity shall be measured annually through a mutually agreed capacity test cycle, witnessed by the Employer and the Contractor.

Penalty: If the measured usable energy capacity falls below the guaranteed usable energy, the Contractor shall pay the Employer liquidated damages of Rs. 8,000 per kWh (Rupees eight thousand per kWh) for the shortfall in capacity, or at the Employer's option, undertake augmentation/replacement of battery modules at no cost to the Employer to restore the guaranteed capacity within 90 days.

If the contractor fails to perform operation and maintenance activity of the plant, WBSEDCL shall have right to terminate the work order after giving notice in writing to the contractor for a period of fourteen days, if not satisfied. In that case WBSEDCL shall take possession of the work, plant and engage other agency to continue the operation and maintenance work. The performance bank guarantee shall be revoked in full for this purpose.

During the entire O&M period, the aggregated penalty arising out of any shortfall in the guaranteed BESS performance shall not exceed 15% (fifteen percent) of the total Contract Price of the BESS Plant, being the aggregate of Proforma D, E and F.

30. LABOUR LICENSE

Contractor will have to obtain Labour License in respect of the above work as per Contract Labour (Regulation & Abolition) Act, 1970 as early as possible.

31. PRICE

Price shall be fixed/firm. No escalation shall be paid due to any reason what-so- ever. Price as quoted at column (III) of Proforma 2: Price Bid against Sl. No. 1, 2, 3, 4, 5 & 6 should be equal to amount arrived by aggregating the quoted prices for the respective items in Proforma A,B, C, D, E & F. In case of any discrepancies between the rate or price as quoted in Proforma 2 and corresponding rates or price in Proforma A, B, C, D, E and F, then rate or price as quoted or arrived in Proforma A, B, C, D, E and F shall prevail and evaluation shall be done accordingly.

Amount of Freight Insurance & Execution Insurance shall be quoted in the Proforma: A & D – Price Break Up for Supply of Equipment & Materials & Proforma: B & E- Price Break Up for

Construction, Erection, Testing and Commissioning, respectively considering the clause of Insurance under Clause No: 26 of GCC.

Any action on the part of the bidder to revise the price and/or change the structure of price at his own after the opening of the bid may result in rejection of the bid and forfeiture of the earnest money.

Total Comprehensive Annual Operation & Maintenance Price inclusive of security and transportation arrangement for 12 years i.r.o. Solar PV Plant i.e., Price of Proforma C shall not be less than 15.0% of the total quoted price in Proforma A & B.

Total Comprehensive Annual Operation & Maintenance Price inclusive of security and transportation arrangement for 12 years i.r.o. BESS Plant i.e., Price of Proforma F shall not be less than 15.0% of the total quoted price in Proforma D & E.

Prices shall be quoted and payable in Indian Rupees only.

32. TERMS OF PAYMENT

Payment will be made as per following schedule:

Sl. No.	Work Head	Pattern of Release of Billing Amount
Part A	<p>Mobilization Advance: Interest Bearing Mobilization advance will be paid to the contractor against submission of BG equivalent to 110% of the Mobilization Advance, subject to the Conditions mentioned below. The interest will be at the Base Rate of State Bank of India at the time of recovery of the advance.</p> <p>The mobilization advance will be recovered along with interests from the Progressive bills to be processed against Sl. No. Part-B below.</p> <p>The mobilization advance will be recovered along with interests from the RA bills within the scheduled completion time of the project.</p>	10% of Schedule of Prices of Proforma- A and D

Part B	Preconditions : <ul style="list-style-type: none"> • After Verification of site, Submission of Detail Design Report (DDR) & Project Implementation Schedule (L-1). • Approval of <ul style="list-style-type: none"> ➢ Completion of Engineering & design of plant layout. ➢ Manufacturing drawings of equipment e.g. Solar Modules, Inverters, transformers, modules structures, HT equipment and all other accessories on pro-rata basis ➢ Submission of Quality Assurance Olan (QAP) of inverters, modules, solar transformers, modules structures and all other equipment. 	
	i. After delivery of the materials/equipment and safe storage at site.	60% of total amount of materials/equipment supplied as per the Price Schedule of Pro-forma- A & D, shall be paid on pro-rata basis. Mobilization Advance with interest will be recovered from RA bills within the scheduled completion time of the project under this payment head.
	ii. After installation and commissioning of all major materials.	20% of total amount of the Schedule of Prices of Pro- forma- A and D shall be paid on pro-rata basis.
	iii. After commissioning with successful Trial Run of Solar PV and BESS Plant incl. PR Test for Solar PV Plant and PG Teat for BESS plant for at least 30 days	10% of total amount of the Schedule of Prices of Pro- forma- A and D shall be paid on pro-rata basis.
	iv. After Final completion as well as closure of the project except O&M.	10% of total amount of the Schedule of Prices of Proforma- A and D shall be paid.
Part C	i. After successful: <ul style="list-style-type: none"> • Completion of Installation and other services including Civil works 	90 % of total amount of the Schedule of Rates and Prices of Proforma – B and E shall be paid on pro-rata basis.
	ii. After issuance of Taking-Over Certificate:	10 % of total amount of the Schedule of Rates and Prices of Proforma - B and E shall be paid on pro-rata basis.

Sl. No.	Work Head	Pattern of Release of Billing Amount
Part D	Comprehensive Annual operation and maintenance.	<p>The payment shall be made on quarterly basis and the Eligible amount will be due for payment after the certification by the controlling officer within 45 (forty-five) days from the end of each quarter subject to satisfactory performance and submission of maintenance report in regular basis as mentioned in Clause no. 28 of GCC.</p> <p>The quarterly amount will be worked out by the controlling officer or his authorized representative by dividing the total quoted Annual Operation and Maintenance Cost for that particular year by 04 (four) i.e. the no. of quarters in a year Further this quarterly amount payable shall be subject to clause no. 29 of GCC document of the tender.</p>

All payments will be made to the Contractor under the contract in Indian rupees only.

The contractor shall submit Invoice in triplicate for release of payment to them. Maximum two nos. of RA bills per month will be accepted from the awarded agency for processing of payment.

Payment against delivery of materials, as mentioned above in Sl. No-Part B-(i), will be released to the contractor for the materials for which delivery instructions would be issued by the authorized officer of WBSEDCL after successful inspection and testing of the materials carried out at the works of the manufacturer. The materials shall be according to the approved bill of materials.

WBSEDCL shall arrange joint inspection and measurement of work by the representatives of WBSEDCL and the contractor, for releasing payments.

Mobilization Advance & Recovery:

10% of Total Schedule of Prices of Proforma- A and D will be paid to the contractor as mobilization advance after submission of the Bank Guarantee (BG) of 110% of the mobilization advance amount in the prescribed format of WBSEDCL and fulfillment of the following criteria:

- Unconditional acceptance of the LOA
- Taking over of site from WBSEDCL
- Execution of Contract Agreement
- Submission of Performance Bank Guarantee
- Submission of duly authenticated 'Activity Schedule' showing the entire execution of work

The Bank Guarantee shall be valid till the scheduled completion of the project plus a claim period of 3 (three) months.

Mobilization advance, so paid shall be recovered with interest from RA bills within the scheduled completion of the project.

Bank Guarantee submitted for mobilization advance will be released after full recovery of the mobilization advance (with interest) and on receipt of written request of the contractor for release of the same.

All payments will be made to the Contractor under the contract in Indian rupees only.

The contractor shall submit Invoice in triplicate for release of payment to them. Maximum two nos. of RA bills per month will be accepted from the awarded agency for processing of payment.

Payment against delivery of materials, as mentioned above in Sl. No-Part B-(i), will be released to the contractor for the materials for which delivery instructions would be issued by the authorized officer of WBSEDCL after successful inspection and testing of the materials carried out at the works of the manufacturer. The materials shall be according to the approved bill of materials.

WBSEDCL shall arrange joint inspection and measurement of work by the representatives of WBSEDCL and the contractor, for releasing payments.

Mobilization Advance & Recovery:

10% of Total Schedule of Prices of Proforma- A & D will be paid to the contractor as mobilization advance after submission of the Bank Guarantee (BG) of 110% of the mobilization advance amount in the prescribed format of WBSEDCL and fulfillment of the following criteria:

- Unconditional acceptance of the LOA
- Taking over of site from WBSEDCL
- Execution of Contract Agreement
- Submission of Performance Bank Guarantee
- Submission of duly authenticated 'Activity Schedule' showing the entire execution of work

The Bank Guarantee shall be valid till the scheduled completion of the project plus a claim period of 3 (three) months.

Mobilization advance, so paid shall be recovered with interest from RA bills within the scheduled completion of the project.

Bank Guarantee submitted for mobilization advance will be released after full recovery of the mobilization advance (with interest) and on receipt of written request of the contractor for release of the same.

33. TAXES, DUTIES, LEVIES

- Basic Customs duty and entry tax (wherever applicable) shall be included in the basic bid price by the bidder.
- GST as applicable will be paid extra as per GST Act.

Tax invoices need to be issued by the bidder for raising claim under the contract showing separately the tax component (CGST, SGST, IGST, Cess as applicable) in accordance with the provisions of the GST Act.

34. STATUTORY DEDUCTIONS

All statutory deductions will be made from each RA/Final Bill as per applicability of different laws of the land.

35. HANDING OVER

The work will be taken over by WBSEDCL after final completion of the plant in all respect. In case of phase-wise commissioning of the plant, the contractor shall have to maintain the same at his risk & cost until handing over of the plant. During handing over the plant, the contractor shall submit the following documents.

- i. Completion Certificate including Warrantee Certificates of the work & spare parts and materials in a 100 Rs. Non-judicial Stamp Paper (Proforma for the same should be approved by WBSEDCL) duly indemnified.
- ii. Operation, Maintenance & Safety Instruction Manual and other information about the project.
- iii. Detailed Bill of Materials for operation & maintenance, inventory of spares at project site.
- iv. Completion certificate as per prescribed format provided by WBSEDCL.

After submitting all the requisite documents as mentioned above, WBSEDCL will hand over the plant to the contractor for comprehensive operation and maintenance for 12 years as per clause no. 28 of GCC.

36. CERTIFICATE OF COMPLETION OF WORKS

Before taking over the works into commercial use, WBSEDCL will issue a certificate of completion based on the following certifications by the Controlling Officer:

- i. Acceptable quality and workmanship of works.
- ii. Acceptance of field tests by the Controlling Officer or his authorized representative after final commissioning the plant.

37. PROVISIONAL ACCEPTANCE

Provisional acceptance has been achieved if the Contractor has complied with all of its construction-related obligations and the plant is ready to be handed over to the Employer. The criteria for achieving provisional acceptance shall include:

- a. Mechanical completion having taken place in accordance with the agreed technical specification and the plant being free from defects (other than non-critical punch list items).
- b. The aggregate value of the punch list items does not exceed 2 % of the contract price.
- c. Grid connection and energization of the plant have been achieved.
- d. All commissioning tests have been successfully completed.
- e. The provisional acceptance performance ratio (PR) test has been passed.
- f. All equipment and sub-Contractor warranties have been assigned
- g. All handover documentation is in place and hard and soft copies provided to the Employer.
- h. Any delay or performance-related liquidated damages (LDs) incurred by the Contractor during the construction phase have been paid to the Employer.
- i. Any performance security or bond required during the EPC warranty period has been delivered to the Employer

38. FINAL ACCEPTANCE CERTIFICATES (FAC)

The Controlling Officer will issue Final Acceptance Certificate (FAC) within 30 (Thirty) days from the date of expiration of 12 years comprehensive operation & maintenance or the date of rectification of deficiencies/damages/ defects, if any, whichever is later.

39. TAKING-OVER CERTIFICATE (ToC)

After installation, necessary testing and commissioning along with successful Trial Run of Solar PV and BESS Plant and after successful PR Test and Performance Guarantee Test for Solar PV and BESS Plant respectively for at least 30 days, the Employer shall issue a Taking Over Certificate to the Contractor. The Taking Over Certificate shall not relieve the Contractor of obligations under the warranty, performance guarantees, or O&M commitments.

SECTION: IV
SPECIAL CONDITIONS OF CONTRACT (SCC)

1. CODES AND STANDARDS

All equipment and materials to be furnished under this specification shall be designed, manufactured and tested in accordance with the latest editions of the relevant IS/IEC/MNRE guidelines or as applicable.

The electrical installation shall meet the requirement of Indian Electricity Act, and Indian Electricity Rules as amended up-to-date and also the applicable section of the latest revision of the relevant IS Code of Practice.

The work shall be done in compliance with the IS Specifications, International Electro-technical Commission Codes, Indian Electricity Act 2003 and all applicable laws in India.

2. RULES AND REGULATIONS

The contractor shall comply with all the statutory provisions of the following prevailing Labour Laws in respect of employees engaged by them:

- Contract Labour (Regulation and Abolition) Act 1970,
- Payment of Wages Act 1936,
- Minimum Wages Act 1948,
- Payment of Bonus Act 1965 and amended in 2015,
- Employees' Provident Fund and Miscellaneous Provisions Act 1952,
- Employees Compensation Act 1923,
- Employees State Insurance Act 1948.

3. SAFETY

All units with respect to their location, layout, general arrangement and design and equipment, structural design, etc. shall be safe to the personnel and conform to the relevant safety rules and regulations/statutory requirement issued by the State Government and the Central Government as well as to:

- i. Indian Electricity Rules 2005
- ii. Indian Electricity Act 2003
- iii. Indian Explosives Manual and
- iv. Fire Protection Manual

The bidder shall also provide necessary fencing and lights to protect the public from accident.

Fire extinguishers shall be kept by the bidder at the site of works where there is risk of fire hazard.

Adequate washing facilities shall be provided near the place of work.

When the work is done near any place where there is risk of drowning, all necessary equipment shall be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provisions shall be made for prompt first aid treatment of all injuries likely to be sustained during the course of work.

These safety provisions shall be brought to the notice of all concerned by displaying on a notice board at a prominent place at the work spot. The persons responsible for compliance of code shall be named by the bidder.

To ensure effective enforcement of the rules & regulations relating to safety precautions, the arrangement made by the bidder shall be open to inspection by the employer and WBS&EDCL.

Notwithstanding the above clauses there is nothing in those to exempt the bidder from the operations of any other Act or Rule in force in the Republic of India.

All storage, handling & use of flammable liquids shall be under the supervision of qualified persons.

First aid arrangements with the degree of hazard and with no. of workers employed shall be maintained in a readily accessible place throughout the whole of working hours.

Reporting of Accident:

All accidents, major or minor, must be reported immediately to WBSEDCL and the contractor will provide first aid to the injured person immediately. The injured person shall report to the First Aid Station along with the 'Injured on work' form as per appropriate Proforma, duly filled in quintuplicate and submit to the Medical Officer of the First Aid Station.

Serious Injuries:

In case of serious injuries, the following procedure shall be adopted by the contractor.

- To provide first aid at his own First Aid Station.
- To take the injured person to the hospital along with the 'Injured on work' form duly filled in.
- To report the accident to WBSEDCL.

Fatal Accident:

In case of any fatal accidents, Office Order No. EDD/92 dated 13.12.2024 of the Director(HR), WBSEDCL (attached as annexure) and as amended time to time shall be followed.

Any sort of fatal/ non-fatal accidents arising out and in the course of employment, necessary compensation shall have to be paid by then agency as per Employees Compensation Act. 1923.

Penalty:

Failure to observe the Safety Rules will make the contractor liable to penalty byway of suspension of work/termination of contract. Adequate arrangement for proper lighting & guarding shall be made at the worksite.

4. CONSTRUCTION POWER

Contractor has to make his own arrangement of power connections/supply for utilization during construction stage of the project.

5. WATER FOR CONTRACTOR'S USE

The contractor can use the water available at the site for construction purposes and maintaining the plant. However, drinking water has to be arranged by the contractor boring a Tube well of adequate depth and size based on locally available data of the respective department.

6. PACKING

The Contractor shall make separate package for each consignment and mark all containers with the implementing document number pertinent to the shipment. Each shipping container shall also be clearly marked on at least two sides as follows:

- a. Consignee
- b. Contract No.
- c. Package No.
- d. Description
- e. Item No.
- f. Net and gross weight
- g. Volume.

7. TRANSPORTATION

The Contractor shall at its own risk and expense transport all the Materials, Plant and Equipment and the Contractor's Equipment to the Site by the mode of transport that the Contractor judges most suitable under all the circumstances.

Unless otherwise provided in the Contract, the Contractor shall be entitled to select any safe mode of transport operated by any person to carry the Materials, Plant and Equipment and the Contractor's Equipment.

The Contractor shall be responsible for obtaining, if necessary, approvals from the authorities for transportation of the Plant and Equipment and the Contractor's Equipment to the Site. The Owner shall use its best endeavors in a timely and expeditious manner to assist the Contractor in obtaining such approvals, if requested by the Contractor. The Contractor shall indemnify and hold harmless the Owner from and against any claim for damage to roads, bridges or any other traffic facilities that may be caused by the transport of the Plant and Equipment and the Contractor's Equipment to the Site.

Issuance & Submission of Way Bill:

Regarding issuance and submission of e-way bill form, you have to follow the procedure given below:

- a) E-way bill has to be generated from your end as per GST Act.
- b) A copy of the same is to be sent to the Senior Manager (F&A), Indirect Tax Cell, WBSEDCL, Vidyut Bhavan, 6th Floor, 'C' Block, through e-mail id: manageridtwbsedcl@gmail.com on the same day of generation of e-way bill.

The utilization report is to be submitted to the Senior Manager (F&A), Indirect Tax Cell, WBSEDCL, Vidyut Bhavan, 6th Floor, 'C' Block within 72 hours from generation of e-way bill.

8. TOOLS & TACKLES

The contractor shall provide all reliable tools & tackles for proper execution of work. WBSEDCL, shall in no way, responsible for supply of any tools & tackles for implementation of the work.

9. ACCIDENT RISK

WBSEDCL shall not be responsible in connection with any sort of accident either fatal or non-fatal which may occur during transportation of materials/equipment, execution/maintenance of works of the PV Power Plant. The Contractor shall have to provide safety precautionary arrangement for his workmen in order to avoid any such incident/accident as per prevalent safety rules and regulations.

10. ROAD PERMITS

In case of procurement of materials for this project outside the state of West Bengal, issuance of Way Bill and Form-C will be taken care by WBSEDCL as per norms.

11. STORAGE AT SITE

The contractor shall provide all necessary storage at the site in specified areas for all materials which are likely to deteriorate by the action of sun, winds, rain or other natural cause due to exposure in the open in such manner that all such materials shall be duly protected from damage by weather or any other cause.

All such stores shall be cleared after completion of the work and the entire site shall be clean and free from debris. All materials shall be stacked in such a manner as to facilitate rapid and easy checking of such materials.

12. REPLACEMENT OF DEFECTIVE PLANT OR MATERIALS

If during the progress of the work the Purchaser's Representative shall decide and notify in writing to the Contractor that the Contractor has executed any unsound or imperfect work or has supplied any plant inferior in quality to that specified, the contractor, on receiving details of such defects or deficiency shall, at his own expense, within such time as may be reasonably necessary for making it good, proceed to alter, reconstruct or remove such work, or supply fresh materials up to the standard of the specification, and in case the Contractor shall fail so to do, the purchaser may, on giving the Contractor 10 (Ten) days' notice in writing of his intention so to do, proceed to remove the work complained of, and at the cost of the Contractor, perform all such works or supply all such materials, provided that nothing in this clause shall be deemed to deprive the purchaser of or affect any rights under the Contract which he may otherwise have in respect of such defects or deficiencies.

13. EQUIPMENT AND MATERIAL

Equipment and material shall comply with description, rating, type and size as detailed in the technical specification. Equipment and materials furnished shall be complete and operative in all respect.

All accessories which are necessary for safe and satisfactory installation and operation of the equipment shall be furnished in the BOQ.

All parts shall be made accurately to standard gauges so as to facilitate replacement and repair.

All corresponding parts of similar equipment shall be interchangeable.

Contractor shall carefully check the available space and the environmental conditions for installation of all equipment available at site and shall design the system accordingly.

Materials brought to the site shall not be removed from the site without the written consent of the WBSEDCL. The contractor shall submit well in advance for approval of samples, specimens as the WBSEDCL may demand from time to time. Any material brought to the site and rejected by the WBSEDCL shall be removed by the contractor from the site of work immediately.

All materials including reinforcing steel, cement for concrete work, sanitary, plumbing & carpentry fittings etc. shall be procured after approval of brand and make by WBSEDCL.

14. MATERIALS AND WORKMANSHIP

Qualified, experienced people should be deployed to install the PV Power Plant. All materials shall be of the best quality and capable of satisfactory operation under the operating and prevailing climatic conditions. Unless otherwise specified, they shall conform in all respect to the latest edition of the relevant code and standards. The project must be supervised by a qualified Structural Engineer/Engineering firm and Electrical/ Electronics Engineer so that the work shall be as per drawing and related IS/IEC Code.

The work shall be performed confirming safety precaution of all level of worker execute the project. The name and the qualification of the project engineers must be submitted to WBSEDCL after placement of order. The qualification of the supervising engineers must have degree in respective stream.

15. TESTING AND INSPECTION

Any authorized representative of WBSEDCL shall, at all times, have full access to all parts of the site, places from which natural materials are being obtained, during production, manufacture and construction and be entitled to examine, inspect, measure and test materials and workmanship, and check the progress of manufacture of plant and production of materials/equipment at manufacturer's workshop. No such activity shall relieve the Contractor from any obligation or responsibility.

Material Inspection will be carried out after submission of all test reports/certificates and after completion of the manufacturing work, against formal intimation from the contractor. The contractor shall give notice of any material being ready for testing to Solar Power Generation Department, WBSEDCL.

The contractor shall arrange for all the necessary tests required for the project in the premises of the contractor or Sub-contractor and provide assistance, labour, materials, electricity, fuel, stores, apparatus and instruments as may be necessary to carry out the tests efficiently without any extra charges. If the facilities are inadequate to carry out tests as per standard, the contractor shall have to arrange suitable testing place having all such required facilities and the cost towards this will be on contractor's account.

The contractor shall also bear all charges towards travelling expenses of the Inspecting Team of the Purchaser or the authorized representatives of the Outside Inspecting agency consisting of at least two (2) persons for to and fro journey by Air from purchaser's Headquarter, including fooding, boarding and lodging at the place of inspection and transit, if any for the purpose of Inspection and Testing.

WBSEDCL, if desired, will visit the contractor's premises/manufacturer's workshop and may proceed with the routine tests. Arrangements for such program shall be done by the contractor. The inspection setup and instruments must be provided by the contractor within the contract value.

The material shall have to be dispatched at site after inspection and clearance from the purchaser.

WBSEDCL, if desired, may test the delivered product (especially solar module) at site from any accredited laboratory of Govt. of India. The result of that test and subsequent decisions taken by the controlling officer will be bound to the contractor.

If during inspection at the contractor's or sub-contractor's, the offered material or equipment are not found in entire offered quantity or found in a part quantity or without any identification mark, the offer will be termed as "Fake Offer". The owner in that case shall ask the contractor to deposit a sum of Rs 50,000/- as penal measure. However, the referred material/equipment shall be inspected further on receipt of re- offer as well as deposition of specific amount, as above to the owner by the contractor.

16. REJECTION

If, as a result of an examination/testing, any plant, materials, design or workmanship is found defective and/or not in accordance with the Contract, WBSEDCL may reject the plant, materials, design or workmanship by giving notice with reasons. The Contractor shall then promptly make good the defect and/or ensure that the rejected/replaced item complies with the Contract.

If WBSEDCL requires this plant, materials, design or workmanship to be retested, the tests shall be repeated under the same terms and conditions. If the rejection and retesting cause WBSEDCL to incur additional costs, the Contractor shall subject to pay these costs to WBSEDCL.

17. ROYALTIES

The Contractor shall pay all royalties, rents and other payments for: i. Natural Materials obtained from outside the Site and ii. The disposal of material from demolitions and excavations and of other surplus material (natural or man-made), except to the extent that disposal areas within the Site are specified in the Contract.

18. SUPPLEMENTARY/EXTRA WORKS

Whenever supplementary/extra items of work become unavoidable for completion of the work in all respect, the Contractor shall bring the matter to the notice of the Controlling Officer and submit their proposal. However, the controlling officers shall have the right to advise the contractor to proceed with such item (s) of work. Rates for supplementary items shall be arrived at as given hereunder:

- 18.1 The rates of all supplementary items shall be decided on pro-rata basis from the existing items in the contract.
- 18.2 When above clause no 18.1 shall not be applicable the rates shall be taken from P.W.D. (WB) schedule of rates for building works, sanitary & plumbing works effective from 01.07.2014 including addenda and corrigenda published up to date of bid opening subject to plus/minus the contractual rate of quotation.
- 18.3 When clause no 18.1 & 18.2 above shall not be applicable, the rates should be analyzed, to the mutual acceptance from present market rates of different elements involved in the item, against documentary evidence, with 5% overhead, contractor's profit as 10% and 1% cess towards BOCWWC Act,1996. In that case contractual rate of quotation

will not be applicable.

Controlling Officer's decision regarding finalization of rate of non-scheduled item(s) shall be final and binding upon the contractors.

19. COMMISSIONING

After the erection and testing of the equipment/works as per above, commissioning of the plant and works shall be carried out and here the term "Commissioning" shall mean the activities of functional testing of the complete system after erection and testing, including tuning or adjustment of the equipment for optimum performance and demonstrating to the owner that the equipment performance meets the requirements of the specifications.

The contractor needs to submit the time schedule for the site work with their detailed design report considering the above factors.

20. DISPUTES

The parties shall take necessary steps to settle any dispute through amicable mutual discussion with issuing prior notice in writing to other side at least 15 (Fifteen) days in advance.

21. JURISDICTIONAL MATTER

If such disputes did not get resolved then either party may approach court of law. All litigation matters between the parties if any shall be held in any Court in Kolkata under the superintendence of High Court Calcutta.

22. ACCOMMODATION

The accommodation of the contractor's Engineers and workers at the site is to be arranged by the contractor. WBSEDCL may arrange the same upon availability of at the nearest field hostel in chargeable basis after receiving request letter from the contractor.

23. NIGHT AND HOLIDAY WORK

None of the permanent work related to contract shall be carried out during the night or Sunday or on other holiday of WBSEDCL without permission in writing of the Controlling Officer of WBSEDCL.

24. SURVEILLANCE

The contractor shall in connection with the works provide and maintain at his own cost all lights, guards, fencing and watching when and where necessary or required by the WBSEDCL or by any competent authority or statutory or other authority for the protection of the works or for the safety and convenience of the public or others.

After final commissioning of the plant, arrangement of security (minimum 1 no. of armed security guard and 3 nos. of security personnel in each of the three shifts) shall be a scope of the operation and maintenance.

PTZ (Pan-Tilt Zoom) outdoor camera as per requirement shall be deployed to cover the whole plant with night vision and central monitoring through 40" LED monitor/TV for surveillance during construction as well as after commissioning of the plant.

25. CLEARING SITE ON COMPLETION

On completion of the works the contractor shall clear away any and remove from the site all constructional plant, surplus materials, rubbish, debris and temporary

works of every kind and leave the whole of the site and works clean and in a good and tidy condition to the satisfaction of the Controlling Officer of WBSEDCL.

The contractor shall dismantle and remove the staging and other temporary structures like stores, offices, labour camps etc. on completion of work, clear and clean the site where such temporary facilities were built and restore the same to original condition.

26. TRAINING FOR WBSEDCL PERSONNEL

The Contractor shall arrange training program at site for WBSEDCL personnel. The duration of the training program shall be minimum 07 (seven) days. The contractor shall provide training materials at least 07 (seven) days before commencement of training programme. The training shall be the part of contract and no extra amount shall be provided for organizing the training programme.

SECTION: V
TECHNICAL SPECIFICATIONS

1. CIVIL WORKS

All civil works shall conform to the latest Indian standards, codes etc as where applicable or to equivalent applicable international standards approved by the engineer-in-charge. Civil works include but not limited to the following items whichever necessary for implementation of the Solar PV Project. All civil works should be carried out as per the relevant standards and guidelines /WB PWD Schedule of Works.

1.1. Scope

The purpose of this chapter is to establish the technical specifications governing the civil execution of photovoltaic engineering and construction.

All works included under this contract will be executed in accordance with the bidding documents, technical specifications and other contract documents. Differing interpretations of documents shall be resolved at the discretion of the Employer. All design drawings have to get the final approval of the Employer before implementation. The design calculation for all structures including the solar module mounting structures is to be submitted in STAAD RUN file, on separate CD or Pen Drive.

1.2. Topographical Works

The instrument needed for this type of work is a GPS with centimetre topographic accuracy and work with RTK (Real-Time Kinetic).

Prior to the start of work, the Contractor shall obtain the approval of the Employer of instruments to be used in carrying out the work and shall provide:

- a. Technical list of the instruments and equipment to be used to perform the work.
- b. Calibration certificates.

To create a primary network database that will work during the entire implementation period, a study must be conducted to identify survey points in the installation area. Usually, it is enough to identify 3 reference points, but they must be selected to ensure visibility and permanence.

- a. The main network database will be completed with a dense secondary network necessary to ensure coverage of all surveying needs. Before starting the works, the Contractor shall verify the land in the presence of Employer. The general plan setting out the coordinates of the vertices of the network main work base shall be signed by the representatives of both parties.
- b. The Contractor shall be responsible for the conservation of these points, signals and markers. If in the course of the works some are destroyed, the Contractor must replace them at its responsibility and expense.
- c. First implementation must be done using main network to minimize mistakes. The main elements to consider in implementation are the foundations and the points to fix the structures, the inverters, buildings, axis of roads, axis of electrical and control canalization, electrical substation and the main equipment, and especially the perimeter of the working area.
- d. The Contractor is obliged, whenever necessary, to stop works to perform checks with the Employer, without special compensation.
- e. When works finish, the contractor will make a final topographic check to edit the as-built drawings.

1.3. Soil Investigation and Contour Survey

- a. The Contractor shall be responsible for detailed soil investigation and contour survey at required locations for the purposes of foundation design and other design/planning required for the successful completion of the project.

- b. The Contractor is advised to and is solely responsible 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, HT lines, etc. Please note however that a soil investigation has already been carried out and is annexed to this document.
- c. The Contractor shall carry out soil investigation through any Govt. approved / certified soil consultant who is enlisted by the Employer. These reports shall be furnished to the Employer prior to commencing work.
- d. 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.
- e. All RCC works shall be provided of required grade of concrete as per relevant IS specifications as well as soil data considering appropriate earthquake seismic zone, wind velocity, weather effect, soil characteristics etc.
- f. Soil Investigation Report, Soil Resistivity Report, bore log records, ERT reports and contour survey is available with the Employer and may be shared in due course of time.

1.4. Local Weather Conditions and Risk of Shadowing

- a. The Contractor shall obtain and study earthquake and wind velocity data for the design of the PV module mounting structure, and consider all parameters related to the weather conditions like temperature, humidity, flood, rainfall, ambient air etc. Design works shall consider worst cyclonic conditions. Please note that a preliminary structural integrity study has been conducted and is annexed to this document. It is expected that the structural integrity calculation of the proposed PV module mounting structure is conducted using the same assumptions and input parameters as in the version annexed to this document.
- b. The Contractor shall carry out a 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 Employer for its review / suggestions / approval.

1.5. Earth Works

1.5.1. Land Cleaning

- a. This chapter includes the extraction and removal in designated areas of all trees, stumps, weeds, plants, debris, trash, land waste and any other undesirable material, if required.
- b. Depending on the type of terrain of each area, the amount of topsoil to be removed and poured into the dump, must be determined to ensure there is no organic material.
- c. If dumping is carried out of the area affected by the project, the Contractor shall obtain, by their means, suitable sites for this purpose, and shall also provide the owner copies of contracts with the Employers of the affected lands.
- d. The Contractor is responsible levelling of ground for commencing the project. Only the area required for building the SPVPP and necessary infrastructure (e.g. internal roads, buildings, water evacuation systems, etc.) shall be levelled. It is to ensure that land must be graded with and levelled properly for the flow of water. The finished ground level shall be determined considering high flood level of the site area and accordingly, land development has to be done.

- e. If the land pocket needs any filling of earth or sand, it is to be ensured that the filled earth is well compacted as per the relevant IS standards. Compaction of minimum 95% shall be required for finish.
- f. The Contractor shall take reasonable care to ensure that the plant is aesthetically designed with proper landscaping by covering open areas with grass turf or similar.
- g. Site will be handed over with demarcation.

1.5.2. Demolitions

Works consist of the demolition of all buildings or building elements, such as roads, buildings, concrete pieces or others needed to be removed for the execution of the work if required. These materials must be carried to an authorized discharge point. The scope of the work is to be estimated during the site visit.

1.5.3. Trenches and Pits Excavations

- a. The excavations dimensions will adjust to drawings, in any case, cannot be lower than these.
- b. When performing digging foundations, axis must be centered with respect to the armatures or structure.
- c. When the terrain features force to perform shoring, or water removal, these tasks will be in the Contractor's scope.

1.6. Internal Roads

- a. Internal Roads shall include: Main Road from nearest access road to main control room and Secondary Roads within the SPVPP boundary.
- b. The internal roads shall be made according to the Bid of the Contractor and accepted by the Employer. For that, the design must comply with the technical specifications below.
- c. The design must be approved by the Employer to serve expected traffic and geotechnical land characteristics. The Contractor will be responsible to design them considering the needs during construction and O&M.
- d. In general terms, it is necessary to provide cross slope at roads to ensure that will be discharged into drains along the path, the usual value is near 2%. Also, the water recollected at the longitudinal drains must be carried until a point where it could be evacuated or stored.
- e. For designing any road, general longitudinal slope must be less than 8%. To design the radius of curves, it is necessary to consider the size of trucks to carry materials for construction (concrete, steel, gravel, sand, others), PV modules, Battery systems, electrical equipment (cabinet, transformers, inverters, others). As a general consideration, it's necessary 15 meters of radius in the internal line.
- f. It is necessary to make fire-protection access roads to all buildings and structures. This kind of roads will fulfil National Fire Protection Association (NFPA) requirements or local requirements if mandatory.
- g. The road must be well compacted as per the relevant IS standards and updated till date. All approach and internal roads shall be Concrete Road with proper base development. Pathways would be of brick soling with of 75 mm thickness. Also, all cable crossings and other crossings shall be provided with Hume pipes.

Main Roads: The useful width of the main roads must be at least 4.5 meters. This main road network must be of 4 inch thick R.C.C. road to ensure a good transit during construction and during operation and maintenance phase. This main road is the axis to the secondary roads to arrive to main equipment (inverters and transformers).

Secondary Roads: The roads between all field inverters/BESS plant and main roads are part of the secondary road network these roads are 4m wide and shall be comprised of 4 inch P.C.C over Brick Flat Soling. The rest of spaces between PV array rows could be made levelling and compacting. The secondary roads are to be planned by the Contractor.

1.7. Ditches for Electrical/ Control Cables

To install electrical and control cables, the laying of cables can be under PVC tubes and covered by sand. To ensure the protection of tubes and cables, a minimum depth 800 mm from top of tubes is required. It is necessary to guarantee separation between power cables (low and medium voltage) and control cables. Whenever possible, cables must be in the same level. Tubes must be marked with different colours to differentiate low/medium voltage and control.

Dimensions (width) of the ditches will adapt to the number of tubes and cables to allow. One side in ditch is designed for power cables, while the opposite one is designed for control cables, with a minimum separation of 300 mm. In the case of medium voltage, each tube allows only one electrical circuit. The minimum diameter of tubes is one and a half times the dimensions of cable. The internal size of the tubes must be smooth.

It is necessary to install precast registers along the ditches to allow good installation and maintenance.

The sand used as a coating for medium voltage cables and copper cable is screened sand without fines present in an amount that causes excessive washing it by the effect of possible rainwater. The filler material will be selected, thereby eliminating for fillings with particle sizes liable to damage the cable. The maximum size of the sand in direct contact with tubes must be 6 mm.

In the bottom of the ditch, before laying tubes, the sand bed must be ensuring a good levelling to avoid folds.

All elements in the implementation part of the trenches will be recognized with a corresponding certificated mark quality, complying with current legislation applicable to them.

1.8. Drainage Ditches

Drainage ditches are to include but not limited to the following:

1.8.1. Rainwater Drainage

- a. To ensure good rainwater drainage of the working area, the Contractor must design a collecting water method useful to maintain dry all the roads and ensure that water will not accumulate around electrical equipment and buildings.
- b. Collected rain flow must be directed to the low-level points/water body, near the channel, at the north of the working area. Thus, all the drainage lines go from south to north.
- c. There are several possibilities for this kind of ditches, the Contractor could choose between the most advantageous solutions considered. If the solution is an open channel, it must be of concrete, with through manufacturing or precast solution.
- d. If the solution is to make an underground filter trench, it's necessary to dispose control registers at least every 80 meters.
- e. In any case the two solutions must ensure, firstly, that there is no leakage along pipeline, and of course the crosses necessary to vehicles, people and any cross with other pipelines are to be considered.
- f. All other internal drains are to be done by excavating the drain of required size and with required trapezoidal section, with brickwork as per suitability, with necessary plaster and neat cement finish.

1.8.2. Storm Water Drainage

- a. The storm water drainage shall be planned for the SPVPP and BESS to ensure no water stagnation in the plant.
- b. The drains must be constructed with brickwork masonry as suitable for the site conditions.
- c. The drains outfall must be connected to the nearest drain outside the plant premises. It is advised that the drainage for the plant must be designed keeping the natural flow of water to the nearest exit point.
- d. The Contractor is to provide RCC Hume pipe at the crossing of road and drains and at required locations.
- e. The peripheral drain shall be of brick pitching which is backed up by cement mortar bed and all joints are filled up with cement mortar in C.M. 1:4. No pointing and plastering is required.

1.9. Design Loads

Loads are divided into categories:

- a. Permanent load (self-weight of structure and PV panels)
- b. Temporary Loads (all other loads-imposed loads)
 - i. Long-term load-acting for a long period (storage load, people, machinery)
 - ii. Short-term – acting for short periods of time (wind).
- c. Special loads (earthquake, explosion)
- d. Minimum Live Load: 0.25 KN/M²

Value of overloads (temporary loads):

- a. Basic wind speed 50m/s as per IS 875 Part 3/ local regulation. Earthquake: Per local regulation.

The buildings constructed in seismically active areas, during settlement term of operation shall observe the requirements of seismic stability and provide safe stay of the people, safety of designs with earthquakes of calculated intensity.

1.10. Peripheral Boundary

Peripheral Boundary wall already present at Project site. Repair of Boundary wall wherever required and painting is under the scope of Contractor. G.I 600 mm dia Helix Concertina along with 4nos. CONSEC runners, mounted on Y-angle duly approved by the department is to be fixed over the existing boundary wall.

1.11. Fencing

Fencing wherever required will be under the scope of contractor. The quality of the material to be used for fencing shall be G.I Chain link fencing, of mesh size 75x75 mm. with wire dia 4.0 mm. & conforming to IS:2721-2003 supported on GALVANISED Steel post with necessary foundation. Total height of fencing should not be less than, 2.4m to avoid any unauthorized access to the plant.

1.12. Buildings

- a. All offered building components and materials must be suitable for operation under the extreme climatic conditions prevailing at the site. The respective technical measures planned by the Contractor shall be described in detail in the Detailed Design Report.
- b. Local Control Room(L.C.R) building/s are required to be constructed for housing the electrical equipment/ panel as per design and one single storey main control room building having minimum

carpet area 250 Sqm, is required to be constructed housing, BESS Control Room, office room (02 numbers), Conference room (minimum sitting capacity for 15) numbers of people), Pantry, Ladies and Gents toilet, (for the operation & maintenance of SPVPP) & store (for spares).

- c. The local control room buildings shall be provided with spiral staircase, to provide access to roof of the building, from outside and the main control room building, shall have staircase (within), in order to access the roof of the building. The roof of the buildings shall have a suitable railing to prevent falling off.
- d. Buildings shall be constructed with conventional RCC framed structure with brick partition walls. The equipment room shall be designed as per the OEM recommendations to ensure desired life of equipment.
- e. Plinth level of all buildings shall generally be kept minimum 600 mm above the FGL/300 mm above H.F.L, of the area under consideration-whichever is higher.
- f. The Contractor shall furnish the drawing of the proposed buildings to the Employer for approval, prior to construction.

1.12.1. RCC Works

Minimum M25 Grade concrete, with Fe500 HYSD bars are to be used.

1.12.2. Brick Works

- a. Brick works, shall be made in cement mortar (CM) (1:6), both for 10"(inch) thick outside wall and for 5" (inch) thick partition wall.
- b. All brick works shall be made, using 1st. class bricks, of approved quality, and conforming to IS:3102.

1.12.3. Doors and Windows

- a. Doors, windows and ventilators shall be with necessary glass panels including all fixtures and painting, complete.
- b. Doors and windows shall be made of aluminium sections. Thickness of door frame shall be 2.5 mm, and remaining section of door shall be provided as 2.00mm thick (min.).
- c. All sections shall be 20 microns anodized.
- d. Sections of door frame and window frame shall be adopted as per industrial standards.
- e. Door shutters shall be made of aluminium sections and combination of particle board (Exterior Grade) and clear float/ wired glass.
- f. The control room shall require a number of windows/ louvers to provide ventilation/ fresh air circulations.

1.12.4. Plastering

All faces of brick work (both internal and external) shall be plastered, with cement mortar (1:6), both for 10" thick and 5" thick wall and all ceilings shall be plastered with cement mortar (1:4) as per IS 1542.

1.12.5. Flooring

- a. Flooring of store shall be of ASF / artificial stone floor with concrete mix (1:2:4) using 10 mm aggregates as per IS 2571.
- b. Flooring for control room building, equipment room and other places shall be of vitrified tiles of thickness 8 mm.
- c. For toilet area, the floor shall be of Kota stone of 18mm thicknesses.
- d. The floor finishing must include skirting up to a suitable height / 200mm.
- e. The wall tiles, if proposed, shall be glazed tiles of 6 mm thickness and provided up to lintel level.

- f. The battery room shall be provided with acid-proof tiles, with skirting up to windowsill level.

1.12.6. Roofing

The roof of the building shall be heat-insulated and waterproof (skid concrete) and both heat insulation and waterproofing shall be done as per relevant IS standard.

1.12.7. Plinth Protection

- a. Plinth protection 1000mm wide shall be provided around all the buildings.

1.12.8. Painting Work

- a. Internal walls – Acrylic emulsion including two coats of cement primer and putty.
- b. External walls – Two coats of weather proofing painting with two coats of primer.
- c. For painting of steel surface, synthetic enamel paints of super gloss variety shall be used.

1.12.9. Rolling Shutters

Rolling shutters made of cold rolled strips shall conforming to IS 4030 with approved gauge thickness shall be provided with all fixtures, accessories, painting all etc. complete.

1.12.10. Main Gates

Installation of Main Entry Gates for the Project are required at 4 different locations.

1.12.11. High Mast

14 no. High Masts of 16 Mtr height with minimum 6 no. arms to be installed at the peripheral boundary. All the arms of high masts to be provided with Flood lights with the following specifications:

Parameters	Values
Power Consumption	200 Watt (approx.)
Luminous Flux	Minimum 24000 Lumen
Correlated Colour Temp.	5700 K
PF	0.95
SPD	Minimum 10 KV
Input Voltage	220-240 V (50Hz)
Ingress Protection	IP-66 outdoor waterproof

1.12.12. Module Cleaning System

RO plant with bore well, water storage & water supply facility for Module cleaning shall be provided irrespective of the water quality of the site.

1.12.13. Water Supply

GI pipes of medium quality with GI fittings to be used for Delivery line at OH tank. The UPVC/CPVC pipe may be used for rest pipelines.

1.12.14. Plumbing and Sanitary

- a. Sanitary fittings, which include water closet, wash basins, sink, urinal fitting including flushing tank, and necessary plumbing lines shall be provided for office cum stores building and security house.
- b. The specification of materials shall be heavy quality as followed by WB PWD SOR and shall be approved by the Engineer-in-charge.

1.12.15. Electrification of Buildings

- a. Electrification of buildings shall be carried out as per IS 732 and other relevant standards.
- b. The lighting design of the buildings shall be carried out as per IS 3646.
- c. The building shall be provided with adequate quantity of light fittings, 5A/ 15A 1 phase sockets; fans etc., controlled by required ratings of MCBs and MCB, DBs.
- d. Supervisor room must be fitted with suitably sized HVAC system.
- e. Latest energy efficient equipment for the electrification and illumination is to be used.

1.12.16. Toilets

Toilet shall be designed for 30 persons; and constructed with following finish:

- a. Floor: 18mm thick kota stone/vitrified tiles
- b. Door- FRP door and Window- Made out of Anodized Aluminium Sections, with 6mm thick float glass
- c. Ventilators: Mechanical exhaust facility
- d. Plumbing fixtures: Approved make & heavy duty.
- e. Sanitary ware: Approved standard make & heavy duty.
- f. WC: 580X440 mm Orissa pattern with health facet, toilet paper roll holder and all fittings with approved make.
- g. Urinal (465 x3550 x 265 mm size) with all fittings.
- h. Wash basin (550 x 400 mm) with all fittings.
- i. Bathroom mirror (600 x 450 x 6 mm thick) hard board backing.
- j. CP brass towel rail (600 x 20 mm) with C.P. brass brackets.
- k. Soap holder and liquid soap dispenser.
- l. Overhead water tank equivalent of 2,000 litre capacity.

1.12.17. Drainage for Toilets

- a. Drainage pipes with all accessories shall be of UPVC (B Type) conforming to IS-13592-1992.
- b. Inspection chambers, septic tank for 30 users and soak well to be constructed for above mentioned requirement.

1.12.18. Watchman Towers and Security Cabins

- a. The Contractor shall provide suitable numbers of watchmen towers at strategic locations within of the SPVPP. The National Building Code of India 2005 (Group 1 to 5) shall be followed.
- b. The minimum size of watchmen tower is 2.0 m x 2.0 m size and height of 5.0 m with appropriate

shed at the top.

- c. Location of the watch tower (minimum 9 nos.) will be as directed by the Employer.
- d. The RCC framed structure Security Cabin of size 3 m x 3 m with a toilet of size 1.2m x 1.0m at the main entrance gate shall be designed and constructed by the Contractor keeping in view the safety and security of the SPVPP.

1.13. Steel Structure

1.13.1. Module Mounting Structure

- a. The module mounting structure shall be fixed axis ground mounted, suitable for the selected PV technology by the Employer.
- b. Bidders are required to offer prefabricated mounting structures with no onsite fabrication or galvanization work.
- c. Bidder shall design the structure in such a way that adequate space at the upper end of the modules is to be left to allow hot air to escape in a free flow manner.
- d. Tilt angle of the module mounting structure shall be finalized in such a way that maximum generation can be achieved.

1.13.2. Codes for Mounting Structure Design

- a. The solar PV mounting structures and allied ancillaries shall comply with the requirements of solar PV-specific standard regulations with updated amendments.
- b. One No. STAAD Pro premium licensed software and one no. AUTOCAD or equivalent with lifetime license shall be provided.
- c. Module Mounting Structure should be designed following limit state method. The following codes and references have been referred for the design of Module Mounting Structure:

Indian Standard Codes		
3	IS800 latest edition	Code for General Construction in Steel.
4	IS456-2000	Plain and Reinforced Concrete-Code of Practice
5	IS 1893-Part 4-2005	Criteria for Earthquake Resistant Design of Structures
6	IS875: Part 1&2	Code of practice for the design loads for buildings and structures-
7	IS875: Part 3-2015	Code of practice for the design of loads for buildings and structures-Wind Loads
8	IS:801-1975- REAFFIRMED-2010	Code for General Construction in Steel.

1.13.3. General Requirements

- a. All offered system components and materials must be suitable for operation under the extreme climatic conditions prevailing at the site. The respective technical measures planned by the Contractor shall be described in detail in the Detailed Design Report.
- b. The module mounting structure shall be fixed ground mounted designed for applicable wind and seismic loading at the project site. Bidders shall thoroughly study the geotechnical investigation studies conducted by the Employer for the project site prior to design of mounting structures.

- c. The mounting structures may be indigenized with equivalent international quality standards.
- d. Mounting structures shall use PV module manufacturer recommended installation accessories like mounting clips, rails, racks etc. The design shall be approved by the module manufacturer prior to fabrication. Any such approval shall be submitted to the Employer for approval prior to fabrication of the same.
- e. No on-site fabrication will be permitted; all the structure members shall be factory fabricated and only assembled on site.

1.13.4. Technical Requirements

- a. The Module mounting structure design shall be appropriate and innovative. It must follow the existing land profile.
- b. The structure shall be designed to allow easy replacement of any module and shall be in line with the site requirement.
- c. Design drawings with material selected and their standards shall be submitted for prior approval.
- d. The bidder shall design the structure height considering highest flood level at the site. The minimum clearance between the lower edge of the module and the ground shall be the higher of (i) 300mm above highest flood level at the site and (ii) 800 mm.
- e. There must be sufficient gaps between the rows of the panels and all precautions to be taken to avoid any shading on the panels.
- f. The module alignment and fixed tilt angle shall be calculated to provide the maximum annual energy output. This shall be decided based on the location of array installation.
- g. The mounting structure for fixed tilt angle shall be designed for simple mechanical and electrical installation. It shall support SPV modules at a given orientation, absorb and transfer the mechanical loads to the base properly. Welding of structure at site shall not be allowed.
- h. The array structure shall be so designed that it will occupy minimum space without sacrificing the output from SPV panels at the same time.
- i. All fasteners shall be of stainless steel of grade SS 316 and must sustain the adverse climatic conditions. Two numbers of anti-theft fasteners of stainless steel on two diagonally opposite corners for each module shall be provided. Clamps/bolts shall use EPDM rubber and shall be designed in such a way so as not to cast any shadow on the active part of the module. All these nuts and bolts have to be got approved from the department.
- j. Nut & bolt, supporting structures including module mounting structures shall have to be adequately protected from atmosphere and weather prevailing in the area.
- k. The Mounting structure shall be grounded properly in line with IS 3043.
- l. The support structure & foundation shall be designed with reference to the existing soil condition in order to withstand wind speed of the location as given in relevant Indian code for wind (IS 875 Part III, latest edition) and seismic load (IS 1893, latest edition).
- m. The module mounting structure shall be designed as per prevailing IS 800 and IS 801 and Sections shall be as per IS 808 and IS 811 (Latest edition) and shall be safe against wind and seismic force. Detailed design including STAAD output file shall be submitted for final approval. The minimum thickness of the structural sections:
 - Stub/Column-3.15 mm
 - Rafter-2.5 mm
 - Bracing/Purlin & other members -2 mm,

However, the final thickness of the structure shall be arrived by structural analysis, considering combination of all possible loads. The members are to be designed taking into consideration the hot & humid nature of the area.

- n. The array structure shall be made of hot dipped galvanized steel of suitable size. The specification of steel should be as per relevant IS 2062 (Latest Edition). The thickness of galvanization should be as per the relevant standards for galvanization, subject to, a minimum of 80 microns. It is to ensure that before galvanization the steel surface shall be thoroughly cleaned of any paint, grease, rust, scale, acid or alkali or such foreign material as are likely to interfere with the galvanization process. The bidder should ensure that inner side should also be galvanized. All galvanized materials shall withstand tests as per IS 2633.
- o. Foundation is to be provided with piling if necessary. Foundation should be of minimum M25 grade of concrete (with provision of cube test as per relevant IS code). Design should be such that the foundation should be safe against the Soil Load Bearing Capacity as obtained at site. The work includes necessary excavation, concreting, curing, back filling, shoring & shuttering etc. F
- p. For multiple module mounting structures located in a single row, the alignment of all modules shall be within an error limit of maximum 10 mm.
- q. The bidder/manufacturer shall specify installation details of the PV modules and the support structures with appropriate diagram and drawings.
- r. Bidder must submit all the quality test documents and test certificates complying with the requirement of the structure.

1.13.5. Construction

- a. The mounting structures shall be tested for stability with minimum deflection and sagging. Maximum permissible limit for sagging shall be 5 mm for designed wind speed.
- b. Minimum clearance of 800 mm or maximum flood level of the site, whichever is more shall be maintained from the ground at the lower height end of mounting structure.
- c. The mounting structure shall be hot dip galvanized steel having thickness 80 micron
- d. The minimum quality of steel must be with a yield strength 350 N/mm². All the structure members shall be hot dip galvanized in accordance to European standard EN1461 or the Indian Standards. Minimum Thickness calculation to be approved by Employer.
- e. The results of the corrosion study are to be seen as a minimum requirement. The Contractors ultimately responsible for ensuring optimum corrosion protection. This must be sufficient at his discretion, so that the computed coating layer thickness could also go beyond 116-120 µm, if required. The IS Code 2620 (1985) shall be followed.
- f. All connection solutions must be bolted.
- g. Mounting structures shall be designed to facilitate easy replacement of PV modules.
- h. The structure shall be designed with appropriate distance between two modules.
- i. The structure shall have provision to connect the earth cable joining one structure to the other. Connecting PV modules and structure to same ground cable.
- j. The structure design shall include a method of fastening the DC cables to the structure at every 50 cm without causing tearing or fluttering of cables.
- k. Adequate air gap shall be maintained between the modules and mounting structures; this isolation shall be achieved by appropriately sized UV resistant EPDM washers.
- l. All fasteners connecting the members of the mounting structure shall be fastened before the connectors holding the solar modules are fastened.

1.13.6. Quality Demonstration

The Contractor under the implementing consultant supervision and in agreement to project specifications shall demonstrate the quality of supply and workmanship on site during mounting and erection. This will essentially include:

- a. Construction of civil foundations and structure: Essential quality observation shall be on the accuracy of top levels of foundations.
- b. Supply and installation of PV module mounting structure: Essential observation on structure alignments and ease of prefabricated structure erection.
- c. Fixing of PV modules: Essential observation shall be accuracy of module alignment, examining modules under stress and sagging effect along the length and width of mounting structure.

1.13.7. Conditions for Quality Demonstration

- a. Manufacturers / Contractor are expected to submit the quality plans and installation method statements.
- b. The Contractor must offer time frame for supply and installation of mounting structures in all respect.
- c. Quality evaluation will be carried out by the Project Implementation Consultant (PIC) on the sample supplies and installation. The PIC will be under contract of the Employer.

1.13.8. Submission

- a. Technical write-up giving complete design, specifications and information of mounting structures, material used, fabrication process, treatments performed, standards followed, types of bolts used, etc.
- b. General arrangement drawing of mounting structures, foundation plans, anchoring plans, overall dimensions, installation plans, structural plans and elevation and framing details.
- c. Standard test certificates for various structure parts from independent testing laboratories.
- d. In case, hot dipped galvanization thickness certificate from the factory.
- e. Installation method statements and quality assurance plans.

1.13.9. Approval

- a. Proposed layout of the Module mounting structure fitted with equipment & other ancillaries as required over the proposed developed land profile shall be submitted with Detailed Design Report, and soft copy of STAAD file for approval.
- b. Design, drawings, specifications of all components with material selected & installation details shall also be included with Detailed Design Report.
- c. Approval of the Engineer in charge shall be taken before execution of the work at site.

The contractor shall deliver the product to the site only after receipt of such approval of drawing, and inspection of materials, from WBSEDCL, against their prayer in writing.

1.14. Civil Works and Site Infrastructure for BESS

1.14.1 Site Preparation and Drainage

The Contractor shall be responsible for complete site preparation, including clearing, grading, and levelling of the allocated land. A comprehensive stormwater drainage system shall be constructed to prevent flooding of foundations, equipment areas, and internal roads.

All drainage shall be designed to withstand monsoon rainfall and cyclone conditions, with channels, culverts, and stormwater outlets sized for extreme events. Foundations and access areas shall be raised

above the highest known flood levels. Landscaping and soil stabilization measures shall be implemented to minimize erosion.

1.14.2 Equipment Foundations

All equipment, including battery containers, PCS units, transformers, switchgear, and auxiliary systems, shall be installed on reinforced concrete foundations. Foundations shall be raised by at least 0.5 m above the highest flood level recorded at the site.

The structural design shall comply with Indian seismic codes and wind load requirements, ensuring resilience against earthquakes and cyclones. Soil investigation and geotechnical analysis shall be performed to determine the safe bearing capacity and settlement characteristics.

1.14.3 Steel Structures and Line Terminations

The scope of Works related to Steel Structures and Line Terminations shall Contract [Steel Structures and Line Terminations], include design and provision of the following:

- 1) Equipment steel supports and steel brackets for all relevant outdoor equipment.
- 2) Steel Structures for the 33 kV equipment.
- 3) Any other equipment needed to satisfy the requirement of Contract.

1.14.4 Security, Fencing and Lighting

The BESS facility shall be enclosed with a perimeter fence of at least 2.2 m height topped with barbed wire. Secure entry gates shall be installed with controlled access. CCTV cameras shall be provided at entry points, around the perimeter, and in all critical equipment areas.

Adequate lighting shall be installed along roads, around equipment areas, and on the perimeter fence to provide a safe and secure working environment. Lighting levels shall comply with Indian and international standards for industrial facilities.

1.14.5 Roads and Access Infrastructure

The Contractor shall construct reinforced internal roads with a minimum width of 4.5 m, designed to withstand heavy equipment transport during construction and long-term O&M. Roads shall be made of reinforced concrete or asphalt, with proper grading and drainage along both sides.

Secondary access roads with a minimum width of 1.2 m and pathways for maintenance personnel shall also be provided, ensuring connectivity between all equipment areas, buildings, and storage zones.

1.14.6 Buildings (offices, storage, sanitary, kitchen, visitor rooms)

BESS plant will share common building infrastructure with solar PV power plant. No separate building will be constructed for BESS plant. Building infrastructure to be shared with SPVPP shall include:

- Offices for administrative and technical staff
- A warehouse and indoor storage for spare parts and tools, dry and secure
- Sanitary facilities for staff and visitors
- A kitchen and small dining area for up to four persons
- Watchman cabins at the main entrance for 24/7 security

2. ELECTRICAL EQUIPMENTS/ WORKS

2.1 SOLAR PV MODULE

2.2.1 SCOPE

This section covers activities related to design, manufacturing, testing at works, supply, insurance, transportation and delivery at Project site, storage, erection, testing, commissioning of solar modules as detailed hereunder.

- Solar Mono-Crystalline modules N-Type Topcon Glass to Glass (G12R) having minimum capacity 600 Wp shall be used for the project for 50 MW (AC) with minimum 60 MW (DC) Solar PV Power Plant. However, the make, capacity, technical specification and the model no. of each module for the whole project shall be the same.
- The proposed solar PV plant shall be of capacity 50 MW (AC) along with their associated equipment. Total capacity of the Solar PV modules shall be designed to ensure minimum 60 MW (DC) and the Net Minimum Guaranteed Generation (NMGG) mentioned in the clause no. 12 of GCC of the tender document.
- The most accurate weather database available during plant design shall be selected in respect of climate data input for the site.

The scope of supply shall also include spare modules (as per spare l required for any normal or breakdown maintenance and special tools & plants required for erection & maintenance. Corresponding parts of all the equipment & spares shall be of the same specification & workmanship and shall be interchangeable. All the material & workmanship shall be of reputed make as have proven successful in their respective uses in similar services & under similar condition.

2.2.2 STANDARDS

The PV modules must conform to the latest edition of any of the following IEC / equivalent BIS Standards for PV module design qualification and type approval:

Sl. No.	Standards	Description
1	IEC: 61215/IS: 14286	Crystalline silicon terrestrial photovoltaic modules – Design qualification and type approval.
2	IEC: 61730 – Part 1	Photovoltaic (PV) module safety qualification – Requirements for construction.
3	IEC: 61730 – Part 2	Photovoltaic (PV) module safety qualification – Requirements for testing.
4	IEC 62716 Ed.1	Photovoltaic (PV) modules - Ammonia corrosion testing
5	IEC: 61701/IS: 61701	Salt Mist Corrosion Testing of the module.
6	IEC: 62804	Test method for detection of Potential Induced Degradation of photovoltaic (PV) modules.

The proposed PV Module must have the Test Certificate issued from accredited test laboratories of Ministry of New and Renewable Energy, Government of India.

The test certificates issued from IEC accredited laboratories shall also be acceptable. The manufacturers shall get their samples tested as per latest norms of MNRE, Govt. of India.

PV Modules shall comply both the **ALMM list I & II** of MNRE approved Models and

2.2.3 IDENTIFICATION AND TRACEABILITY

Each PV module must use a RF identification tag (RFID), which must contain the following information:

- i. Name of the Plant Owner
- ii. Name of the manufacturer of PV Module
- iii. Name of the Manufacturer of Solar cells
- iv. Month and year of the manufacture (separately for solar cells and module)
- v. Country of origin (separately for solar cells and module)
- vi. I-V curve for the module
- vii. Peak Wattage, I_m , V_m and Fill Factor for the module
- viii. Unique Serial No and Model No of the module
- ix. Date and year of obtaining IEC PV module qualification certificate
- x. Name of the test lab issuing IEC certificate
- xi. Other relevant information on traceability of solar cells and module as per ISO 9000 series.

RFID for each solar module shall be provided inside or outside of the module and must be able to withstand environmental conditions and last the lifetime of the solar module as per latest MNRE norms.

All individual modules shall be provided with Name Plate label at the back of module which shall provide the information given below for identification. They shall be clearly visible and shall not be hidden by equipment wiring. Type of labels and fixing of labels shall be such that they are not likely to peel off/ fall off during the life of the panel. Name plate shall contain the following:

- i. Manufacturer's Name
- ii. Model Number, Serial Number
- iii. Overall Dimensions (W x L x D)
- iv. Weight (kg)
- v. Maximum Power (P_{MAX}), Voltage (V_{mp}), Current (I_{mp})
- vi. Short Circuit Current (I_{sc}), Open Circuit Voltage (V_{oc})
- vii. Nominal System Voltage
- viii. Relevant standards, Certification Lab details
- ix. "Property of WBSEDCL"
- x. Warnings, if any

2.2.4 AUTHORIZED TESTING LABORATORIES/ CENTERS

PV modules must qualify (test reports/ certificate from IEC/NABL accredited laboratory should be enclosed) as per the relevant IEC/IS standard. Additionally, the performance of PV modules at STC conditions must be tested and approved by one of the IEC / NABL Accredited Testing Laboratories including Solar Energy Centre (SEC). However, qualification certificate from IEC/NABL accredited laboratory as per relevant IEC/IS standard for the offered wattage capacity.

2.2.5 GUARANTEE BENCHMARKS

Product Guarantee

The Contractor shall be legally bound to provide a linear performance guarantee ensuring that PV modules of entire plant will be fully functional with desired output for at least 30 years from the date of commissioning. Consequently, irrespective of manufacturer's guarantee to the Contractor, the PV modules will be guaranteed against any manufacturing defect. Defects liability shall include but not be limited to glass, frame bowing, de lamination, water ingress, junction box arching, hot spots, etc.

The Product Guarantee will not be limited for PV modules but will also include termination connectors, cables and all associated accessories. In the event of failure during guarantee period, manufacturer shall replace and install modules free of cost or refund the then current market price of modules, transportation and installation shall apply.

Nominal Power Guarantee: In addition to the Product Guarantee, manufacturers shall grant linear Nominal Power Guarantee for a minimum period of 30 years. Under these guarantees the manufacturer shall ensure that PV modules will deliver nominal power output based on manufacturer provided annual degradation rate. The output shall be measured at string level. The PV Modules will have the following warranties.

Material Warranty

The manufacturer should warrant the Solar Module(s) to be free from (i) defects and/or failures due to manufacturing defects and/or failures due to materials, including PID defects and (ii) non-conformity to specifications due to faulty manufacturing and/or inspection processes for a period not less than twelve (12) years from the date of commission. If the solar Module(s) fails to conform to this warranty, the Contractor will replace the defective solar module(s) at site at no additional cost to the employer.

Performance Warranty

For crystalline Si modules, performance of all PV modules shall be warranted with more than 99% power output in the first year and 85% of minimum rated power at the end of 30 years with not more than 0.48% degradation over a period of one year.

If PV module(s) fail(s) to exhibit such power output in the prescribed time span, the Contractor will replace the PV Module(s) at site at no additional cost to the Employer.

2.2.6 TECHNICAL REQUIREMENTS

All offered system components and materials must be suitable for operation under the extreme climatic conditions prevailing at the site. The respective technical measures planned by the Contractor shall be described in detail in the Detailed Design Report.

Nominal Power Rating

For the proposed development at least 50 MW (AC) power plant, the minimum acceptable module power rating shall be 600 Wp at STC for crystalline Si technology. Contractor is expected to offer respective ratings based on manufacturer's production availability and compliance with the Employer's requirements.

Nominal Power Tolerance

The maximum tolerance for nominal power of modules shall not be more than -0 /+ 3%.

Efficiency

Minimum acceptable efficiency of all the modules under standard test conditions shall be at least 22% for crystalline Si modules.

Temperature Co-efficient

Variation in temperature has a significant effect on electrical parameters of PV modules; following are the expected temperature coefficients for all the proposed modules by manufacturers:

- Temperature Coefficient of P_{mpp} (-) 0.30%/°C or lower value in absolute.
- Temperature Coefficient of V_{oc} (-) 0.26%/°C or lower value in absolute.

Note: Only indigenously manufactured PV modules and Cells should be used in Solar PV Power Plants under this scheme. However, other imported components can be used, subject to adequate disclosure and compliance to specified quality norms and standards.

2.2.7 PERFORMANCE RATIO OF THE SOLAR PV PLANT

Performance Ratio of the plant calculated for any time period of measurement shall be minimum 80%.

PR - Provisional Acceptance Test Verification Procedure

The Performance ratio test aims at the comparison of the actual PV plant energy production with the guaranteed value for a limited operation time of the PV plant of 30 consecutive days.

After Commissioning of the Plant and after receiving all the satisfactory results regarding the correct operation of the plant, there will be continuous monitoring of the performance for 30 days. This monitoring will be performed on the site under the supervision of the Employer / Employer's engineer.

The final tests to prove the guaranteed performance parameters shall be conducted at site by the Contractor in presence of the Employer. The Contractor's commissioning / start-up Engineer shall make the plant ready to conduct such tests. The Performance Guarantee Tests (PG tests) shall be commenced, within a period of one (1) month after successful Commissioning. Any extension of time beyond the above one (1) month shall be mutually agreed upon.

Performance Ratio of the plant will be calculated as per IEC 61724: 1998 (Photovoltaic system performance monitoring - Guidelines for measurement, data exchange and analysis) and as per Technical Report NREL/TP-5200-57991.

$$\text{Performance Ratio (PR)} = Y_A / Y_R [1 - \alpha * (T_{\text{Cell avg.}} - T_{\text{Cell}})]$$

Where;

Y_A = Final PV system yield (representing the number of hours that the system would need to operate at its rated output power P_{Nom} to contribute the same energy to the grid as was monitored)

$$\text{Or, } Y_A = E_{ac} / P_{Nom}$$

Y_R = Reference yield (representing the number of hours during which the solar radiation would need to be at STC irradiance levels in order to contribute the same incident energy as was monitored)

$$\text{Or, } Y_R = \frac{I_R \text{ Site}}{I_R \text{ STC}}$$

$$E_{ac} = \text{AC Power generated at any point of time (kW)}$$

$$P_{Nom} = \text{Installed nominal peak power of modules (Flash test rating at STC) (kWp)}$$

IR Site	=	Irradiation on the module plane of array during a clearly specified amount of time (measured with a Pyranometer installed on the array plane) (kWh/sq. m)
IR STC	=	Irradiance at STC (kW/ sq. m)
Tcell avg	=	Average cell/ module temperature ($^{\circ}\text{C}$)
Tcell	=	STC cell/ module temperature ($^{\circ}\text{C}$)
α	=	temperature coefficient of power (negative in sign) corresponds to the installed module ($\%/^{\circ}\text{C}$)

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 $\pm 1^{\circ}\text{C}$.
- Shielded ventilated thermocouple with a measurement accuracy of $\pm 1^{\circ}\text{C}$.
- An anemometer mounted on a 10m mast to measure wind speed (without additional shadowing on modules).

During the comprehensive O&M period after commissioning, PR shall be tested in yearly basis considering 100% grid availability. However, WBSEDCL may check the PR at any time of the year for a period of minimum 7 days.

2.2.8 TECHNICAL REQUIREMENTS

- Modules shall be Mono-Crystalline (N Type TOPCon) type having capacity of minimum 600Wp (G12R).
- The module frame shall be made of anodized Aluminium or corrosion resistant material, which shall be electrically & chemically compatible with the structural material used for mounting the modules. In case of metal frames for modules, it is required to have provision for earthing to connect it to the earthing grid. Module frame thickness/Height should be minimum 35 mm, the anodization thickness shall not be less than 15 micron. Junction box of IP 67 rated with min 3 no. of bypass diode and MC4 connectors with 0.5 meter of TUV 2pfg 1169/09.07 certified Cu cable of 4 sq mm.
- Solar module shall be laminated using lamination technology using established Monomer (EVA: Ethylene-vinyl acetate).
- The EVA used for the modules should be of UV resistant in nature. No yellowing of the back sheet with prolonged exposure shall occur.
- The sealant used for edge sealing of PV modules shall have excellent moisture ingress protection with good electrical insulation (Break down voltage >15 kV/mm) and with good adhesion strength.
- The solar modules shall have suitable encapsulation and sealing arrangements

to protect the silicon cells from the environment. The arrangement and the material of encapsulation shall be compatible with the thermal expansion properties of the Silicon cells and the module framing arrangement/material. The encapsulation arrangement shall ensure complete moisture proofing during the whole life of the solar modules.

- The Module shall be made of high transmittance glass on both faces, front surface giving high encapsulation gain. The glass used to make the crystalline silicon modules shall be toughened low iron glass with minimum thickness of 3.2 mm for 144 half cut cell. The solar cell shall have surface anti-reflective coating to help to absorb more sunlight in all weather conditions with low iron content. The glass used shall have transmittance of above 90% and with bending less than 0.3% to meet the specifications.
- Module rating is considered under standard test conditions, however Solar Modules shall be designed to operate and perform as per installation site condition.
- All materials used shall be having a proven history of reliable, light weight and stable operation in external outdoor applications and shall have service life of 30 years.
- The modules should be 100% PID (Potential Induced Degradation) free and should comply with IEC 62804.
- Solar PV Module design shall conform to following requirement:
 - Weather proof DC rated MC connector and a lead cable coming out as a part of the module, making connections easier and secure, not allowing for any loose connections.
 - Resistant of water, abrasion, hail impact, humidity & other environment factor for the worst situation at site.
 - The PV Junction Box shall confirm IP 67 and shall have sufficient bypass diodes to avoid shadowing effects.
- Modules shall perform satisfactorily in relative humidity up to 85% and temperature between -10⁰C and 85⁰C (module temperature).
- The PAN file of the solar module shall be validated by Third party Lab.
- The developer shall arrange for the details of the materials along with specifications sheets of from the manufacturers of the various components used in solar modules along with those used in the modules sent for certification. The Bill of materials (BOM) used for modules shall not differ in any case from the ones submitted for certification of modules.
- Proof of procurement of components like cell, lamination material, frames, Glass, sealant etc), mentioning manufacturer name, manufacturing date and relevant test certificate shall be submitted at the time of pre-dispatch inspection and acceptance.
- No different quality/makes of back sheets shall be used in the single lot of supply of modules.
- The modules used in the Plant are to be freshly manufactured (not having manufactured before the last date of bid submission)
- The I-V characteristics of all modules as per specifications to be used in the systems are required to be submitted at the time of supply.
- SPV module shall have module safety class-II, fire safety class C and should be highly reliable, light weight and must have a service life of more than 30 years.

2.2.9 SPECIFICATION OF THE PV MODULES

Desired specification of the PV Module shall be as mentioned hereunder:

SI. No.	Item	Description
1	Type	Mono Crystalline Cell (N Type TOPCon G12R)
2	Efficiency of module	Minimum 22 % at STC
4	Fill Factor	Minimum 80 %
5	No. of cells per module	Half Cut 144 Cells
6	Module Frame	Non-corrosive and electrolytically compatible with the structural material, preferably anodized Aluminium.
7	Termination box	Thermo-plastic, IP 68, UV resistant
8	Blocking & Bypass Diode	Schottky type or any other advance technology
10	Power Rating	The nominal power of a single PV module shall be minimum 600 Wp (G12R)
11	Power tolerance	upto +3 %
12	Temperature co-efficient of power	Maximum - 0.30 % / °C
13	Glass	High transmittance glass with Anti Reflective Coating (ARC)
14	RF Identification tag for each solar module	Shall be provided inside or outside the module and must be able to withstand environmental conditions and last the lifetime of the solar module as per MNRE Norms.

2.2.10 APPROVAL

- The Detailed Design Report Submitted by the contractor to WBSEDCL must contain but not limited to the following details of the solar modules:
 - Detailed specification
 - Necessary Drawings
 - Type Test Report and Necessary Certificates etc.
 - Satisfactory performance certificate not less than 1 year from the date of publication of Bid.
- Joint inspections and testing will be done by WBSEDCL and the authorized representatives of the contractor at the manufacturer's workshop on regular basis for quality assurance and testing. Acceptance Tests as per relevant Indian Standard shall be carried out at the module manufacturer's workshop. Following tests as per relevant Indian Standard shall be carried out on certain number of modules from a lot (decided by WBSEDCL) as acceptance tests of Solar PV Modules:
 - Visual Inspection
 - Performance Test of the modules at STC and NOCT with Sun Simulator of Class B or better as per Indian Standard
 - Performance Test of the modules at low irradiance (200 W/m²) with Sun Simulator of Class B or better as per Indian Standard
 - Dielectric withstand test
 - Continuity and leakage current test
 - Insulation Resistant test
 - Wet leakage current test
 - Mechanical load test
 - PID Test report will be verified during the approval of the offered module and also during inspection one (1) sample for entire project will be selected randomly by WBSEDCL, which shall be tested at third party laboratory.
 - Any other test as desired by WBSEDCL

Arrangements for the aforesaid testing and inspection at manufacturer's end are to be provided by the contractor.

- Prior to the delivery of the product, the contractor shall submit but not limited to the following documents:
 - Guarantee Certificates
 - Instructions manual for installation and operation.
 - Test reports for routine tests and acceptance tests etc.
- The contractor shall deliver the product to the site only after receiving such approval against their prayer in writing from WBSEDCL.
- WBSEDCL may select certain number of modules delivered at site by the contractor on random basis for conducting performance test of those modules from any accredited test laboratory of MNRE/NABL. If there are any discrepancy found in the test results and the values specified by the contractor, the contractor will be bound to accept the decision made by WBSEDCL in respect of taking further course of action.

2.2 PV ARRAY CONFIGURATIONS

2.2.1 SCOPE

This section covers activities related to PV array configurations and design, manufacturing, testing at works, supply, insurance, transportation and delivery at Project site, storage, erection, testing, commissioning of array junction box as detailed hereunder.

The Solar array shall be configured in multiple numbers of sub-arrays, providing optimum DC power to auditable number of sub arrays. The Contractor shall submit their own design indicating configuration of PCU and respective sub arrays and associated bill of material.

- UV resistant Cable-ties (suitable for outdoor application shall be used to hold and guide the cables/wires from the modules to junction boxes or inverters. All the cables were aesthetically tied to module mounting structure.
- In case the string monitoring Box (SMB) is mounted on the module mounting structure, Contractor to take into consideration of the load thus added on the MMS. Accordingly, suitable supporting members for mounting the SMB must be designed and supplied. Separate structure for mounting of SMB can also be proposed.
- Every major Component of the Plant should be suitably named/ numbered & marked for ease of traceability, identification and maintenance.

2.2.2 STRING MONITORING BOX (SMB)

- a. Adequate number of SMBs shall be provided for termination of array string with inverter.
- b. The number and specification of PV Array Junction Box will be as per plant configuration.

The SMBs shall be suitable for interfacing with SCADA system and all necessary transducers shall be included in the scope of supply.

2.2.3 STANDARDS

The SMBs shall conform to the latest edition of following Standards except where specified otherwise in this specification:

Sl. No.	Standards	Description
1	IEC 61439	Low Voltage Switchgear and Assemblies
2	IEC60269/IS 13703	Low-voltage fuses
3	IEC 60529	Ingress Protection of Enclosure
4	IEC 62262	External Mechanical Impact Protection
5	IEC 61326	EMC Requirements of Electrical Equipments

6	IEC 61643-11	Surge Protection Device
7	IEC 62852	Solar cable connector
8	IEC 60695-2-11	Fire hazard test

Equipment meeting with other authoritative standards which ensure an equal or better quality is also acceptable. Where the equipment conforms to any other authoritative standard, the salient points of difference between the standard adopted and IS/IEC shall be clearly brought out in the tender. Complete set of documents and standards in English shall be supplied by the bidder without any extra charge. It shall, however, be ensured that equipment offered comply with one consistent set of standards except in so far as they are modified by the requirement of this specification.

2.2.4 TECHNICAL REQUIREMENTS

- The SMBs shall have suitable arrangement for the followings (typical):
 - Provide arrangement for disconnection for each of the groups.
 - Provide a test point for each sub-group for quick fault location and to provide group array isolation.
 - SCADA Communication device with all necessary equipment for communicating with main SCADA Server.
 - Suitable space for workability and natural cooling.
- All junction boxes should be equipped with appropriate functionality, safety (including fuses, grounding, contacts etc.) and protection.
- The junction boxes shall be dust, vermin, and waterproof and made of thermoplastic/ metallic in compliance with IEC 62208, which should be sunlight/ UV resistive as well as fire retardant thermoplastic material. Enclosure degree of protection shall be at least IP 67 and mechanical impact resistance Class II shall be at least IK 08.
- The terminals will be connected to copper bus-bar arrangement of proper sizes to be provided. The junction boxes will have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables. Suitable markings shall be provided on the bus-bars for easy identification and weather resistant cable ferrules will be fitted at the cable termination points for identification.
- SMBs shall have adequate ratings of solar DC fuses at the terminals (+ve as well as -ve), provided in recommendation with the inverter manufacturer. The fuses should be so designed that it should protect the modules from the reverse current overload.
- At outgoing side DC Disconnect or switches Switch of suitable capacity shall be provided.
- The SMBs shall also have suitable surge protection. In addition, over voltage protection shall be provided between positive and negative conductor and earth ground such as Surge Protection Device (SPD). The maintenance free earthing shall be done as per the relevant standards.

2.2.5 APPROVAL

The Detailed Design Report Submitted by the contractor to WBSEDCL must contain but not limited to the following details of the array junction boxes:

- Detailed specification
- Necessary drawings, BOM, Test & Performance certificates etc.

Prior to the delivery of the product, the contractor shall submit but not limited to the following documents:

- Guarantees
- Instruction manuals for installation and operation.
- Necessary test certificates

The contractor shall deliver the product to the site only after receiving such approval against their prayer in writing from WBSEDCL.

2.3 SOLAR INVERTER

2.3.1 SCOPE

This section covers the activities related to design, manufacturing, testing at works, supply, insurance, transportation and delivery at project site, storage, erection, testing, commissioning of Solar Inverters as detailed hereunder.

- a. Adequate number of PCU of minimum capacity having high quality, high efficiency and reliable operation. Total inverter capacity of the plant shall be in accordance with the PV array capacity.
- b. The rated power/name plate capacity of the inverters shall be the AC output of the inverter at 50°C.
- c. The scope of supply shall also include necessary spares, if any, required for normal or any breakdown maintenance for at least 12 (twelve) years and special tools & plants required for erection & maintenance. Corresponding parts of all the equipment & spares shall be of the same specification & workmanship and shall be interchangeable. Consumable items up to 12 Years O&M period shall be in the scope of the bidder.

All the material & workmanship shall be of reputed make as have proven successful in their respective uses in similar services & under similar condition.

The solar inverter/power conditioning unit shall be suitable for interfacing with SCADA system and all necessary transducers shall be included under the scope of supply. Warranty of Solar Inverters shall be 12 years.

2.3.2 STANDARDS

The equipments and materials covered by this specification shall conform to the latest edition of following Indian Standards or equivalent IEC standards except where specified otherwise in this specification:

Sl. No.	Standards	Description
1	IEC: 61683	Photovoltaic systems – Power Conditioners – Procedure for measuring efficiency
3	IEC 60068	Environmental Testing
4	IEC 62116 / IEEE 1547/UL 1741/ equivalent IS standard	Photovoltaic (PV) systems - Characteristics of the utility interface
5	IEC 61727 Relevant CEA/ CERC regulation and grid code (amended up to date)	Utility-interconnected photovoltaic inverters - Test procedure of islanding prevention measures
6	IEC 61000 series	EMC, harmonics, etc.

7	IEC 62109 (1&2), EN 50178 or equivalent	Electrical safety
8	Recommended practice for PV – Utility interconnections	IEEE standard 929 – 2000 or equivalent
9	IEEE 519	Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems Balance-of-system components for

Note: CEA Technical Standards for Connectivity to the Grid Regulations 2007 with 2013
and latest Amendment (if any)

Solar Inverters shall have certificate and approval from VDE, IEC, UNE, RD, EDF, BDEW etc. The inverters should have CE conformity according to LVD (Low Voltage Directive) and EMC (Electro Magnetic Compatibility) Directive for safety purpose.

Type test certificate issuing authorities should be any NABL/IEC Accredited Testing Laboratories or MNRE approved test centres.

Equipment meeting with other authoritative standards which ensure an equal or better quality is also acceptable. Where the equipment conforms to any other authoritative standard, the salient points of difference between the standard adopted and IS/IEC shall be clearly brought out by the contractor.

2.3.3 TECHNICAL REQUIREMENTS

- The inverter should be 3- Φ static solid state type power conditioning unit.
- Inverter/PCU shall be centralized grid tied in nature; Maximum Power Point Tracker (MPPT) shall be integrated in the power conditioner unit to maximize energy drawn from the Solar PV array. The MPPT should be microprocessor based to minimize power losses. The details of working mechanism of MPPT to be submitted with the detailed design report. The MPPT unit shall conform to IEC 62093 for design qualification.
- The minimum euro efficiency of the PCU as per IEC 61683 shall be 98%. The bidder shall specify the conversion efficiency at following load conditions i.e. 25%, 50%, 75% and 100% during detail engineering, which shall be confirmed by type test reports.
- Degree of protection: Minimum IP65 for Electronic section & minimum IP54 for rest part of Inverter.
- Nuts & bolts and the PCU enclosure shall have to be adequately protected taking into consideration the atmosphere and weather prevailing in the area.
- Only those PCUs/ Inverters which are commissioned for the design capacity till date in India shall be considered for this project with individual Inverter capacity to be selected as per site suitability. Contractor has to provide sufficient information to the satisfaction of the plant owner before placing the final order for PCUs/Inverters. Service centre of the PCU manufacturer must be in India
- All PCUs shall consist of associated control, protection and data logging devices and remote monitoring hardware and compatible with software used for SMB level monitoring.
- The dimension, weight, foundation details etc. of the PCU shall be clearly indicated in the technical specification to be submitted with the detailed design report.
- The PCU shall be capable of complete automatic operation, including wake-up, synchronization & shut down independently & automatically. Inverters / PCU shall operate in sleeping mode when there will no power connected.
- The Inverter shall have internal protection arrangement against any sustained fault in output line and lightning in the grid. AC protection boxes shall be provided at the inverter output which shall include over current, under voltage protection etc.
- Both AC & DC lines should have suitable fuses & surge arrestors and contactors (as per requirement) to allow safe start up and shut down of the system as per the type tested design.
- The inverter output shall always follow the grid in terms of voltage and frequency. This shall be achieved by sensing the grid voltage and phase and feeding this information to the feedback loop of the inverter. Thus control variable then controls the output voltage and frequency of the inverter, so that inverter is always synchronized with the grid. The inverter shall be self-commutated with Pulse width modulation (PWM) technology.
- The PCU shall be able to withstand an unbalanced load conforming to related IEC standard (+/- 10% voltage). 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 which may be unsafe or damaging. Faults due to malfunctioning within the PCU, including commutation feature, shall be cleared by the PCU protective devices and not by the existing site utility grid service circuit breaker.
- Operation outside the limits of power quality as described in the technical data sheet should cause the power conditioner to disconnect the grid. Additional parameters requiring automatic disconnection are over voltage, over current, earth fault, short circuit and reverse power.
 - The inverter itself shall consist of one circuit breaker for isolation from the circuit during any fault or maintenance purpose.
 - All three phases shall be supervised with respect to rise/fall in programmable threshold values of frequency.
 - The PCU shall be capable of controlling power factor dynamically.
 - The inverters shall operate satisfactorily within the operating ambient temperature range of -15°C to +60°C. The contractor shall assure that the inverter shall not de-rate up to +50°C ambient temperature.
 - To take care of PID (Potential Induced Degradation), the inverter shall have active negative grounding kit. [Only PID free Solar PV modules shall be used for the proposed plant and necessary test certificates shall be submitted.]
 - The inverter manufacturer shall qualify the Ministry of New & Renewable Energy (MNRE) Order No. 283/22/2019-Grid Solar Dated 23rd Sep 2020 for the Public Procurement (Preference to Make In India) including any amendments thereto, so as to Provide Purchase Preference (linked with local content) with respect to Renewable Energy (RE) Sector & Department for Promotion of Industry and Internal Trade (DPIIT) Notification No. P-45021/2/2017-PP (BE-II) dated 4th June, 2020 including any amendments, the procurement of Solar Inverter for the subject tender will be supplied through Class I Local Suppliers only. A 'Class-I local supplier' means a Supplier or Service Provider, whose Goods, Services or works offered for Procurement, has local content equal to or more than 50%, as defined under the above said orders
 - The PCU shall have the following main features for convenience of operation:
 - Auto 'Wake up': The system shall automatically "wake up" in the morning and begin to export power provided there is sufficient solar energy and the grid voltage and frequency is in range.
 - Stand – By Mode: The control system shall continuously monitor the output of the solar power Plant until pre-set value is exceeded & that value to be indicated.
 - Sleep Mode: Automatic sleep mode shall be provided so that unnecessary losses are minimized at night. The power conditioner must also automatically re-enter standby mode when threshold of standby mode reached.
 - Basic System Operation (Full Auto Mode): The control system shall continuously monitor the output of the solar power Plant until pre-set value is exceeded & that value to be indicated.
 - Following protections shall be provided with the inverter.
 - Over voltage both at input & output
 - Over current both at input & output
 - Over/under grid frequency
 - Synchronization loss
 - Anti-islanding Protection (IEEE 1547/UL 1741/ equivalent BIS standard)
 - Heat sink over temperature
 - Short circuit

- Protection against lightening
- Protection against unbalance phase voltage
- Power regulation in the event of thermal overloading
- Protection for each solid-state electronic device
- Surge arrestors to protect against Surge voltage induced at output due to external source
- Direct earth fault protection and body earthing
- Set point pre-selection for VAR control
- Insulation monitoring of the PV array with sequential fault location
- Any other protections required
- Inverters should have user friendly LED/LCD or touch display for programming and view on line parameters such as:
 - Inverter per phase Voltage, current, kW, kVA, frequency and power factor
 - Grid Voltage, frequency and power factor
 - DC voltage and current
 - Inverter Import export kWh summation
 - Solar kWh summation
 - Inverter ON/OFF
 - Grid ON/OFF
 - Inverter under voltage/over voltage
 - Inverter over load
 - Inverter over temperature
 - Any other if required

2.3.4 SPECIFICATION

Sl. No.	Operating Parameter	Desired specification
1	Input (DC)	
	PV array connectivity capacity	As per site requirement
	MPPT Voltage range	Compatible with the array voltage
	Number of MPPT Channel	As per design of the manufacturer.
	IGBT	Shall be of Infineon/ Fuji / Toshiba or equivalent Grade
2	Output (AC)	
	Nominal AC Power output	As per site suitability
	Number of Grid Phase	3
	Adjustable AC voltage range	+/- 10%
	Frequency range	+/- 5%
	AC wave form	Sine wave
	THD	Less than 3% at 100% load
3	General Electrical data	
	European Efficiency	98 % (minimum)
	No load loss	< 1% of rated power
4	Protection	
	DC Side	As mentioned in the Technical Requirement
	AC side	As mentioned in the Technical Requirement

	Isolation Switch	PV array Isolation switch (DC)
Sl. No.	Operating Parameter	Desired specification
	Ground fault detection device (RCD)	To be provided
5	Display	
	Display type	LED/LCD or touch display
	Display parameter	
	DC	As mentioned in the Technical Requirement
	On grid connected mode	As mentioned in the Technical Requirement
9	Interface (Communication protocol)	Suitable port must be provided in the inverter for i. On site upgrade of Software ii. On site dumping data from the memory iii. Plant based remote monitoring system
10	Monitoring	Matched with the monitoring and data logging system (SCADA)
11	Mechanical Data	
	Protection Class	As mentioned in the Technical Requirement
	DC Switch	Integrated
	Operating ambient temperature	-15° C to +60° C
	Relative Humidity	15 to 95 %
	Cooling	Forced cooling

2.3.5 APPROVAL

The Detailed Design Report Submitted by the contractor to WBSEDCL must contain but not limited to the following details of the Solar Inverter/Power conditioning Unit:

- Detailed technical description of the complete unit including necessary design calculations.
- Necessary Schematic & Other Drawings.
- Type Test Reports, Performance certificate from plant owner etc.

Joint inspections and testing will be done by WBSEDCL and the authorized representatives of the contractor at the manufacturer's workshop on regular basis for quality assurance and testing. Acceptance Tests as per relevant Standard shall be carried out at the module manufacturer's workshop. Following tests shall be carried out on certain number of Inverters from a lot (decided by WBSEDCL) as acceptance tests of Solar Inverters:

- Visual Inspection
- Performance Test and measurement of AC & DC parameters

- DC reverse polarity protection
- Islanding Protection
- Over Voltage & Under Voltage withstand
- Over Frequency & Under Frequency withstand
- Night consumption
- Any other test as desired by WBSEDCL

Arrangements for the aforesaid testing and inspection at manufacturer's end are to be provided by the contractor.

Prior to the delivery of the product, the contractor shall submit but not limited to the following documents:

- Guarantees
- Instructions for installation and operation, manual
- Safety precautions
- Test reports for routine tests and acceptance tests etc.

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBSEDCL.

2.4 INVERTER DUTY TRANSFORMER

2.4.1 SCOPE

This section covers the activities related to design, manufacturing, testing at works, supply, insurance, transportation and delivery at Project site, storage, erection, testing, commissioning of step up transformers and associated equipments as detailed hereunder.

- Adequate number of 3- Φ , multiple winding, oil filled, ONAN type cooled transformers with suitable capacity considering 0.9 power factor shall be provided to step up voltage from 3- Φ , Grid tied Solar Inverter output to 33 kV voltage level for feeding the generated power to the 33 kV switchyard.
- LV winding of the transformer will be connected to the output of inverters and the HV sides will be connected to the 33 KV line through VCB, Isolator etc. Transformers shall be Oil Type and placed outside of each control room.
- All the transformers shall be suitable for outdoor installation with 3 phases,
- 50Hz and shall be suitable for service under fluctuations in supply voltage up to plus 10% to minus 15%.

The scope of supply shall also include necessary spares required for normal operation & maintenance of transformers for a period of 5 (five) years & special tools & plants required for erection & maintenance. Corresponding parts of all the equipments & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable. All the material & workmanship shall be of suitable commercial quality as have proven successful in their respective uses in similar services & under similar condition.

The transformers and associated equipment shall be suitable for interfacing with SCADA system and all necessary transducers shall be included in the scope of supply.

2.4.2 STANDARDS

The equipments and materials covered by this specification shall conform to the latest edition of following Indian Standards or equivalent IEC standards except where specified otherwise in this specification:

Sl. No.	Standards	Description
1	IS: 2026 (Part I to IV)/ IEC 60076	Power Transformer
2	IS: 2099/IEC 137	Transformers bushings for alternating voltage above 1kV
3	IS: 335	Transformer oil
4	IS: 3637	Gas and oil operated relay
5	IS: 3639	Fittings and accessories for power transformers
6	IS: 6088	Dimensions for porcelain transformer bushings
7	IS: 3347	Loading guide for oil-immersed transformers
8	CBIP Manual No. 295 and latest publications	Transformer Design Manuals

Equipment meeting with other authoritative standards which ensure an equal or better quality is also acceptable. Where the equipment conforms to any other authoritative standard, the salient points of difference between the standard

adopted and IS/IEC shall be clearly brought out in the tender. Complete set of documents and standards in English shall be supplied by the contractor without any extra charge. It shall, however, be ensured that equipment offered comply with one consistent set of standards except in so far as they are modified by the requirement of this specification.

2.4.3 TECHNICAL REQUIREMENTS

The transformers shall be three winding, ONAN, oil filled, 3- Φ , Step Up transformers.

Sl. No.	Standards	Description
1	Type	Multi Winding (as per Plant Design)
2	No. of phases	3
3	Installation	Outdoor Foundation
4	Rated continuous MVA at maximum ambient temperature of 40°C	As required according to Solar Inverter capacity
5	% Impedance at 75°C, rated current & frequency	As per relevant Indian Standard
6	Type of cooling	ONAN
7	Winding material	Copper
8	Connection	
	HV	Delta
	LV	Star/ Star-Star/as per design
9	Vector group	Dy11/ Dy11y11/as per design
10	Voltage	
	HV	33 kV
	LV	As per Solar Inverter Output Voltage
11	Rated Frequency	50 Hz
12	Type of Bushing	
	HV Winding	Porcelain/ XLPE bushing
	LV Winding	Porcelain bushing
13	Insulation level (impulse withstand)	
	HV	170 kV (Peak)
	LV	NA
14	Insulation level (Power freq. withstand)	
	HV	70 kV (rms)
	LV	10 kV (rms)
15	Tapping	OCTC
	Range	+5% to -5% @ 2.5%
16	Temperature rise of oil/ winding over design ambient temperature of 50°C	50°C / 55°C

Sl. No.	Standards	Description
17	Hot spot temperature over a maximum yearly weighted average ambient temperature of 32 °C	105°C
18	Short circuit current on HV side	25 kA
19	Short circuit withstand time	3 sec
20	Insulation	
	HV winding	Class A (Winding insulation shall be able to withstand 33 kV continuously)
	LV winding	Class A (Uniformly insulated)
21	Voltage withstand capacity during sudden disconnection of load	1.4 times the rated voltage for 5 sec. 1.25 times the rated voltage for 1 min. 1.1 times the rated voltage for continuous operation.
22	Noise level	< 90 dB As per NEMA TR-1 standard
23	Cooling medium	Mineral oil (as per IS 335)
24	Earthing	As per Inverter manufacturer recommendation.
25	Minimum efficiency	98%

2.4.4 DESIGN CRITERIA

- The Design of the IDT shall be in line with the IS 2026, IEC 60076 and IEEE Std C57.12.00 with latest amendments.
- The rating of the Transformers shall be sufficient to evacuate generated power from the Solar Inverter under full load conditions. The Transformers shall be able to evacuate generated power under all conditions of ambient temperature, frequency and voltage variations.
- The transformers will have Off Circuit Tap Changer (OCTC) with tap ranging +5% to -5% in steps of 2.5 % at HV side. The transformers will operate without injurious heating at the rated capacity at any voltage within +/-10% of the rated voltage of that particular tap. The transformer will be designed to deliver rated MVA continuously even at the lowest tap without exceeding specified temperature rise.
- HV line terminals shall be brought out through 33 kV class weather proof, shaded porcelain bushing.
- Ambient air temperature for the transformer
 - Maximum ambient air temperature: 50⁰ C
 - Maximum daily average ambient air temperature: 40⁰ C
 - Maximum yearly weighted average ambient air temperature: 32⁰ C
 - Minimum ambient air temperature: - 5⁰ C
- The transformers shall be designed to withstand short circuit current of 25 KA or second without any damage. This capability shall be demonstrated by type test report.
- The transformers will be capable of being loaded in accordance with IS 3347 - loading guide for oil immersed power transformers. The transformers shall also be designed for operation at unbalanced loading conditions.
- The transformers shall be suitable for co-ordination and integration with SCADA System and necessary contacts and/or ports for the purpose shall be provided.
- Earthing arrangement of the transformers shall be provided as per the relevant Indian Standard and as per Inverter manufacturer recommendation.

- Necessary protection arrangement should be provided in the transformer.
- Marshaling Box shall be of sheet steel, dust and vermin proof provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55 or better. Marshalling Box of all transformers shall be preferably Tank Mounted. One dummy terminal block in between each trip wire terminal shall be provided. 20% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber. Also Marshalling Box, shall be at least 450 mm above ground level. Wiring scheme (TB details) shall be engraved in a stainless steel plate with viewable font size and the same shall be fixed inside the Marshaling Box door.
- The radiators shall be detachable type, mounted on the tank with shut off valve at each point of connection to the tank, lifts, along with drain plug/valve at the bottom and air release plug at the top.
- Construction of different parts of the transformer shall conform to the latest edition of IS 2026.
- Fittings and accessories as per relevant Indian Standard shall be provided within the scope of the work.

2.4.5 TYPE TSET

All the transformers used for the plant must be type tested. Type test certificate for the offered voltage level and capacity Transformers shall be produced. The contractor must ensure the type tests are to be conducted separately at no extra cost for the transformers. These tests should be conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at CPRI/NABL accredited Laboratory/ Govt. Recognized test house. The type tests shall be performed are furnished below:

Sl.No.	TYPE TESTS
1.	Impulse Voltage Withstand Test, including Full Waves and Chopped Waves as listed below as per IEC 60076/IS2026: <ul style="list-style-type: none"> • One full wave at 50% BIL; • One full wave at 100% BIL; • One chopped wave at 50% BIL • Two chopped waves at 100% BIL and • Two full waves at 100% BIL.
2.	Short Circuit withstand Test as per IEC 60076/IS202
3.	Temperature Rise test at a tap corresponding to maximum losses as per IEC 60076. Gas Chromatography shall be conducted on oil sample taken before & immediately after temperature rise test. Gas analysis shall be as per IS: 9434 (based on IEC: 60567), results will be interpreted as per IS: 10593 (based on IEC: 60599)
4.	Measurement of harmonics of no load current (special test)
5.	Measurement of acoustic noise level as per NEMA TR-1 (special test)
6.	Tank Vacuum & Pressure Test (as per CBIP norms)

2.4.6 APPROVAL

The Detailed Design Report Submitted by the contractor to WBSEDCL must contain but not limited to the following details of the transformers:

- Detailed specification including Fittings and Accessories
- Necessary Drawings shall contain but not limited to the following:
 - Outline dimension/GA drawings of transformers, fittings/accessories and weight of main components.
 - Bushing Assembly drawings (for both HV & LV).
 - Marshalling Box GA & Connection Drawings.
 - Transport drawings, showing main dimensions and weight of each package.
 - Instruction plate for oil filling procedure for Aircell conservator as per Proforma provided by WBSEDCL during approval.
 - Foundation details
 - Tap-changing equipment
 - Rating & Property plate diagrams
- Necessary test certificates and type test reports.
- GTP shall be provided by the contractor as per Proforma provided by WBSEDCL during approval.

A joint inspection and testing will be done by WBSEDCL and the authorized representatives of the contractor at the manufacturer's workshop. Testing and inspection of the transformers will be carried out as per relevant Indian Standard. Arrangements for the aforesaid testing and inspection at manufacturer's end are to be provided by the contractor.

Prior to the delivery of the product, the contractor shall submit but not limited to the following documents:

- Guarantees
- Instructions for installation and operation, manual
- Safety precautions
- Test reports for routine tests and acceptance tests etc
- Detailed schematics of all power instrumentation and control equipment and subsystems along with their interconnection diagrams. Schematics shall indicate wiring diagrams, their numbers and quantities, type and ratings of all components and subsystems etc.

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBSEDCL.

2.5 33 KV SWITCH YARD EQUIPMENT AND INDOOR CONTROL & RELAY PANEL

2.5.1 SCOPE

This specification covers the design, manufacture, testing at manufacturer's works before dispatch, supply, delivery at site, transit insurance, storage at site, erection, testing & commissioning of 33 kV Indoor C & R Panel & Power Evacuation System with all necessary equipments and accessories required for satisfactory operation of the Grid connected Solar Power Plant.

The scope of supply shall 33KV C&R Panel with all accessories, Vacuum Circuit Breaker (VCB), Current Transformer (CT), Potential Transformer (PT), Isolator, Lightning Arrestor (LA) and other materials & equipments for power evacuation in 33 KV system voltage grade and also include necessary spares required for normal operation & maintenance of C & R Panel equipments and Power Evacuation System for a period of 5 (five) years.

All the switchyard equipments including C&R Panels shall comply the standard specifications of WBSEDCL available in the link below:

https://www.wbsecl.in/irj/go/km/docs/internet/new_website/technicalSpecification.html. In case of any contradiction with the following specifications, the standard specifications of WBSEDCL available in the above link shall prevail.

Corresponding parts of all the equipments & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable. All the material & workmanship shall be of suitable commercial quality as have proven successful in their respective uses in similar services & under similar condition.

2.5.2 STANDARDS

The equipments covered under this chapter shall comply with the requirement of latest edition of following IS/BS/IEC specifications as amended up to date except where specified otherwise.

Sl. No.	Standards	Description
1	IS: 5	Colors for ready mixed paints & enamels
2	IEC: 60298/IS: 3427	AC metal enclosed switchgear & control gear for rated voltages above 1 kV & up to & including 52 kV.
3	IS: 13947	Degree of protection provided by enclosures for switchgear.
4	IS: 1901	Specification for visual indication lamps
5	IS: 13118/IEC-56	High Voltage Alternating current circuit breakers
6	IS: 2705 - (Part I-IV)	Current Transformers
7	IS: 3156 - (Part I-IV)	Voltage Transformers
8	IEC: 60694	Common clauses for high voltage switchgear & control gear
9	IS: 1248	Indicating Electrical measuring instruments
10	IS: 8084	Inter connecting Bus bars for AC voltage between above 1 kV up to and including 36 kV
11	IS-5578 & 11353	Making and arrangement for switchgear bus bar main connections and auxiliary wiring.
12	IEC: 62271-102	Alternating current disconnectors and earthing switches
		Metal oxide surge arresters without gates for

Sl. No.	Standards	Description
15	IS: 3231	Electrical relays for Power Systems
16	IS-8686	Static Protection Relays
17	IEC-60255 & IEC-61330	Numerical Relays
18	IEC-137	Bushing for AC Voltages
19	IS-3347	Porcelain Transformer Bushings.
20	IS-2099	High Voltage Porcelain Bushings.
21	IS-5561	Terminal Connectors
22	IS-13779	Static Energy Meters
23	IS 14697/1999	HT Static Tri-vector TOD Energy meter
24	IS-1248	Electrical measuring instruments
25	IS-10118	Minimum clearances for Outdoor Switchgear.
26	IEC-694	Common Clauses for High Voltage Switchgear and Control gear
27	IS 6875 amended upto date	Control switches

Equipment meeting with other authoritative standards which ensure an equal or better quality is also acceptable. Where the equipment conforms to any other authoritative standard, the salient points of difference between the standard adopted and IS/IEC shall be clearly brought out in the tender. Complete set of documents and standards in English shall be supplied by the contractor without any extra charge. It shall, however, be ensured that equipment offered comply with one consistent set of standards except in so far as they are modified by the requirement of this specification.

2.5.3 SPECIFIC TECHNICAL REQUIREMENTS/PARAMETERS:

All indoor C & R Panel panels shall have minimum technical parameters for design consideration as mentioned hereunder:

2.5.3.1 C & R PANEL:

- Each C & R Panel shall be completely metal enclosed and shall be dust, moisture and vermin proof for tropical use. The enclosure shall provide a degree of protection not less than IP-41 in accordance with IS-2147. Type test report in this respect shall be furnished with offer
- Separate C&R panel shall be provided for each VCB.
- Panels shall be free standing, floor mounting type and shall comprise structural frames enclosed completely with specially selected smooth finished, cold rolled sheet steel of thickness not less than 3 mm for weight bearing members of panels such as base frame, front sheets and door frames and not less than 2mm for sides, door, top & bottom portions. There shall be sufficient reinforcement to provide level surfaces, resistance to vibration and rigidity during transportation and installation.
- Control Cable entries to the panel shall be from the bottom. Bottom plates of the panels shall be fitted with detachable gland plates to allow cable entries from the bottom. Gland plates shall be suitable for fixing the cable glands at an elevated height of at least 100 mm above the ground level. Terminal Connectors and Test terminal blocks for cables shall be fixed at an elevated height of at least 200 mm above the Bottom plate. Side blocks cut out to be

arranged at the top of both sides of panel for inter panel bus wires. Dimensions of the cut out will be 530 mm X 50 mm, 255 mm from the top.

- The Control and Relay Panel shall be of Simplex type and the access door shall be provided at the back of each Panel where no instruments or relays shall be mounted. The indicating and signaling devices and relays etc. shall be mounted on the front side and the auxiliaries which shall be inside the Panel. The access door shall be at the back side and of double door type of height 1900 mm (with tolerance $\pm 1\%$).
- **The Relay and C&R manufacturer shall be same.**
- The individual panel shall be of 2250 mm (with tolerance $\pm 1\%$) in height with Channel base, 610 mm. in depth and of suitable width 1000mm to accommodate the equipment at a suitable height, suitable gaps to facilitate easy workability as specified hereafter. Individual piece of Channel base of C&R Panel is to be provided to obtain the flexibility of inter-changing the Panel, if any.
- The complete panel shall incorporate all necessary instruments, meters, relays, auxiliary relays, control switches, indicating lamps, mimic, annunciator, audible alarms, horizontal and vertical wiring trough, wiring supports, interior lighting system, terminal blocks, fuses and links etc.

2.5.3.2 CIRCUIT BREAKERS

SI. No.	Description	Requirement
1	Type	Vaccum
2	No. of Poles	3
3	Nominal/Highest System Voltage	33 kV/36 kV
4	Type of Installation	Outdoor
5	Duty Cycle	0- 0.3 sec-CO-3 min-CO
6	Operating cycles	Min. 10000
7	Control Voltage	30V DC (10% to -15%)
SI. No.	Description	Requirement
8	Short Time Current Rating for 3 sec	25 kA
9	Continuous current rating	As per system design
10	Symmetrical Breaking Current Capacity	25 kA (rms)
11	Short Circuit Making Current	62.5 kA
12	Degree of protection	IP 65
13	Operating mechanism	Spring Charged
14	Auxiliary contacts	As required plus 6NO and 6NC contacts per pole as spare.
15	Noise level	Maximum 140dB at 50m distance from base of circuit breaker
16	Seismic acceleration	0.4 g horizontal

2.5.3.3 CURRENT TRANSFORMER

SI. No.	Description	Requirement
1	Type	Outdoor
2	Nominal/Highest System Voltage	33 kV/36 kV
3	Short Time Current Rating for 1 sec	25 kA

4	No. of Phases	Single
5	Insulation Class	Class A
6	Rated Power Frequency withstand voltage (Primary/secondary)	70 kV (rms)/3 kV (rms)
7	Rated Lightning Impulse Withstand Voltage	170 kV (peak)
8	Degree of protection	IP 65
9	Partial discharge level	10 Pico coulomb max.
10	Temperature rise	As per IEC 60044
11	Number of cores	Two (2) with One (1) protection core and one (1) metering core of accuracy 5P20 and 0.5 class respectively
12	CT secondary current	Protection cores – 1 Amp Metering Core – 1 Amp

2.5.3.4 POTENTIAL TRANSFORMER

SI. No.	Description	Requirement
1	Type	Outdoor
2	Nominal/Highest System Voltage	33 kV/36 kV
3	Short Time Current Rating for 1 sec	25 kA
4	No. of Phases	Single
5	Insulation Class	Class A
6	Rated Power Frequency withstand voltage (Primary/secondary)	70 kV (rms)/3 kV (rms)
7	Rated Lightning Impulse Withstand Voltage	170 kV (peak)
8	Rated voltage factor	1.2 continuous & 1.5 for 30 sec
SI. No.	Description	Requirement

9	Class of Accuracy	0.5/3P
10	Degree of protection	IP 65
11	Partial discharge level	10 Pico coulomb max.
12	Temperature rise	As per IEC 60044

2.5.3.5 ISOLATOR/DISCONNECTING SWITCH

The isolators and accessories shall conform in general to IEC 62271-102. Each isolating switch should have the following particulars under the site conditions for the system under design:

- Isolators shall comply with routine tests as per IEC 606181
- Isolator shall be gang operated for main blades and earth switches. The operation of the three poles shall be well synchronised and interlocked.
- The design of linkages and gears shall be such so as to allow one man to operate the handle with ease for isolator and earth switch.

SI. No.	Description	Requirement
1	Type	Outdoor
2	Nominal/Highest System Voltage	33 kV/36 kV
3	Short Time Current Rating for 1 sec	25 kA
4	No. of Poles	3
5	Continuous current rating	As per requirement
6	Short Time Current Rating for 3 sec	25 kA
7	Rated Power Frequency withstand voltage	
	a. To earth & between poles	70 kV (rms)
	b. Across isolating distance	80 kV (rms)
8	Rated Lightning Impulse Withstand Voltage	
	a. To earth & between poles	170 kV (peak)
	b. Across isolating distance	195 kV (peak)
9	Temperature rise	As per Table-IV of IS: 9921
10	Operating mechanism of Isolator and Earth Switch	Manual operated

2.5.3.6 SURGE ARRESTOR

SI. No.	Description	Requirement
1	Type	Metal Oxide Gapless
2	Rated Voltage	30 kV
3	Nominal Discharge Current	10 kA (8x20 micro impulse shape)
4	Installation	Indoor
5	Degree of protection	IP 67
6	Rated Power Frequency withstand voltage	70 kV (rms)
7	Rated Lightning Impulse Withstand Voltage	170 kV (peak)
8	RIV/Partial Discharge when energized at 1.05 times its continuous operating voltage shall not exceed b	250 microvolt/ less than 50 pico-coulomb

2.5.4 GENERAL REQUIREMENTS

The 33 kV Indoor C & R Panel shall be designed considering the minimum general requirements as mentioned hereunder:

- The C & R Panel shall confirm IP 41 or higher degree of protection.
- Each panel shall be equipped with space heaters to prevent moisture condensation within the enclosure and shall be complete with MCB, thermostats and auxiliary relay (if required).
- C&R Panel design shall comprise of fully compartmentalized execution having separate vertical sections for each circuit.
- Structure and control wiring shall be designed and arranged in such a manner so that future extension of the switchboard would readily be feasible.
- The circuit breaker shall be suitable for remote electrical and local electrical/manual operation. The closing coil shall operate correctly between 85% to 110% of its rated voltage and shunt trip shall operate correctly under all operating conditions of the circuit breaker between 70% to 110% of its rated voltage.
- The disconnecting switches shall be provided with local electrical/manual control from the panel. The disconnecting switches shall be fitted with earthing link wherever required. The disconnecting switch shall be connected between the transformer and circuit breaker for the power incoming from solar PV and for synchronization between the bus bar and transmission line through breaker, at 33 kV.
- The supplier shall ensure that the current transformers shall have adequate VA output for the type of protection & metering offered. The supplier shall also ensure that the current transformers quoted by him have adequate output for prescribed accuracy class and accuracy limit factor for the type of relays and instruments connected in their circuits. PS class CTs shall have low secondary resistance and high knee point voltage so as to avoid any possibility of CT saturation under through fault conditions.
- Three single phase voltage transformers shall be suitable for connecting in a bank of three phase voltage transformers for protection and measurement purpose for each incomer and outgoing feeders. Separate and dedicated voltage transformers shall be provided for synchronization.
- Each cubicle shall be equipped with space heaters, thermostats, illumination lamps & 240 V AC, 5A receptacle.
- Suitable single compression type, heavy duty brass cable glands with check nuts, rubber sealing ring and brass washers mounted on a removable gland plate shall be supplied with the C & R Panel to support all power and control cables entering the C&R Panel.
- Cables for each equipment must be tagged with permanent metal tag of impregnated cable number as per drawings at C&R Panel end and equipment terminal end as well as in the mid portion of the cables at certain distances as instructed by the owner or his authorized representative.
- The accuracy class of indicating instruments shall be 1 or better as per IS. The accuracy class of meters for commercial metering shall be 0.2 All instruments shall have means for calibration, testing and adjustment at site.
- Three phase watt hour meters conforming to latest issue of relevant Indian standard shall be provided with test link for CTs & PTs. Meters shall be compensated for temperature errors and factory calibrated to directly read the primary quantities.
- Following equipments at 33 kV C&R Panel shall be monitored from SCADA:
 - 1) Circuit breaker - On/Off status & Control
 - 2) Transformer - Winding temperature & Oil temperature Alarm status
 - 3) Energy meters

- 4) Numerical Relays
- 5) Voltmeters
- 6) Ammeters
- Suitable earthing arrangement must be designed for the system.
- Finishing work like painting etc. for C&R Panel should be as per relevant IS.

2.5.5 APPROVAL

The Detailed Design Report submitted by the contractor to WBSEDCL must contain but not limited to the following details of the Ring Main Unit/C & R Panel:

- Detailed specification of all the items.
- Necessary Drawings (as per requirement during approval).
- All necessary test certificates and approvals etc.
- GTP and all other technical requirement/specification shall be in line with the specification available in;
https://www.wbsedcl.in/irj/go/km/docs/internet/new_website/technicalSpecification.html

The successful bidder required to produce all necessary test certificates and approvals of the product as per relevant standard with the Detailed Design Report.

Prior to the delivery of the product, the contractor shall submit but not limited to the following documents:

- Guarantees
- Instructions for installation and operation, manual
- Electrical diagrams
- Safety precautions
- Detailed schematics of all power instrumentation and control equipment and subsystems along with their interconnection diagrams. Schematics shall indicate wiring diagrams, their numbers and quantities, type and ratings of all components and subsystems etc.

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBSEDCL.

2.6 CABLES & CONDUCTOR

2.6.1 SCOPE

The scope of work under these specification covers the Design, Manufacture, Assembly, Shop Testing, Delivery at site, transit insurance, Storage, Erection, Testing & Commissioning of power, control and instrumentation cables (complete with cable terminals and all accessories for making the systems complete and for warranting a trouble free and safe operation).

The scope shall also include supply of all material, fabrication and erection of cable supporting structure, cable racks & trays as well as laying of cables on cable racks.

The scope of supply shall also include necessary spares required for a period of 12 years & special tools & plants required for erection & maintenance.

The contractor shall assess the quantity of various sizes of the power, control, instrumentation and communication cables & its accessories along with cable racks & trays including the mandatory spares required for the project and shall furnish same in the bid. He shall also furnish the unit price for each item.

2.6.2 STANDARDS

The equipments covered under this chapter shall comply with the requirement of latest edition of following IS/BS/IEC specifications as amended up to date except where specified otherwise.

Sl. No.	Standards	Description
1	IS: 7098 Part 1	Cross linked Monoethylene insulated PVC sheathed cables for working voltage up to and including 1.1kV
2	IS: 7098 Part 2	Cross linked Monoethylene insulated PVC sheathed cables for working voltage from 3.3kV up to and including 33kV
3	IS 10418	Drums for cables
4	IS 8130	Conductors for insulated electric cables and flexible cords
5	IS 8308	Compression type tubular inline connectors for aluminium conductors
6	IS 8309	Compression type tubular terminals for aluminium conductors
7	IS 8438	Moulds of cast resin based straight joints of cable up to including 1.1kV
8	IS 11967	Specifications for co-axial cables
9	IS : 2062	Structural Steel (Standard Quality)
10	IS : 513	Cold rolled low carbon steel sheets & strips
11	IS : 277	Galvanized sheet steel
12	IS : 808	Rolled Steel Beam, Channels and Angle section
13	IS : 2629	Recommended practice for hot dip galvanizing of iron and steel.
14	IS : 2633	Method of testing uniformity of coating on zinc coated articles.
15	IS : 800	Specification for use of structural steel in general building construction.

Cables and other accessories complying with other internationally accepted standards such as IEC, IEEE, BS, etc. will also be accepted if they ensure performance and constructional features equivalent or superior to standards listed above. In such a case the Contractor shall clearly indicate the standard/standards adopted and furnish a copy of English version of the latest revision of the standard(s) along with the Bid and the salient features of comparison shall be brought out.

2.6.3 GENERAL REQUIREMENTS

Minimum requirements are mentioned hereunder.

- The cables shall be of type and design with proven record of similar power station installations.
- The colours of the cables (both AC & DC) should be so selected that there should not be any problem for identification of cables used for various circuits during inspection & testing.
- To facilitate easy identification of cores, multi-core control and instrumentation cables shall be colour coded by using PVC insulation of red, black, yellow, blue and grey colours in accordance with IS 1554 (Part I).
- Cable lengths shall be considered in such a way that straight through cable joint is avoided.
- Cable terminations shall be made with suitable cable lugs & sockets etc, crimped properly and passed through brass compression type cable glands at the entry & exit point of the cubicles.
- The contractor shall ensure that no bimetallic action takes place between the Aluminium conductor of the cable and the cable connecting lugs by filling the lugs with suitable compound.
- For the main cable ways, a system of cable racks and trays as well as cable ducts and trenches shall be provided. The power and the control cables will run on separate trays. The cables for emergency lighting, fire alarm systems, etc., shall run on separate trays. The power cables shall be laid on the uppermost rack to prevent spread of fire.
- In indoor installations, the cables must be laid through PVC conduit or GI pipe. In case of using metallic pipe as conduit proper grounding of the conduit must be done.
- Exposed cables, wherever, used, shall preferably have UV resistant jacket besides being water resistant.
- Cables for each equipment must be tagged with permanent metal tag of impregnated cable number as per drawings at MCC/C & R Panel end and equipment terminal end as well as in the mid portion of the cables at certain distances as instructed by the owner or his authorized representative.
- The loop length shall be provided for various cables as per the relevant Indian Standard.
- Cables shall be properly clamped at regular intervals with the help of non magnetic/molded fiber glass strip clamps/PVC sleeved clamps, of suitable size.
- When power cables are laid in the proximity of communication cables, the minimum horizontal and vertical separation between them may be 530 mm.

2.6.4 TECHNICAL REQUIREMENTS FOR CABLES AND CONDUCTOR

Minimum Technical requirements are mentioned below:

- All cables and connectors for use for installation of solar field must be of solar grade which can withstand harsh environment conditions including High temperatures, UV radiation, rain, humidity, dirt, burial and attack by moss and microbes for 25 years and voltages as per latest IEC standards. DC Solar cables of voltage grade as per relevant IEC, system voltage & industry standard for PV systems is under development, the cables for outdoor installations should comply with the IS 17293 for service life expectancy of 25 years.
- All cables shall be Fire Retardant Low Smoke (FRLS) type. The cables shall be sized based on the following considerations:
 - Rated current of the equipment
 - The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during running condition, shall be limited to 3% of the rated Voltage
 - Short circuit withstand capability De-rating factor for various conditions of installations shall be considered while selecting the cable size
 - Variation in ambient temperature for cables laid in air
 - Grouping of cable
 - Variation in ground temperature and soil resistivity for buried cables
- HT cable shall be designed based on the short circuit conditions and LT cable shall be sized based on the voltage drop.
- Size of aluminium power cable shall in no case be less than 16 mm² and copper power cable shall not be less than 6 mm² in case of Y-connector connection and in case of string formation cable size shall be as per the DC voltage drop allowable limit.
- Minimum size of the control cable for CT circuit shall be 4 mm² and that for potential circuit shall be 2.5 mm².
- The cables shall be capable of satisfactory operation under a power supply system voltage variation of $\pm 10\%$ and frequency variation of $\pm 5\%$ and a combined frequency voltage variation of 10% (absolute sum). The cables shall have heat and moisture resistant properties.
- Conductor size of cables and wires shall be selected based on efficient design criteria. The wiring size shall be designed such that maximum voltage drop at full power from the PV Array to Inverter(s) should be less than 1.5%. From Inverter to AC Grid interfacing panel should be less than 2.5%.
- The continuous withstand temperature shall be 90°C and 70°C for XLPE and PVC cables respectively and the short circuit withstand temperature shall be 250°C and 160°C for XLPE and PVC cables respectively.
- The Jointing Boxes shall comply in all aspects with the provision of the latest issue of relevant standards.
- The control cables shall be multi-core, colour coded, annealed, stranded high conductivity copper, single conductor, insulated with HR-PVC insulation, PVC sheathed, unarmoured FRLS type conforming to IS 1554 (part I & II)/relevant IEC. The outer sheath is of specially formulated PVC compound.
- The instrumentation cables in addition to meeting the requirements of control cables shall be provided with electrostatic shielding by aluminium tape and screening by annealed tinned copper wire.
- For connecting solar modules with solar inverter via string monitoring box, solar inverter output with three winding transformer input, three winding transformer output with 33 kV Indoor C & R Panel (33 kV) and 33 kV Indoor C & R Panel (33 kV) with the 33 kV Switchyard (33 kV), cables of suitable size shall be provided. Voltage grade of cables shall be selected as per relevant IEC, system voltage & industry standard.

- Number of Local Control Rooms with 33 kV Indoor C & R Panel shall be as per plant design. One number Main Control Room shall be provided adjacent to the 33 kV Switchyard, as per design. Cable Trench of suitable size as per relevant standard shall be a part of the scope of work.

2.6.5 TECHNICAL REQUIREMENTS OF CABLE LAYING

Minimum technical requirements for cable racks and trays are mentioned below:

- The contractor shall fabricate and supply the mounting arrangement for the support and installation of all the cable trays on galvanized steel structure including channels, angles, rods etc at requisite spacing in the suspended cable trays, cable trenches. Supporting structures wherever necessary, shall be provided by the contractor.
- The contractor shall provide embedment/anchor fasteners for fixing the supporting structures.
- These supporting structures shall be fabricated from structural steel members (channels, angles and rods) of the required size.
- The vertical member of the support will be of ISRO12 threaded rod or ISMC100 channel. The horizontal member of the support will be of angle ISA 50X50X6. For the threaded rod support configuration the horizontal member shall be fixed by bolting whereas for channel configuration the horizontal member shall be fixed by welding to the channel.
- Trays shall be of ladder type. The trays shall be fabricated from Hot Rolled Carbon Mild Steel GI with minimum 80 micron galvanization thickness (conforming to IS 1079, Grade "O", of chemical composition (C, Si, Mn, S, Ph) sheet of proper thickness as per IS.
- Cable trays shall be fixed with support by hold-down clamps. The clamps shall be fabricated from MS sheet of appropriate thickness and Hot Dip Galvanized.
- The contractor shall supply various tray fittings and accessories like coupler plate with fasteners, horizontal tees, vertical and horizontal elbows, vertical and horizontal adjustable connectors required for the mentioned trays. All accessories, fittings, elbows and tees shall be Hot Dip Galvanized. The nuts, bolts and washers shall be cadmium plated or electrolytically galvanized.
- Proper earthing of the trays and continuity between tray components must be ensured by the contractor.
- The contractor shall install the cable trays in accordance with relevant standards.
- Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.
- Cables shall be laid on cable trays strictly in line with cable schedule. Laying of cable shall be done stretch-wise as follows:
 - a) PV array field to SMB: as per design and site condition using DWC conduit pipe through buried trench.
 - b) SMB to Inverter Room: on cable tray / buried cable trench as per Technical Specification- Electrical
 - c) All AC power cables including control cables in Control Room and Switchyard shall be laid in RCC cable trench.

- Power and control cables shall be laid on separate tiers in RCC cable trench with slab cover in line with approved guidelines/drawings. The laying of different voltage grade cables shall be on different tiers according to the voltage grade of the cables. In horizontal tray stacks, H.T. cables shall be laid on topmost tier and cables of subsequent lower voltage grades on lower tiers of trays. Single core cable in trefoil formation shall be laid with a distance of four times the diameter of cable between trefoil center lines and clamped at every two meter. All multi core cables shall be laid in touching formation. Power and control cables shall be secured fixed to trays/support with self-locking type nylon cable straps with de-interlocking facilities. For horizontal trays arrangements, multi core power cables and control cables shall be secured at every five meter interval. For vertical tray arrangement, individual multi core power cables and control cables shall be secured at every one meter by nylon cable strap. After completion of cable laying work in the particular vertical tray, all the control cables shall be binded to trays/supports by aluminium strips at every five meter interval and at every bend.
- Bending radii for cables shall be as per manufacturer's recommendations and IS: 1255. Directly Buried Cables.
- Cable trenches shall be constructed for directly buried cables. Construction of cable trench for cables shall include excavation, preparation of sieved sand bedding, riddled soil cover, supply and installation of brick or concrete protective covers, back filling and compacting, supply and installation of route markers and joint markers. Laying of cables and providing protective covering shall be as per IS: 1255. Cable shall be laid in such a systematic manner, so that in case of occurrence of fault the faulty cable can be identified in shortest possible time.
- RCC cable route and RCC joint markers shall be provided wherever required. The voltage grade of the higher voltage cables in route shall be engraved on the marker. Location of underground cable joints shall be indicated with cable marker with an additional inscription "Cable Joint". The marker shall project 150 mm above ground and shall be spaced at an interval of 30 meters and at every change in direction. They shall be located on both sides of road crossings and drain crossings. Top of cable marker/joint marker shall be sloped to avoid accumulation of water/dust on marker.
- Cable tags shall be provided on all cables at each end (just before entering the equipment enclosure), on both sides of a wall or floor crossing, on each duct/conduit entry, and at every 20 meters in cable tray/trench runs. Cable tags shall also be provided inside the C & R Panel, motor control centers, control and relay panels etc. where a number of cables enter together through a gland plate. Cable tag shall be of rectangular shape for power cables and control cables. Cable tag shall be of 2 mm thick aluminum with number punched on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280. Alternatively, the Contractor may also provide cable tags made of nylon, cable marking ties with cable number heat stamped on the cable tags.
- Inspection pit at suitable places to be provided for the purpose of maintenance.
- Adequate no. of spare DC cables shall be laid for the purpose of better reliability and minimize interruption period. Spare cable to be provided by the bidder as per list of spare provided in the tender document.
- For each Transformer at both Incoming and outgoing side minimum one no. spare cable shall be laid for the purpose of better reliability and minimize interruption period.

2.6.6 APPROVAL

The Detailed Design Report Submitted by the contractor to WBSEDCL must contain but not

limited to the following details of the Cables and conductor and the accessories for their installation:

- Detailed design and specification of all the items.
- All necessary drawings
- Calculations for choosing cable size
- Type test reports and necessary certificates etc.
- Performance certificate from the purchaser.
- For all the above cable and conductor, GTP and all other technical requirement/specification shall be in line with the specification available in;
https://www.wbsedcl.in/irj/go/km/docs/internet/new_website/technicalSpecification.html

Before dispatch, sample pieces of the cable shall be subjected to type, routine, acceptance and FRLS tests at the manufacturer's works as stipulated in IS 1554 (Part I)/IEC in the presence of owner or his representative. Routine tests and acceptance tests as per relevant standards shall be carried out on each type of cable in presence of the owner or his representative.

Before commissioning of complete system all cabling system shall be checked as per cable schedule and complete report shall be prepared by Contractor and shall be submitted.

Prior to the delivery of the product, the contractor shall submit but not limited to the following documents:

- Guarantees
- Cable routing and layout drawings
- Detailed procedure adopted for the earthing of the trays
- Type test certificates for cable trays etc.

The contractor can deliver the product to the site only after receipt of such approval against their prayer in writing from WBSEDCL.

2.7 STATION AUXILIARY TRANSFORMER

2.7.1 SCOPE

This section covers the activities related to design, manufacturing, testing at works, supply, insurance, transportation and delivery at Project site, storage, erection, testing, commissioning of 100 KVA 33 / 0.415 kV oil fill type station auxiliary transformers and associated equipments as detailed hereunder.

The scope of supply shall also include necessary spares required for normal operation & maintenance of transformers for a period of 5 (five) years & special tools & plants required for erection & maintenance. Corresponding parts of all the equipments & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable. All the material & workmanship shall be of suitable commercial quality as have proven successful in their respective uses in similar services & under similar condition.

The transformers and associated equipment shall be suitable for interfacing with SCADA system and all necessary transducers shall be included in the scope of supply.

2.7.2 STANDARDS

The equipments and materials covered by this specification shall conform to the latest edition of following Indian Standards or equivalent IEC standards except where specified otherwise in this specification:

Sl. No.	Standards	Description
1	IS: 2026 (Part I to IV) /IEC 76	Power Transformer
2	IS: 2099/IEC 137	Transformers bushings
3	IS: 2705/IEC 185	Current transformers
4	IS: 1180	Three phase distribution transformer
5	IS: 6088	Dimensions for porcelain transformer bushings
6	IS: 3347	Loading guide for oil-immersed transformers
7	IS: 335	Transformer oil
8	CBIP No. 295	CBIP Manual on Transformers Publication

Equipment meeting with other authoritative standards which ensure an equal or better quality is also acceptable. Where the equipment conforms to any other authoritative standard, the salient points of difference between the standard adopted and IS/IEC shall be clearly brought out in the tender. Complete set of documents and standards in English shall be supplied by the bidder without any extra charge. It shall, however, be ensured that equipment offered comply with one consistent set of standards except in so far as they are modified by the requirement of this specification.

2.7.3 TECHNICAL REQUIREMENTS

- Capacity of the Station Auxiliary Transformer (SAT) shall be calculated based on the total auxiliary load of the plant.
- HT side of the transformer shall be connected to the 33 kV Bus through Isolator with earth switch of required rating and LT side shall be terminated to the Station Service Board (SSB)/ 415 V LT Switchgear.
- SAT shall be installed at the switchyard of the plant.

- The transformer shall be able to perform satisfactorily under voltage variation limit of +/- 10 % and frequency variation limit of +/- 5 %.
- Vector group of the transformer shall be Dyn11
- Off Circuit Tap changer (-7.5% to +5% @ 2.5% steps) shall be provided with the transformer. Owner will take final decision regarding this based on the proposal submitted by the contractor.
- % Impedance, type of bushing, class of insulation, temperature rise etc. shall be as per relevant Indian Standard.
- The transformers shall be suitable for co-ordination and integration with SCADA System and necessary contacts and/or ports for the purpose shall be provided.
- Earthing arrangement of the transformers shall be provided as per the relevant Indian Standard.
- Necessary protection arrangement like should be provided in the transformer.
- Construction of different parts of the transformer shall conform to the latest edition of relevant Indian Standard.
- Fittings and accessories shall be provided as per relevant Indian Standard code.
- Transformer oil shall conform to latest edition of IS 335.

2.7.4 APPROVAL

The Detailed Design Report Submitted by the contractor to WBSEDCL must contain but not limited to the following details of the transformers:

- Detailed specification
- Fittings and Accessories
- Necessary Drawings and GTP as mentioned in case of Solar Transformer.
- Tools and spare parts etc.
- Type Test Reports and certificates etc.
- GTP and all other technical requirement/specification shall be in line with the specification available in;
https://www.wbsedcl.in/irj/go/km/docs/internet/new_website/technicalSpecification.html

A joint inspection and testing will be done by owner and the authorized representatives of the contractor at the manufacturer's workshop, if desired so by the owner. Testing will be done as per relevant IS Code.

Prior to the delivery of the product, the contractor shall submit but not limited to the following documents:

- Guarantees
- Instructions for installation and operation, manual
- Test Reports for routine and acceptance tests etc.

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBSEDCL.

2.8 LT ACDB

2.8.1 SCOPE

The scope of work under this specification covers the design, manufacture, assembly, testing at manufacturer's works, transportation, transit insurance, delivery at site, storage, installation, testing, and commissioning of indoor type following 415V LT ACDB complete with all accessories and spares. Design shall be finalised during detail designing of the plant.

2.8.2 STANDARDS

The equipments covered under this chapter shall comply with the requirement of latest edition of following IS/BS/IEC specifications as amended up to date except where specified otherwise.

Sl. No.	Standards	Description
1	IS: 13947 (Part 1 to 5)	Specification for Low-Voltage Switchgear and Control gear.
2	IS: 10118 (Part 1 to 4)	Code of practice for selection, installation and maintenance of switchgear & control gear.
3	IS: 1248	Specifications for Electrical Indicating Instruments
4	IS: 2633	Hot dip Galvanizing
5	IS: 2705	Current Transformers
6	IS: 3156	Voltage Transformers
7	IS: 3231	Electrical Relays for Power System Protection
8	IS: 5082	Wrought Aluminum and Aluminum Alloy bars, tubes and sections for electrical purposes.
9	IS: 8623	General requirement for factory built assemblies up to 1000V.
10	IS: 8828	Circuit breakers for over current protection for household and similar installations
11	IS: 13703	Low Voltage fuses for voltages not exceeding 1000V AC
12	IS: 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals.

Equipment meeting any other authoritative national or international standards that ensure equal or better quality than the standards mentioned above are also acceptable. Where the equipment conforms to any other standards than those mentioned above, salient points of difference between the standards adopted and standards mentioned above shall be brought out in the tender.

The electrical installation shall meet the requirement of Indian Electricity rules and other statutory regulations as amended up to date and relevant BIS code of practice.

2.8.3 TECHNICAL REQUIREMENTS

- Main Incoming A.C. circuits on Station service Board shall be controlled circuit breaker. Type and capacity of the breakers shall be proposed by the bidders in their bid considering the total auxiliary load of the plant.
- The LT ACDB shall be suitable for indoor installation in the control room.

- LT ACDB shall be placed in each control room and shall be connected to each other by means of 415 V (3 phase, neutral) transmission line along the whole area. LT switchgear at main control room shall be connected with Station Auxiliary Transformer 1 (as mentioned in the chapter "Station Auxiliary Transformer") and LT switchgear of a local control room placed at a suitable distance away from the Main Control Room shall be connected with Station Auxiliary Transformer 1 (as mentioned in the chapter "Station Auxiliary Transformer").
- The Station Service Board (SSB) shall be sectionalized in two parts through sectionalizing breakers on the bus to ensure continuity of supply to the auxiliaries in case of failure/fault on one section.
- For interconnection with various boards and all outgoing feeder circuits, 25 kA, 3 pole draw-out type MCCBs with adjustable current setting shall be provided.
- The 415V switchboards shall be metal-enclosed fixed type, free standing, self- supporting, floor mounted, indoor type, totally enclosed and compartmentalized to house the switchgear. Circuit breakers and other switchgear components shall be arranged in compartments, vertically in a multi-tier formation. All metering and protection equipment associated with a particular circuit shall be housed in separate and independent compartment earmarked for particular circuit and in the fixed portion of the vertical panel in case of breaker panels.
- Construction of all the switchboards and equipments shall conform to the latest edition of relevant IS codes.
- All cable glands and aluminum crimping type cable lugs for all power and control cables shall be in the bidder's scope of supply. Panels shall be suitable for bottom entry of cable unless otherwise specified.
- The bidder shall indicate clearly the de-rating factors, if any, employed for each component and furnish the basis for arriving at these de-rating factors duly considering the specified current ratings, ambient temperature etc.
- The equipment shall comply with all safety requirements during erection and operation as per relevant standards.
- The neutral of the incoming transformer secondary shall be connected to the neutral bus of the auxiliary boards. The neutral shall be connected to the common earthing system of the switchyard/control room.
- All auxiliary devices for control, indication, measurement and protection such as push buttons, control and selector switches, indicating lamps, Power monitors, kWh meters and protective relays shall be mounted on the front side of the respective compartment. The design shall be such that unless required for maintenance / inspection purposes, all power ON/OFF or START / STOP and relay reset operations shall be performed without opening the panel door.
- The switchboard panels shall be provided with thermostatically controlled space heaters to prevent moisture condensation.
- LED lamp fittings along with necessary isolating switches shall be provided for illumination inside the panels. Each panel shall be provided with an industrial grade power socket as well.
- The 415V bus shall be of suitable cross-section so as to be able to carry the required continuous and short circuit currents within the limits of temperature rise for the site conditions.

- Control and selector switches shall be rotary type with escutcheon plates clearly marked to show the function and positions. The switches shall be of sturdy construction suitable for mounting on panel front.
- AC Distribution Board is to be provided in the main switchgear room and in the particular local control room having auxiliary transformer as per requirements.
- Instrument transformers shall be provided and shall conform to the relevant standard.
- All protective device shown in the drawing and others required for operation of the system as per the specification shall be included in the scope of supply.
- All instruments and meters shall be suitable for operation under the climatic conditions prevailing at site. The instrument cases shall be dust-proof, water tight, vermin proof, specially constructed to adequately protect the instruments against damage or deterioration due to high ambient temperature and humidity.
- Watt hour meter shall be suitable for 3-Phase, 4-wire unbalanced system and shall comply generally with the requirements of relevant IS code and shall be of first grade for the purpose of accuracy classification. Watt hour meters shall be provided in each LT ACDB.
- Panels shall be supplied completely wired internally to equipment and terminal blocks for connection to external cables entering the panel from the bottom. Terminal blocks shall be complete and provided with necessary terminal accessories for cable ends.
- Engraved PVC labels shall be provided on incoming and all outgoing breaker compartments, the exact details of legend to be engraved shall be furnished later to the contractor.
- All vertical cubicles shall be connected to earth bus bar running throughout the length of the switchboard. All doors and movable parts shall be connected to the earth-bus with flexible copper connections. Provision shall be made to connect the earthing bus bar to the main earthing grid at two ends. All non-current carrying metallic parts of the mounted equipment shall be earthed. Earthing bolts shall be provided to ground cable armours.
- Finishing work like painting etc. for ACDB should be as per relevant IS.

2.8.4 APPROVAL

The Detailed Design Report submitted by the contractor to WBSEDCL must contain but not limited to the following details of the LT Switchgear:

- Detailed specification of all the items.
- All necessary drawings
- All necessary test certificates and approvals etc.
- GTP and all other technical requirement/specification shall be in line with the specification available in;
https://www.wbsedcl.in/irj/go/km/docs/internet/new_website/technicalSpecification.html.

Prior to the delivery of the product, the contractor shall submit but not limited to the following documents:

- Guarantees
- Instructions for installation and operation, manual
- Electrical diagrams
- Safety precautions

- Detailed schematics of all power instrumentation and control equipment and subsystems along with their interconnection diagrams. Schematics shall indicate wiring diagrams, their numbers and quantities, type and ratings of all components and subsystems etc
- The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBSEDCL.

2.9 DC BATTERY, BATTERY CHARGING EQUIPMENT & DCDB

2.9.1 SCOPE

The scope of work under this specification covers the design, manufacture, assembly, testing at manufacturer's works, transportation, transit insurance, delivery at site, storage, installation, testing, and commissioning of D.C equipment comprising of 30V D.C Battery Bank of suitable designed capacity complete with battery charging equipment, D.C. Distribution Board and other auxiliary equipments.

The scope shall include all associated devices, components, relays, contactors, switches etc. required for satisfactory operation of the DC equipment as per the proposed logic control scheme.

The scope of supply shall also include necessary spares required for normal operation & maintenance of DC equipments for a period of 12 years and special tools & plants required for erection & maintenance.

Corresponding parts of all the equipments & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable. All the material & workmanship shall be of suitable commercial quality as have proven successful in their respective uses in similar services & under similar condition.

2.9.2 STANDARDS

The equipments covered under this chapter shall comply with the requirement of latest edition of following IS/BS/IEC specifications as amended up to date except where specified otherwise.

Sl. No.	Standards	Description
1	IS: 1651	Stationary cells & batteries, lead acid type (with tubular positive plates)
2	IS: 266	Battery grade Sulphuric Acid. (Battery electrolyte)
3	IS: 1069	Water for storage batteries
4	IS: 1146	Rubber & Plastic containers for lead Acid storage batteries
5	IS: 1248	Electrical Indicating Instruments
6	IS: 13947	Low voltage switchgear and control gear
7	IS: 3895	Mono-crystalline semi-conductor rectifier cells & stacks
8	IS: 8320	General requirement and methods of tests for lead acid storage batteries
9	IS : 6071	Synthetic separators for lead acid batteries
10	IS : 8623	Factory built assemblies of switchyard and control gear for voltage up to including 1000 V AC and 1200 V DC (Part 1 to 3)
11	IS 4540	Non-crystalline semi-conductor rectifier assemblies & equipment

Equipment meeting any other authoritative national or international standards that ensure equal or better quality than the standards mentioned above are also acceptable. Where the equipment conforms to any other standards than those

mentioned above, salient points of difference between the standards adopted and standards mentioned above shall be brought out in the tender.

2.9.3 GENERAL REQUIREMENTS

Minimum general requirements for the DC Battery, Battery charger and DC Distribution Board are mentioned below.

- Lead acid tubular type battery of required rating shall be provided at Main Control Room and each Local Control room. Battery Bank at Main Control Room shall be 30V and Battery Bank at Local Control Rooms shall be selected based on the Control Voltage required for closing and tripping of 33 kV Indoor type VCBs. 10 hours continuous discharge shall be considered for sizing the battery.
- One float charger and one float cum boost chargers shall be provided to maintain constant voltage at D.C. bus bars while supplying the continuous load in addition to keeping the battery on float charge.
- In case of sudden D.C. requirements due to failure of A.C. supply or charger itself, the battery shall be capable of meeting the system load demand. In case of failure of float charger supplying the continuous DC load, the affected battery charger shall get disconnected automatically from the DCDB and the complete D.C. load requirements shall be met by the float charger of float cum boost charger unit.
- The charger shall be protected against overloads by having suitable characteristics so that all loads in excess of the capacity of the charger would be transferred to the battery.
- In the event of failure of A.C. supply, the battery shall meet the complete D.C. requirements. After the discharge of battery to a considerable extent, the boost charger on restoration of A.C. supply shall recharge the battery in a short period. During the period of boost charging, the D.C. load requirements of power station shall also continue to be met.
- The distribution board with necessary switch and interlock, if any, shall be provided for distributing the D.C. power for the control & protection circuits, emergency D.C. supply for essential lighting etc.
- The bidder may give his recommendation on the scheme of operation of battery, battery chargers as described in the specifications. However, the decision of the owner in this regard shall be final and bound to the bidder/contractor.
- The battery shall be capable of delivering the rated output at the minimum temperature of -3°C and maximum temperature of +40°C.
- The battery shall be mounted on the two tier wooden racks supplied along with the battery. Each cell as well as its locations shall be numbered for proper record of maintenance operations. Battery should be placed on the porcelain base kept on the wooden rack.
- The battery shall be connected to D.C. distribution board by single core cables laid above ground. Suitable terminal arrangement with glands shall be provided for this purpose.
- Battery room shall be painted with acid proof paint. Exhaust fans should be provided in the battery room. Contractor shall submit the details of the same to the owner.
- The ripple content in the D.C. current shall be less than 1%.

- The float charger unit shall be capable of supplying continuous D.C. load and trickle charge the battery.
- Necessary alarm and indication shall be provided with the DC System and also in the annunciation window of the Battery Charger.
- Necessary terminals with lugs for earthing the charger panels with two distinct separate earthing for each panel shall be provided. In addition, separate terminals for earthing of equipment shall be provided. The charger panels shall have space heaters.
- Compression type cable glands of suitable rating for PVC unarmoured cable, suitably mounted in the panel for cable entry from the bottom for A.C. & D.C. supplies shall be provided.
- Type of cell, cell terminal, containers and installation of battery, chargers, inverter, DC Distribution Board, cables etc. should conform to the latest edition of relevant Indian Standard.
- During installation of battery, charging & discharging and charging is to be done proper installation procedure.

2.9.4 TECHNICAL REQUIREMENTS

Minimum technical requirements for the DC Battery, Battery charger and DC Distribution Board are as following.

- The battery shall be made of lead-acid cells with tubular type plates conforming to latest issue of IS 1651. The battery cells shall be high discharge performance (HDP) type.
- The capacity of 30V D.C. batteries based on 10 hours discharge rate shall be selected to fulfill the plant's requirement. The contractor shall propose the same to the owner and decision of the owner will be final and bound to the contractor.
- The battery shall normally remain under floating condition with the charger supplying the normal continuous load. However, the battery shall be capable of supplying the load without fall of terminal voltage per cell below 1.85V (92.5% of rated voltage).
- The number of cells of the 30volt battery bank at Main Control Room and required voltage at Local Control Room shall be chosen to suit the following conditions.
 - Nominal floating voltage per cell shall be between 2.15 and 2.21 V.
 - The voltage of each cell under floating conditions shall be of optimum value for its performance and maintenance in a healthy condition.
 - The voltage of the battery after meeting the D.C. load cycle shall not be less than 90% of the rated voltage. The manufacturer shall ensure safe operation of the battery after the aforementioned end voltage.
 - The voltage across the load shall not exceed 110% of rated value under charging conditions of the battery. To achieve this condition under quick charging, a blocking diode may be incorporated by the supplier in the charging equipment.
- The bidder shall clearly justify the choice of number of cells in the tender on the above lines and furnish any clarifications required by the owner.

- All cell terminals shall have adequate current carrying capacity and shall be of lead-alloy or lead-alloy reinforced with copper core inserts. Cell terminal posts shall be equipped with acid resisting connector bolts and nuts.
- The electrolyte shall be of battery grade sulphuric acid. The battery shall be transported dry.
- The charging equipment shall preferably employ solid state full wave rectifier in a 3 phase full wave bridge circuit with suitable filter circuit of AC ripples, suitable for operation in conjunction with static voltage regulator. A.C. and D.C. Circuit breakers with thermal overload and instantaneous short circuit releases shall be provided on input and output sides of chargers respectively.
- Capacity of the float charger and the boost charger in the float cum boost charger shall be sufficient to meet the system requirement. Contractor shall submit the details to the owner.
- The charger shall be capable of providing the floating voltage between 2.15 V to 2.21 V per cell with the variation of not more than +1% irrespective of input supply voltage fluctuations within +/-10%, frequency fluctuation within +/-5 % throughout its ampere rating with ambient air temperature range of -30°C to 40°C.
- The DC Distribution Board (DCDB) shall be free standing, self-supporting and floor mounting type. It shall be totally enclosed and compartmentalized. DCDB shall be made as per relevant Indian Standard.
- The Emergency Lighting Board supplying the emergency lighting requirement of the power house at A.C shall have an arrangement so that automatic changeover to emergency lighting in case of A.C. failure, is achieved through an inverter of suitable capacity. Normally, the inverter shall run on AC. supply. In the event of failure of AC, the inverter shall automatically switch-over to DC supply and feed the selected emergency loads (lighting loads) at 230 V AC. On restoration of AC supply, the inverters load will automatically return to AC.
- The DC system shall have necessary control & protection arrangement which include but not limited to the following.
 - Auto/Manual selector switch
 - Digital D.C. voltmeter, ammeter
 - A.C. failure alarm
 - Ground fault relay and its annunciation
 - Double pole D.C. contactor of suitable capacity for annunciation
 - Triple pole A.C. contactor of suitable capacity for ON/OFF operation
 - MCCB and DC contactor of suitable capacity in output circuit of each charger to suit the operation requirements.
 - Indicating lamps, as required
 - Triple pole, A.C. circuit breaker of sufficient capacity to meet system requirements & capacity with overload and short circuit release for incoming A.C. supply to charger panel
 - MCB/MCCBs for A.C. supply to individual chargers
 - A.C. under voltage relay
 - A.C. voltmeter, ammeter etc.
- Nearest local control room from the main control room should be connected with 30V DC from Battery Bank DCDB.
- 30V AC/DC converter is to be provided in each isolated C & R Panel for operation of circuit breaker/isolator as and where required. Power required in ACDB/DCDB for illumination, control system etc. for each control room should

be collected from 415 V (3phase+N) transmission line with necessary cables and protection.

2.9.5 APPROVAL

The Detailed Design Report submitted by the contractor to WBSEDCL must contain but not limited to the following details of the DC system:

- Detailed specification of all the items.
- Necessary Drawings
- Test Certificates etc.
- GTP and all other technical requirement/specification shall be in line with the specification available in;
https://www.wbsedcl.in/irj/go/km/docs/internet/new_website/technicalSpecification.html

Prior to the delivery of the product, the contractor shall submit but not limited to the following documents:

- Guarantees
- Instructions for installation and operation, manual
- Detailed schematic, connection and control wiring diagrams etc.

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBSEDCL.

2.10 PROTECTION SYSTEM

2.10.1 SCOPE

The scheme shall consist of design, engineering, quality surveillance, manufacture, tests at manufacturer's works before dispatch, transport, transit insurance, supply, delivery to site, storage at site, erection, testing, trial run and commissioning, handing over to the purchaser of protection system for

- PV Array yard
- Solar Inverter
- Three winding Step up Transformer
- Incomer feeder for 33 kV Switchyard
- Station Auxiliary Transformer
- 33 kV outgoing feeder

The protection system shall include protection relays, trip relays, relay contacts, trip & alarm circuits, Annunciation system, diagnostic system, other necessary equipment with all accessories, wiring and cubicles for making the protection system complete.

2.10.2 STANDARDS

All materials and equipments shall conform to latest edition of relevant Indian/IEC Standards unless otherwise specified. Equipment conforming to any other authoritative standard ensuring equal or better quality than the standards indicated below will also be acceptable. However, in such eventuality, the salient points of difference between the standards adopted and the standards mentioned below shall be brought out by the bidder. The list of reference standards is given below:

	Standards	Description
1	2705	Current Transformers
2	3156	Voltage Transformer s
3	IEC: 60255 (Part 1 to 23)	Electric Relays
		Control switches and low voltage switching devices for control and auxiliary circuits
5	1885	Electro-technical vocabulary on Electrical relays, Electric Power System Protection and Switchgear & Control
	IS:13947	Degree of protection provided by enclosures low voltage switchgear and control gear
7	3231	Electric relays for Power System protection
	5834	Electric Timer relays
	8686	Static Protective relays

2.10.3 TECHNICAL REQUIREMENTS

The technical requirements of the protection system shall be but not limited to the following.

- Protection shall be designed to ensure reliability, sensitivity and stability under through fault conditions of the system.
- The protection system shall be fully integrated with SCADA system.
- The protection scheme shall be coordinated with control & protection of solar modules, solar inverters and generator transformers etc. All protection, though not specified but which are

recommended for this capacity of the machine as per relevant IEC / other Standards shall be provided.

- The protective relays shall be of the numerical, fully tropicalized, plug in type, arranged in protection cubicles including all ancillary devices, such as interposing transformers, tripping matrix and relays, test facilities, power supply units, etc. with all circuits complying to latest editions of IEC 60255-4 recommendation or British Standard 142 and 5992, parts 1, 2 and 3 or relevant Indian Standard.
- The relays/protection system shall be of state of the art of technology and only latest proven versions of the relay series shall be offered. If the protection system mentioned in the awarded Contract become obsolete at the time of supply, the Supplier shall offer the latest model with the approval of Employer, without any extra cost.
- Protection system shall be provided to prevent operation of protective equipment due to, magnetizing current inrush during switching-in of the transformer from the high voltage side.
- Precaution shall also be taken so that the unavoidable inductive and capacitive couplings from the power circuits do not cause disturbances.
- Protection relay shall have features but not limited to the following:
 - Man machine communication interface with alarm and trip value setting, displaying of alarm/trip set values, alarmed/tripped values, fault current and disturbance values etc.
 - Self-supervision and indication of any failure.
 - Continuous monitoring of external and internal auxiliary voltages
 - Ease of replacing a set in case of failure.
 - Communication interfaces or ports.
 - Indication of alarm and trip condition.
 - Test facilities etc.
- All devices shall be insensitive to mechanical shocks, vibration and external magnetic fields.
- The protection relays, shall be located in conventional panels and shall be flush mounted in dust and moisture proof cases with protection class IP 54 and of the draw out type with rear connections. The protection class of the cover for all relays or protection systems, in which the modules are mounted, shall not be inferior to IP 54.
- The protection systems shall be fed by the battery banks installed in the main control room and local control rooms. Relay shall be suitable for operation on DC systems without the use of voltage dropping resistors.
- The supplier has to supply the equipments for protection of best quality. The supplier has to maintain control and quality assurance during the manufacture, installation, testing and commissioning of equipments as per approved quality assurance plan.

2.10.4 APPROVAL

The Detailed Design Report submitted by the contractor to WBSEDCL must contain but not limited to the following details of the protection system:

- Detailed specification of all the items.
- All required drawing etc.
- GTP and all other technical requirement/specification shall be in line with the specification available in;
https://www.wbsedcl.in/irj/go/km/docs/internet/new_website/technicalSpecification.html

Prior to the delivery of the products, the contractor shall submit but not limited to the following documents:

- Guarantees
- Instructions for installation
- Instruction O&M manual Testing & commissioning manuals
- Detailed BOQ covering protection relays, CTs /PTs, DC Sources and all other devices.

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBSedCL.

2.11 EARTHING SYSTEM

2.11.1 SCOPE

The scope of work under this specification covers the design, supply, transportation, delivery at project site, transit insurance, storage at site, erection, testing & commissioning of earthing system along with necessary materials

2.11.2 STANDARDS

The grounding system shall conform to the requirement of following standards.

Sl. No.	Standards	Description
1	ANSI/IEEE: 80 –2000	Guide for safety in AC Substation Grounding
2	CBIP Publication: 223	Design of Earthing Mat for High Voltage substation
3	IS: 3043	Code of Practice for Earthing Indian Electricity Rules

2.11.3 OBJECTIVE

The grounding system shall be designed with the following objectives:

- To provide low impedance path to fault currents, during ground faults, to ensure prompt and consistent operation of protective devices to effect isolation
- To keep the maximum voltage gradient during ground faults along the surface inside and around the switchyard, PV array yard, control rooms etc. within safe limits
- To protect the life and property from electrical shocks due to over voltage
- To stabilize circuit potentials with respect to ground and limit the overall potential rise

2.11.4 TECHNICAL REQUIREMENTS

Minimum technical requirement of the earthing system is mentioned below.

- The earth resistance should be less than 1 Ω .
- Suitable number of earthing pit shall be provided at the array field.
- Design and installation of the earth mat and other associated system shall confirm to IS: 3043 and IEEE Std P80 with latest amendments.
- The earthing for solar field and power distribution system shall be made with GI pipe of suitable size including accessories, and providing masonry enclosure with cast iron cover plate having locking arrangement, watering pipe using charcoal or coke and salt as required as per provisions of IS: 3043. The Mounting structure shall be grounded properly using GI strips and maintenance free earthing kit.
- Necessary provision shall be made for bolted isolating joints of each earthing pit for periodic checking of earth resistance.
- The earth conduction shall run through GI pipe partly buried and partly on the surface of the control room building.
- The complete earthing system shall be mechanically & electrically connected to provide independent return to earth.
- All three-phase equipment shall have two distinct earth connections.
- Along the cable trays suitable size of GI Flat shall be provided inside the control room.

- For each earth pit, necessary Test Point shall have to be provided.
- The earthing system shall be connected to the following.
 - Solar modules with suitable number of earthing pit at the solar array field
 - The neutral point of each system/equipment
 - Equipment framework and other non-current carrying parts
 - Frames of panels & cubicles
 - Metallic structures of switchgear, cable racks, casing of cable boxes
 - Equipment supporting Steel structures
 - All extraneous metallic frame work not associated with equipment
 - The earth point of lightning arrestors; voltage transformers and lightning conductors through their permanent independent earth electrodes.
 - Fence
- For equipment connection to mat/riser, 50 mm x 6 mm or higher size GS flat shall be used.
- The conductor shall be of adequate cross-section to safely withstand the system fault current for time duration of fault clearance by the remotest/back up protective system.
- Sufficient allowance needs to be provided for corrosion of the embedded conductor on account of chemical properties of soil and also due to galvanic action with other embedded systems.
- For determination of the size of the conductor, the minimum value of earth fault current shall be taken as 25 kA, duration of fault current shall be considered as 3 second. The extra allowance of minimum 20% to take care of corrosion shall be added to arrive at final conductor size.
- For designing of the earth mat for 33kV switchyard, the material of ground mat conductor shall be MS Flat and that of risers emanating from ground mat shall be GS flats. Soil resistance of the site is available in the soil report.
- Lightning shield wire design of switch yard shall be done using rail pole.

2.11.5 APPROVAL

The successful bidder shall carry out the earth resistance measurement at the site and they need to submit the measurement report to WBSEDCL.

The Detailed Design Report submitted by the contractor to WBSEDCL must contain but not limited to the following details of the earthing system:

- Detailed specification of all the items.
- Soil resistivity measurement data
- Necessary calculations and drawings etc.

The successful bidder required to produce schematic diagram of the earthing system and the proposed locations for earth mat as per relevant standard with the Detailed Design Report.

All drawings and calculations submitted by the contractor will be subjected to approval of the WBSEDCL.

2.12 CONTROL, MONITORING AND DATA ACQUISITION SYSTEM

2.12.1 SCOPE

The scope of work under this specification covers the design, engineering, manufacture, testing at manufacturer's works, transportation, transit insurance, delivery at project site, storage at site, erection, testing at site and commissioning of Control, monitoring & Data Acquisition system comprising of computers, VDU, key board/mouse, PLC's, input and output relays, meters, fields sensors, panels/cubicles for housing above equipment/devices, power supplies, transducers, converters, wiring etc to make the system complete.

2.12.2 REQUIREMENTS

- The automatic control panels shall be located in each control room. The control panels shall be provided with local automatic selection. On local automatic selection, control will be transferred to control panels located in local control rooms from where unit can be started by single push button control. Control panel should be equipped with seamless data transmission via Modbus TCP protocol to remote interface Master SCADA centre at ALDC, WBSEDCL. To adhere this data transmission to ALDC, SIM based/ or additional modem need to be integrated with existing ALDC system.
- All necessary support as and when required to integrate the plant data with SCADA at ALDC shall be adhered by the EPC Agency within the contract value.
- The SCADA work station and push button control panel shall be interlocked by means of hardwired and software (Logic) to ensure smooth and safe operation of the plant.
- All pre-synchronization checks shall be made to ensure normal and safe operation of the machine. Detailed philosophy shall be submitted by the contractor.
- PTZ (Pan-Tilt-Zoom) outdoor camera covering the whole plant to be deployed with night vision and central monitoring through 50" LED monitor/TV of reputed make such as Sony, Samsung, LG etc.
- System shall acquire on continuous basis the parameters of PV array, like DC current of string, DC voltage of each combiner box etc., Parameters of Solar Inverter like Power at the input of each inverter, Power at the input of each inverter, phase current, voltage, PF, MVAR, MW, Frequency etc., similar parameters of Generator Step-up and auxiliary Transformers etc.
- The Monitoring system shall perform String level monitoring for trouble free operation and maintenance of the plant. System shall indicate these on VDU Mimic alongside relevant device.
- System shall monitor and indicate on VDU status of all electrical devices including 33 kV VCB.
- Shall provide mimics of main single line diagram, Auxiliary SLD and DC SLD in colour. The parameters as above shall be displayed by the side of respective device in proper units of measurement.
- The control & monitoring system for the generating units shall be microprocessor based digital control.

- The data logger shall have reliable battery backup and data storage capacity to record all sorts of data simultaneously round the clock.
- Inverters should be integrated with SCADA and provision of Data logging should be there. Logger should have the provision of recording the data of solar insolation, PV Module temperature and ambient temperature and associated electrical parameters at different stages to study performance of system as well as to study status of the system at a particular instant. The data logger should have required transducer to monitor and record the required system data. The data logger should be provided with an insolation sensor and a module temperature sensor, ambient temperature sensor matched with the system.
- Plant based Remote Monitoring system must be compatible with data logger. The other required accessories, hardware and compatible software shall have to be provided as an integrated part of the system to monitor the real time data through the server. The Data logger shall continuously send data to the server. Plant based Data logging system may be provided with special software (minimum 10 users). Up gradation of the software, if any, shall be done by the contractor. The server shall not be provided by WBSedCL or end-user.
- In case the data cable to be laid in the array field, SPD (surge protection device) suitable for communication network, as much number at suitable location are required must be provided with the system.
- The Plant based monitoring system should have the provision of graphical representation of the data shall include but not limited to the following:

SI. No.	Operating Parameter	Desired specification
1	Input data	<ul style="list-style-type: none"> • PV Power • PV Energy
2	Meteorological data	<ul style="list-style-type: none"> • Insolation (inclined on the plane of module as well as horizontal) • Module Temperature • Ambient Temperature • Wind Velocity
3	Output data	<ul style="list-style-type: none"> • Inverter Export Power • Inverter Export energy

- All data shall be recorded chronologically date wise. The data file should be MS Excel/XML/any readable form compatible and should have the facility of easy downloads.
- IT grade server may be installed including provision for back up data at least for 05 years. Generation 11, 32 GB RAM , 8 TB Sata HDD (3 nos.) , Data redundancy , Raid 5 with 22 " LED monitor.

2.12.3 APPROVAL

The Detailed Design Report submitted by the contractor to WBSedCL must contain but not limited to the following details of the data acquisition and monitoring system:

- Detailed scheme
- Details of panels, metering system
- Necessary drawings for the scheme etc.

Drawings and scheme submitted by the contractor will be subjected to approval of the owner.

2.13 MISCELLANEOUS

GENERAL SCOPE

The scope of work under this specification covers the following systems.

- Illumination system
- Fire protection system
- Ventilation system
- Air conditioning system
- Drinking water
- Weather station
- Communication system
- Signage
- Surveillance System

2.13.1 ILLUMINATION SYSTEM

SCOPE

The scope of work under this specification covers design, manufacture, assembly, shop testing, delivery, site erection, testing & commissioning of Illumination system comprising of main Illumination switchboards, distribution boards, sub distribution boards, switchboards, lighting fixtures, convenience and power outlets, conduits & fittings, cabling, outdoor lighting including mounting structures & poles, LED etc. for control rooms, security cabin, watch tower, access road, across the fence (maximum 15 m between two adjacent lamps).

The illumination system shall be designed as per relevant Indian Standard / Guideline for different location of the plant. The lighting arrangement should be LED Based.

The scope of supply shall also include necessary spares required for normal operation & maintenance of illumination equipment for a period of 12 years & special tools & plants required for erection & maintenance. Corresponding parts of all the equipments & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable.

STANDARDS

The material, equipment and its installation under the scope shall comply with all applicable provisions of the latest Indian standards and codes of practice. Some of the relevant standards are given below:

Sl. No.	Standards	Description
1	IS: 3646	Code of practice for interior Illumination (Part I, II, III)
2	IS: 6665	Code of Practice for Industrial Lighting
3	IS: 732	Code of Practice for Electrical wiring installations
4	IS: 9537	Conduits for Electric installations
5	IS: 2418	Tubular fluorescent lamps for general lighting service
6	EN 61347-2-13	Particular requirements for D.C. or A.C. supplied electronic control gear for LED modules
7	EN 62384	D.C. or A.C. supplied electronic control gear for LED modules
8	EN 61000-3-2	Electromagnetic compatibility (EMC). Limits for harmonic current emissions (Equipment input current < 16 A per phase)

The installation shall generally be carried out in conformity with the requirements of Indian Electricity Act 1910 (latest Amendment) & Indian Electricity Rules.

REQUIREMENT

The lighting system for outdoor and indoor areas of Solar Power Plant shall be designed in such a way that uniform illumination is achieved.

In outdoor yard equipment / bus bar areas and the peripheral wall are to be illuminated and luminaires shall be aimed for clear view.

LIGHTING LEVELS

The complete switchyard shall be lightened with an average illumination level of 100 lux.

Lighting in other areas such as control room, office rooms and battery room & other areas (i.e. street light) shall be such that the average LUX level to be maintained shall be as under:

Sl No.	Area	LUX
1	Control Room and equipment rooms	500
2	Office	530
3	Communication Room	530
4	Battery & other rooms	150
5	Other areas including periphery wall	20
6	H – pole and metering point	20
7	Outdoor switchyard including road	30
8	Road within campus including colony Area	30
9	Auxiliary Buildings like Pump room and other houses	150
10	ACDB- DCDB room/Store / Store Office	150
11	Conference room	530
12	Dining room/Kitchen	150
13	Maintenance room	150
14	Stairs	100
15	Toilet	100
16	Corridor	100
17	Any other spot where high level of illumination required	150

EMERGENCY LIGHT POINTS

Light points using LED lamps of 15-20 W (at 240 V) shall also be provided as given below:

- Control room and equipment room – 4 Nos.

- Battery room – 1 No
- Office – 1 No
- Corridor – 1 No
- Local Control Room – 2 Nos.

These lights shall operate on AC/DC changeover supply from the DC distribution Board. Separate wiring and distribution board shall be provided from these lights.

APPROVAL

The Detailed Design Report submitted by the contractor to WBSEDCL must contain but not limited to the following details of the illumination system:

- Detailed scheme and specification
- Illumination calculations for arriving at the number of lighting fixtures for different areas & rooms considering the required lux level as per relevant IS Code.
- Necessary drawings etc.

Drawings and scheme submitted by the contractor will be subjected to approval of the owner.

The contractor can deliver the product to the site only after receipt of such approval against their prayer in writing from WBSEDCL.

2.13.2 FIRE PROTECTION SYSTEM

SCOPE

The scope of work under this specification covers design, engineering, quality assurance, manufacture, shop testing, transport, transit insurance, delivery to site, storage at site, site erection, testing & commissioning of fire protection system (fire extinguisher (type shall be selected as per requirement), fire buckets, fire alarms at all control rooms etc.) complete with all accessories.

The scope of supply shall also include necessary spares required for normal operation & maintenance of illumination equipment for a period of 12 years & special tools & plants required for erection & maintenance. Corresponding parts of all the equipments & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable.

STANDARDS

All equipment covered under this section will conform to the latest edition of following Indian Standards:

Sl. No.	Standards	Description
1	IS: 3034	Code of Practice for Fire Safety of Industrial buildings: Electrical generating and distributing stations.
2	IS: 3844	Code of Practice for installation of internal fire hydrants in multi-storied buildings
3	IS: 1646	Code of Practice for fire safety of buildings (General) Electrical Installations
4	IS: 2878	Specification for fire Extinguishers – Carbon dioxide type
5	IS: 2171	Specification for fire Extinguishers – Dry Powder type
6	IS: 933	Specification for fire Extinguishers – Foam type
7	IS: 2175	Specification for heat sensitive fire detectors for use in automatic electrical fire alarm system

APPROVAL

The Detailed Design Report submitted by the contractor to WBSEDCL must contain but not limited to the following details of the fire protection system:

- Detailed scheme and technical specification
- Placing and type of fire extinguisher with justification
- Necessary drawings related to the system etc.

Drawings and scheme submitted by the contractor will be subjected to approval of the owner.

The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBSEDCL.

2.13.3 VENTILATION SYSTEM**SCOPE**

The scope of work under this specification covers design, manufacture, shop testing, supply, transportation, delivery, storage at site, erection, testing and commissioning of ventilation system complete with all accessories at each control rooms, store room etc.

The Scope shall include supply of all blower fans, GS ducting, air plenum, exhaust fans air dampers etc as required to make the ventilation system complete in all respects for satisfactory operation.

The scope of supply shall also include necessary spares required for normal operation & maintenance of ventilating equipments for a period of 12 years and special tools & plants required for erection & maintenance.

Corresponding parts of all the equipments & spares shall be of the same material & dimensions, workmanship & finish and shall be interchangeable. All the material & workmanship shall be of suitable commercial quality as have proven successful in their respective uses in similar services & under similar condition.

STANDARDS

The ventilating equipment shall comply with the requirement of the latest edition of relevant Indian standards or equivalent British Standards. Some of the relevant standards are given below:

Sl. No.	Standards	Description
1	IS : 3103	Code of Practice for industrial ventilation
2	IS : 2312	Specifications for propeller type A.C. Ventilating fans.
3	IS: 4894	Centrifugal fans

APPROVAL

The Detailed Design Report submitted by the contractor to WBSEDCL must contain but not limited to the following details of the fire protection system:

- Detailed scheme and technical specification
- Calculations showing air requirements at various locations
- Necessary drawings etc.

The successful bidder required to produce all necessary test certificates and approvals of the product as per relevant standard with the Detailed Design Report.

Drawings and scheme submitted by the contractor will be subjected to approval of the owner. The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBSEDCL.

2.13.4 AIR CONDITIONING SYSTEM

SCOPE

The scope of work under this specification covers design, manufacture, testing, supply, transportation, transit insurance, delivery, storage at site, erection, testing and commissioning of Air conditioning system with control and accessories at the operator's work station, SCADA room and Conference/seminar room at main control room building.

STANDARDS

Equipment shall conform to the latest Indian standards or equivalent British Standards.

Standards	Description
IS: 659	Safety code for Air conditioning
IS: 660	Safety code for Mechanical Refrigeration
IS: 655	Metal Air ducts

SPECIFICATION

Five Star rated Inverter AC of reputed make and adequate capacity such as O- General/Mitsubishi etc. shall be supplied. Approval of AC capacity shall be accorded after submission of requisite documents.

2.13.5 DRINKING WATER

SCOPE

The scope of supply under this section shall cover the design, manufacture, shop testing, supply, transportation, delivery, storage at site, erection, testing and commissioning of deep tube well, pump, water purifier unit and other related plumbing arrangement and accessories etc. for drinking water supply for the personnel at the power house.

STANDARDS

The whole system shall conform to the latest edition of relevant Indian Standard.

APPROVAL

The Detailed Design Report submitted by the contractor to WBSEDCL must contain but not limited to the following details of the water purification unit:

- Detailed Technical specification
- Necessary drawings etc.

Specification submitted by the contractor will be subjected to approval of the owner. The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBSEDCL.

2.13.6 WEATHER STATION

SCOPE

The scope of supply under this section shall cover the design, manufacture, shop testing, supply, transportation, delivery, storage at site, erection, testing and commissioning of weather station comprising of

- Temperature sensor with radiation protection
- Temperature sensor in the module
- Solar radiation sensor (Inclined on the plane of module as well as horizontal)
- Sensor which indicates the speed and direction of the wind etc.

The monitoring system shall be linked to the weather station by means of its digital/analogue inputs, allowing the data collected by the sensors stored through software.

STANDARDS

The equipments shall conform to the latest edition of relevant Indian Standard.

APPROVAL

The Detailed Design Report submitted by the contractor to WBSEDCL must contain but not limited to the following details of the equipments of weather station:

- Detailed Technical specification
- Necessary drawings etc.

Specification submitted by the contractor will be subjected to approval of the owner. The contractor can deliver the product to the site only after receiving such approval against their prayer in writing from WBSEDCL.

2.13.7 COMMUNICATION SYSTEM

Communication system at the Main Control Room (telephone sets) and required number of walkie talkies for security personnel and main control room shall be provided by the contractor.

2.13.8 SIGNAGE

Project information Signage:

- The Signage shall be provided with details of the project as approved by WBSEDCL.
- The font size on the signage has to be big enough so that everyone can read it easily.
- This signage will be outdoor type.
- The Signage shall be installed two (02) prominent place of each project location.

Safety Signage:

Safety Signage must be provided mentioning the level and type of voltage and symbols as per IE Rule at different position as may be required.

2.13.9 SURVEILLANCE SYSTEM

The specification covers design, supply, erection, testing and commissioning of the complete surveillance system including cameras, Network Digital video recorder, computer with peripherals, mounting arrangement for cameras, cables etc. for effective visual monitoring of total power plant premises.

The number of cameras and their locations shall be decided to monitor at least:

- All the Transformers.
- The operation of each and every isolator of the complete yard.
- All other Major Equipments (such as CB, CT, PT, SA etc.)
- Key areas of control room cum administrative building, Indoor C&R panel room etc.

- All the Entrance doors of Control Room Building, Pump House, Sub-Station main gate, gates of switchyard, colony entrance gate etc.

The cameras can be mounted on structures, buildings or any other suitable arrangement to be provided by the contractor.

TECHNICAL REQUIREMENTS

The system shall use video signals from various types of indoor/outdoor CCD colour cameras installed at different locations, process them for viewing on workstations/monitors in the control Room and simultaneously record all the cameras after compression using MPEG 4 or better standard and streamed over the IP network. Mouse-Keyboard controllers shall be used for Pan, Tilt, Zoom, and other functions of desired cameras. The System shall provide sufficient storage of all the camera recordings for a period of 90 days or more @ 25 FPS, at 4 CIF or better quality using necessary compression techniques. It shall be ensured that data once recorded shall not be altered by any means. The recording resolution and frame rate for each camera shall be user programmable. The provision for transfer of recorded data to separate external media shall be ensured.

The surveillance CCTV System shall operate on 230 V, 50 Hz single-phase power supply.

SYSTEM REQUIREMENTS

- Camera with external encoder shall be used for image capture.
- Indoor cameras shall be either with fixed focal length lens or with Pan/Tilt & Zoom lens as per site requirement. All outdoor Cameras shall be Day/Night PTZ Dome type cameras. At least four number PTZ Dome type cameras have to be installed.
- Housing of cameras meant for indoor use shall be of IP 42 rating whereas outdoor camera housing shall be of IP 66 or better rating.
- All camera recordings shall have Camera ID & location/area of recording as well as date/time stamp. Camera ID, Location/Area of recording & date/time shall be programmable by the system administrator with User ID & Password.
- System to have facility of additional camera installation beyond the originally planned capacity.
- System shall be triplex i.e. it should provide facility of simultaneous recording, playback & network operation.
- The offered system shall have facility to export the desired portion of clipping (from a desired date/time to another desired date/time) on CD or DVD. Viewing of this recording shall be possible on standard PC using standard software like windows media player etc.
- System shall have provision for remote monitoring.

The equipment should generally conform to Electromagnetic compatibility requirements for outdoor equipment in EHV switchyards. Type test reports to establish compliance with this requirement shall be submitted during detailed engineering.

VIDEO SURVEILLANCE APPLICATION SOFTWARE

- Digital video surveillance control software should be capable to display and manage the entire surveillance system. It should be capable of supporting variety of devices such as cameras, video encoder, Servers, NAS boxes/Raid backup device etc.
- Surveillance control software should be compatible with MS Windows operating system.
- The software should have inbuilt facility to store configuration of encoders and cameras.
- The software should Support flexible 1/2/4/8 Windows Split screen display mode or scroll mode on the PC monitor.
- The software should be able to control all cameras i.e. PTZ control, Iris control, auto / manual focus, and color balance of camera, Selection of presets, Video tour selection etc.
- There must be a single encoder for each camera.
- The software should have user access authority configurable on per device or per device group basis. The user shall have the facility to request the access and control of any camera for a pre-determined time period. Control of camera shall be released automatically after expiry of the pre-determined time period.
- The system shall provide user activity log with user ID, time stamp, action performed, etc.
- The users should be on a hierarchical basis as assigned by the administrator. The higher priority person can take control of cameras, which are already being controlled by a lower priority user.
- It should have recording modes viz. continuous, manual, or programmed modes on date, time and camera-wise. All modes should be disabled and enabled using scheduled configuration. It should also be possible to search and replay the recorded images on date, time and camera-wise. It should provide onscreen controls for remote operation of PTZ cameras. It should have the facility for scheduled recording. Different recording speeds (fps) and resolution for each recording mode for each camera should be possible.
- The software for clients should also be working on a browser based system for remote users. This will allow any authorized user to display the video of any desired camera on the monitor with full PTZ and associated controls.
- Retrieval: The VMS application should allow retrieval of data instantaneously or any date / time interval chosen through search functionality of the application software. In case data is older than 30 days and available, the retrieval should be possible. The system should also allow for backup of specific data on any drives like DVD's or any other device in a format which can be replayed through a standard PC based software. Log of any such activity should be maintained by the system.

DIGITAL VIDEO RECORDER

The Personal Computer based network digital Video recorder is to be provided. The Personal computer shall include the PC (min intel core i5 processor, 4GB DDR3 RAM, 1 TB hard disk) with latest configuration available in the market along with:

- Coloured LED monitor of minimum 40", coloured Laser printer, and External USB DVD writer.
- Windows operating system latest version with license.

Sl. No.	Items	Specifications Requirement
1	Recording & Display Frame Rate	Real time 240 frames per second total, 30 frames per second per camera
2	Recording Resolution	(NTSC): 704(H) x 480(V) / (PAL): 704(H) x 586(V) It should be possible to select lower resolutions
3	Operating System	MPEG4 Hardware RTOS (Real time operating system)
4	Compression Method	MPEG-4
5	Video Motion Detection Capable	Standard and built-in (selectable in menu)
6	Video Motion Detection Options	Masking, sensitivity adjustment
7	Monitoring Options	Split screen 1,2, 4 or 8 cameras
8	Playback Options	Search, still image capture
9	Network Operation Capable	To be provided by using WAN or LAN router
10	Ethernet/Modem Built-in	Ethernet standard and built-in
11	HDD Storage Consumption	80 ~ 350 MB per hour / channel variable based on frame speed and
12	HDD Speed	7200 R.P.M + 8 MB buffer
13	Operation	Triplex operation (simultaneous recording, playback, network operation)
14	Number of Video Inputs	Eight (8) video inputs for eight (8) cameras
15	Audio Recording Capable	Eight (8) audio inputs for eight (8) microphones
16	Number of Video Outputs	Two (2) A/V outputs, one (1) VGA output
17	Pan / Tilt / Zoom Protocol Drivers Built-in	Yes

CAMERA FOR VISUAL MONITORING SYSTEM (VMS)

The VMS camera shall be suitable for wall mounting, ceiling mounting and switchyard structure mounting. The VMS camera should be colour high resolution, super HAD (Hole-accumulation Diode) , Weatherproof, Dome type. The Camera shall have an internal amplifier that applies gain to the signal. The amplifier must operate when there is insufficient light in the scene to produce an acceptable video output level, and must only apply as much gain as is necessary. The camera shall

incorporate one level of automatic gain Compensation (AGC), allowing the user to achieve the optimal balance of noise and low light performance in demanding environments.

Sl. No.	Items	Specifications Requirement
1	Resolution(TV lines)	480 horizontal TV lines (Minimum)
2	Effective Pixels (minimum)	(PAL): 752(H) x 582(V) pixels (NTSC):768 (H) x 494 (V)
3	Low Light Sensitivity (lux)	0.1 lux
4	Signal to noise Ratio	More than 45 dB (AGC off)
5	White Balance Control (WBC)	Adjustable / Automatic (2,100° ~ 8,000°K)
6	Gamma Correction	d = 0.45

SPECIFICATION FOR FIXED DOME CAMERA

The High Resolution DSP Colour Dome Camera (Digital Signal Processing using a DSP chip) shall include, as a minimum, the following features/ functions/ specifications:

- The High Resolution DSP Colour Dome Camera shall incorporate a 1/3-inch Charge-coupled device (CCD).
- The Dome Camera shall support the use of Auto Iris/ Direct Drive lens connected to the camera via 4-pin molex socket located from the inside of the camera housing. The camera must provide power to the lens.
- The Camera shall support the use of fixed lens, focal length is 3.6mm, each.
- The power consumption of the High Resolution DSP Colour Mini Dome Camera shall be no more than 1 watt.

SPECIFICATION FOR PTZ CAMERA

The features of PTZ shall include:

- Fully functional dynamic keyboard controllers with joystick for smooth camera movements
- Controls all pan / tilt and zoom functions
- Many preset options for quick access to frequently monitored areas and advanced tour programming
- PTZ Camera 8 MP 32 XIR Network Speed Dome identification range of min 200 mtr, min qty. 10 nos.
- Bullet camera and Dome camera as per site condition
- Surveillance system must be accessed remotely
- Storage data is mandatory for 90 days

Sl. No.	Items	Specifications Requirement
1	Electronic Shutter	1/60 ~ 1/100,000 sec. automatic
2	Back Light Compensation	Adjustable / Automatic and built-in
3	Automatic Gain Control (AGC)	Automatic ([0 ~ 30 dB] / 41) dB and built-in
4	Lens	270x (27x optical / 10x digital) IR-corrected aspherical power zoom lens
5	Lens Aperture	F1.6 ~ 3.7
6	Pan / Tilt / Zoom Protocol Languages Supported	Yes
7	Panning Range	Complete 360 degrees (horizontal)
8	Pan Speed	Adjustable
9	Tilting Range	180 degrees (vertical)
10	Tilt Speed	Adjustable

NOTE:

Any item/equipment not mentioned in the Technical Specification, but required for successful completion of the project shall be deemed to be a part of the scope of the work and the same shall be included by the bidder in their Bill of Quantity (BOQ).

2.14 Battery Energy Storage System (BESS)

2.14.1 Key technical parameters and minimum performance requirement of BESS

The BESS plant shall be designed to be able to deliver the minimum technical requirements as detailed in Table below to achieve the desired system performance for the applications as mentioned elsewhere in this document. For avoidance of doubt, the BESS Plant shall be able to meet the minimum technical requirements with consideration for use in the climate and site conditions as detailed in section Design climate and site conditions.

Parameters	Requirements		
Rated discharge power	10 MW (AC, at Point of Common Coupling)		
Minimum usable energy storage capacity	40 MWh @ 0.25-C (Maximum)		
Battery technology	Lithium Iron Phosphate (LFP)		
MWh rating (dispatchable Capacity at POI) for full range of environmental	40 MWh (dispatchable capacity) Dispatchable at the beginning of life (i.e. at the time of COD) and minimum dispatchable throughput capacity at the end of each year of operation (as a % of Capacity at Beginning of Life/CoD) as per below:		
	Year	Minimum Dispatchable Energy / State of Health (SoH) of BESS at the start of year (%)	Minimum Dispatchable Energy of BESS at the start of year in MWh in one full cycle
	1	100%	40.00
	2	97.50%	39.00
	3	95.00%	38.03
	4	92.50%	37.08

condition at project Site	5	90.00%	36.15
	6	87.50%	35.25
	7	85.00%	34.37
	8	82.50%	33.50
	9	80.00%	32.67
	10	77.50%	31.85
	11	75.00%	31.06
	12	72.50%	30.28
	Dispatchable capacity at end of Project life shall not be less than 70% of Beginning of Life capacity at any point of time up to End of Battery Life. (Refer Table-3).		
Design life	15 years (Fifteen (15) years BESS service that includes replacement, disposal, Operation and Maintenance (O&M) of the BESS plant)		
Cycle life guarantee	≥ 7,000 full cycles, with ≥ 70 % usable capacity		
C-Rate (charging/discharging conditions)	0.25 C (Maximum)		

Cycling requirement	Minimum 1 operational cycle per day, i.e. 1 complete charge-discharge cycle per day, and maximum 2 operational cycles per day, subject to 550 Operational Cycles in a contract Year. Each Cycle (Charge & Discharge) for 8 hours.
Power ramp-up response	Suitable for Application requirement.
Full power response time	Full power response should be able to achieve within 200 ms
Power accuracy	Active power should reach the set point (either manually dispatched or as a pre-determined function of grid frequency and SOC) within 1s, with an error of not more than 5% of power capacity
BESS Plant Availability	≥ 95%
BESS Round Trip ac-dc-ac efficiency at metering point	≥ 83% (including Auxiliary Losses) up to the end of the 12th year from the commencement of the O&M period.
Operation and Maintenance	Contractor shall provide comprehensive O&M of the BESS system(s) including Battery, BMS, PCS and EMS for a period of Twelve (12) years from the date of COD.
System architecture	Modular, containerized BESS units with integrated HVAC/Liquid cooling system, BMS, and fire suppression system
Container IP rating	IP54 & above
Use case requirements (Any other control/ application mode if required during O&M, it is to be configured by Contractor to meet special requirement. During FAT, these control modes is to be checked and ensured)	<ul style="list-style-type: none"> a) Peak Management b) Grid Ancillary services c) VAR support to Grid / voltage Regulation d) Frequency Regulation/Grid support e) Energy Arbitrage/energy shifting Operation f) Ramp rate support g) Power Quality mitigation to Grid h) Interaction on real-time with IEX for schedule of charging and discharging. i) Inertia Support to Grid as virtual Synchronous Generator
Ventilation System inside the Container	Should be such as to maintain minimum and maximum Temperature as recommended by the manufacturer for optimum performance of the batteries on continuous basis.
Power Factor range at POI/metering point (minimum)	As per CEA connectivity regulation when it is charging/discharging condition

****Note:**

- 1) Disposal of Battery/Battery cells, if found damaged/not working/inefficient, etc., within the Contract Project (including Comprehensive O&M Period of 12 years) shall be in the scope of the bidder subject to replacement of the same type & quantity which should match the technical requirements, etc. Disposal of Batteries should be as per guidelines of GoI.

2.14.2 Definition of terms

Unless otherwise stated, all references to a particular Clause, Sub-Clause or sub-paragraph are references to a clause, sub-clause or sub-paragraph in this Contract/ Appendix.

Unless otherwise stated, capitalized words and expressions shall have the meaning given to them in the Conditions of

Contract and/or in the various Contract Appendices.

The following terms shall have the meaning of:

1. Battery Management System, BMS

A system that controls, monitors, protects and optimizes the performance of the BESS. It can collect all information about the battery such as voltage, current and temperature, and, based on the information, categorizing the condition as over-voltage, under-voltage, discharge overcurrent, charge overcurrent, high temperature charge-discharge, low temperature charge-discharge, or short circuit. When an abnormality in the battery system occurs, the BMS has the ability to control the battery module to disconnect from the system. The BMS is completely independent from the Energy Management System (EMS) but is capable of providing battery modules information to the EMS for management and data storage.

2. Point of Common Coupling, PCC / Point of Interconnection, POI

The point of common coupling is where the BESS Plant connects to the transmission line. For this project, the PCC shall be defined as the connection point at the 33 kV BESS bay.

3. Power Conversion System, PCS

The device that connects the step-up transformer and switchgear to the Battery cabinet/Container. Also known as the power conditioner, the PCS can perform AC-DC or DC-AC bi-directional conversion between the BESS and the PCC.

4. Energy Management System, EMS

The EMS collects data and status information from the BMS, PCS, step-up transformer, switchgear and protective relay of the BESS, and the voltage, current, frequency, and switchgear status of the PCC to effectively control, monitor, and protect the BESS Plant. The EMS can interrupt the BESS Plant when abnormalities occur.

5. Rated Power Capacity

The largest continuous charge/discharge power of the BESS Plant as specified in the tender documents expressed in MW.

6. Nominal Power Capacity

The largest continuous charge/discharge power of the BESS Plant as specified by the Contractor in units of MW whose value shall be greater than or equal to the Rated Power Capacity.

7. Rated Energy Capacity

The DC capacity of the BESS as specified in the tender document in units of MWh. It is also the total DC capacity that the BESS can store and release within the warranty period.

8. Nominal Energy Capacity

The DC capacity of the BESS as specified by the Contractor in units of MWh. It is also the total DC capacity that the BESS can store and release whose value shall be greater than the Rated Energy Capacity

9. Depth of Discharge, DOD

Denotes the degree of ESS discharge, i.e. in the discharge period of the cycle, the ratio of discharged capacity to the nominal capacity expressed as a percentage.

$$DOD = \frac{\text{Discharge Capacity}}{\text{Nominal Energy Capacity}} \times 100\%$$

10. State of Charge, SOC

Denotes the degree of BESS charge, i.e. the ratio of the actual capacity (or remaining capacity) to the nominal capacity expressed as a percentage.

$$SOC = \frac{\text{Remaining Capacity}}{\text{Nominal Energy Capacity}} \times 100\%$$

11. State of Health, SOH

The actual available capacity in the BESS will gradually decline as a function of the number of charge/discharge cycles, the charge/discharge power, and environmental conditions. The SOH denotes the health of the BESS, i.e. the ratio of actual available capacity to the nominal capacity expressed as a percentage.

$$SOH = \frac{\text{Actual Available Capacity of the BESS}}{\text{Nominal Energy Capacity}} \times 100\%$$

12. Efficiency of BESS

The ratio of actual output energy by the ESS to the actual received energy at the PCC expressed as a percentage.

$$\eta = \frac{\text{Actual output energy}}{\text{Actual received energy}} \times 100\%$$

13. Total Response Time

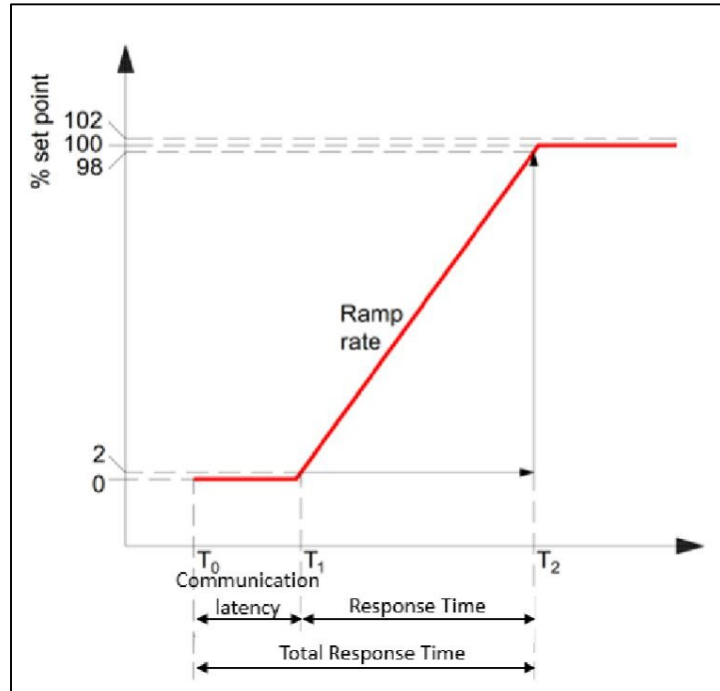
The period between the time BESS receives a signal (or command) and the time the BESS charge/discharge power reaches $100 \pm 2\%$ of the nominal power (including the communication latency and response time) expressed in seconds. Total Discharge Response Time = $T_2 - T_0$ and vice versa, as shown in Figure 1.

14. Response Time

The time required for the BESS discharge power to increase from 0% to 100% (with a tolerance of $\pm 2\%$) of the nominal power expressed in seconds. Discharge Response Time = $T_2 - T_1$ and vice versa, as shown in Figure below.

15. Charging/Discharging Ramp Rate

The BESS Charging/Discharging Ramp Rate is the average rate of change of the active power between T_2 and T_1 per unit time, as shown in Figure below.



16. Container for BESS and Equipment

Installation of the battery, BMS, PCS or related auxiliary equipment in containers to protect it from moisture and dust. Personnel may enter the container for maintenance and testing through doors and passages with restricted access.

17. Outdoor cabinet

Installation of the BESS related auxiliary equipment in outdoor cabinet or enclosure to protect it from moisture and dust. All maintenance and testing are performed outside.

18. Unit battery

A unit battery is the minimum field-replaceable stored energy component or assembly. It may consist of one or more electrochemical cells, electrically interconnected in any series and/or series-parallel configuration. A unit battery has one (and not more than one) set of positive and negative terminals, by which it is interconnected with the rest of the storage system.

19. BESS Plant

“BESS Plant” shall mean the collection of the BESS and all associated ancillary equipment, including electricity networks connections till PCC (POC) at 33 KV Bay.

BESS shall be defined and comprised of the following equipment, but not limited to:

- 1) Battery cells, modules and racks (incl. suitable containers)
- 2) Power Conversion System (PCS / PCU)
- 3) Inverter duty power transformers and redundant BESS auxiliary transformers
- 4) Battery Management System (BMS) and Energy Management System (EMS)
- 5) Structures and enclosures (including but not limited to control rooms, switch rooms, PCS and battery enclosures or containers, spare part storage containers and workshop, etc., as required) with the required HVAC.

- 6) Low-voltage and 33 kV electrical systems, including but not limited to power cables and control cables, circuit breakers, disconnectors, current and voltages transformers, surge arresters, power transformers, cable connectors, protection equipment, plant grounding and lightning protection system, grounding system and high precision energy measurement and billing and settlement equipment.
- 7) Telecommunication, SCADA, monitoring, instrumentation and control systems.
- 8) Auxiliary power supply.
- 9) LV power distribution systems for the site including all switchgear and associated infrastructure.
- 10) HVAC, Fire and Smoke detection system and Fire Suppression system.
- 11) Back up supply for the critical systems in case of Grid failure.
- 12) Protection relay systems and metering systems.

2.14.3 Overall Scope of Work

The scope of work shall include, but not limited to:

- 1) Engineering studies, design, manufacture, testing at works, supply of BESS plant, equipment, materials, onsite installation, site supervision, testing and commissioning services for a complete, commissioned and fully functional BESS Plant and its safe and effective operation which shall include but not limited to the following:
 - 2) Project execution strategy including design, installation, quality, testing and commissioning plans.
 - 3) Engineering network system studies and studies reports.
 - 4) Pre-manufacturing equipment design and verification studies and all necessary study reports including but not limited to protection relay setting report.
 - 5) Design, manufacture and supply of BESS plant and shall complete with all the associated equipment and materials, include but not limited to the following:
 - 6) Battery energy storage systems (battery cells/modules/racks/containers, BMS, EMS, Battery Controllers)
 - 7) Outdoor rated Power Conversion System(s) (PCS)
 - 8) Inverter Duty Power Transformers and redundant BESS auxiliary transformers
 - 9) Uninterruptible Power System (UPS) for Control and Critical Auxiliary power (30 mins back-up)
 - 10) Auxiliary power supply.
 - 11) Devices and components (relays, PLCs, media converter, network switches)
 - 12) LV power distribution systems for the site including all switchgear and associated infrastructure.
 - 13) Structures and enclosures (including but not limited to control rooms, switch rooms, PCS and battery outdoor rated enclosures or containers, spare part storage containers and workshop, etc., as required) with the required HVAC/Liquid Cooled system.
- 14) Low-voltage and 33 kV electrical, protection and metering systems, including but not limited to power cables and control cables, circuit breakers, disconnectors, current and voltages transformers, surge arresters, power transformers, cable connectors, protection equipment, plant grounding and lightning protection system, grounding system and high precision energy measurement and billing and settlement

equipment.

- 15) Complete Lighting system (indoor and outdoor) including fence lighting system.
- 16) HVAC/Liquid Cooled, Fire and Smoke detection system and Fire Suppression system
- 17) SCADA system integration and the required Remote Terminal Unit Rooms, etc
- 18) Remote monitoring system for BESS equipment
- 19) All necessary cabling and works within the BESS plant and between the BESS Plant and the Employer's interface points.
- 20) Monitoring, security and CCTV system with coverage of complete BESS plant periphery
- 21) Documents (Product, installation, and commissioning manuals)
- 22) Spare parts for installation and commissioning period
- 23) Special tools for installation and commissioning (if any)
- 24) Spare parts for 12 years of operation (as recommended by the manufacturer)
- 25) The Contractor shall ensure 100% compliance to safety requirements, rules and regulations.
- 26) Complete set of cable trays for cable support.
- 27) Complete set of flexible conductors, clamps, connectors and fittings for the above connections.
- 28) Delivery to site, receiving and off-loading of the BESS and all the associated equipment and materials including power and control cables.
- 29) Assembly and installation of the BESS on site.
- 30) Supply and installation of all necessary equipment required for control, protection, ptimized and measurement system of the BESS and relevant control interfaces.
- 31) Design, installation and testing of the earthing system in the BESS site area and connection to the existing earthing grid system of the substation as required.
- 32) Design, supply and installation of AC and DC auxiliary supply systems for the BESS Plant as required.
- 33) Design, supply and installation of earthing transformers as required.
- 34) Site supervision and performance of final checks by the OEMs and commissioning tests for the entire BESS installations in verifying that BESS is ready for operation.
- 35) Training (on-the-job training during commissioning & post-commissioning training) for the Employer's personnel to ensure they are competent to operate and maintain the BESS for its operational life.
- 36) Post-commissioning system operation studies and studies reports.
- 37) All drawings, design reports, test and commissioning reports, as-built documentations, operating and maintenance manuals necessary to operate and maintain the BESS and associated equipment for its operational life.
- 38) Any other associated equipment, materials or works needed to satisfy the functional and technical requirements for a complete, safe and reliable operational BESS Plant.

2.14.4 Design Basis

A. Studies and investigations

- 1) The Contractor is responsible for its own studies and investigations to establish sufficient and accurate information in support of its design. The Contractor shall make its own assessment of all the information provided by the Employer and collect own information. The Employer is not responsible for the accuracy of any information provided.
- 2) The available studies, if any, are provided for illustrative and information purposes only. The Employer does not accept any responsibility regarding the validity and accuracy of these studies and, therefore, the Contractor is invited to carry out geotechnical, hydrological, topographical, subsurface and any other type of studies and surveys, as required, to ensure the quality and accuracy of the information required to carry out its Works.

B. Design conditions

- 1) The BESS Plant and all its equipment shall be designed for a minimum operational lifetime of 15 years and to withstand all extreme weather, seismic and meteorological conditions.
- 2) The BESS Plant shall be designed to meet the similar climatic conditions. The Contractor shall take due consideration of the local ambient conditions and prevailing severe climatic conditions, such as high ambient humidity at high air temperatures and corrosive environment.
- 3) A lightning risk assessment for the BESS Plant shall be carried out and a suitable lightning protection system must be designed and installed as per the relevant national and international norms and standards.

C. System impact analysis

- 1) The Contractor shall conduct the System Impact Analysis for the implementation of Battery Energy Storage System (BESS) in the grid to provide the applications.
- 2) The system Impact study shall be conducted using Power System Simulator for Engineering (PSS®E), ETAP, MATLAB/Simulink, PSCAD using actual system design and components of BESS plant and grid interconnection facilities. The scope of system Impact study shall include but is not limited to the following:
 - i. Modelling
 - ii. Power-flow & Contingency Analysis
 - iii. Short Circuit Analysis
 - iv. Reactive Power Requirements
 - v. Transient Stability Analysis
 - vi. Fault Ride-Through Capability
 - vii. Power Quality requirements

D. Pre-manufacturing equipment design and verification studies

- 1) The Contractor shall take full account of the pre-manufacturing equipment design and verification studies for the complete BESS Plant. Design reports shall contain full details of key considerations, assumptions made, calculations performed, and reference materials used in the design.
- 2) The design of the major aspects, systems, components, plant items and settings shall be addressed and detailed in the reports. Analysis for the equipment rating required to cover all modes of BESS operation, considering the worst possible combination of manufacturing tolerance and frequency deviation shall be also presented. The Contractor shall describe in detail, the methodology of each study in the tender

submission.

- 3) The Contractor shall also complete detail design for equipment manufacturing and procurement for:
 - i. 33 kV Inverter Duty Transformer and necessary protection equipment to step-up the voltage from PCS
 - ii. 33 kV Substation equipment and associated systems
- 4) The Contractor shall carry out necessary studies to verify to the Employer that the device described by the specification meets all system requirements and equipment performance requirements. The studies shall include but not limited to:
 - i. System Impact Analysis
 - ii. Risk management and fire safety research

E. Performance model

- 1) The Contractor shall provide a performance model, complete with the related data sheets of the selected main components (battery cell, power conversion system and transformer) as specified in Control Philosophy
- 2) The Contractor shall be responsible to define control philosophy of BESS Plant (with reference to findings from System Impact Analysis findings and recommendation) subjected to the Employer's approval and embedded in the BESS Plant control and management system (i.e. EMS, BMS, BESS Controller, PCS, etc) as required to be fit for the intended purpose of Peak Load Shaving (Primary).

2.14.5 Statutory compliance

The BESS plant shall be designed to comply all statutory compliance, regulations, guidelines, standards and their amendments as applicable to utility application of BESS.

1. Central Electricity Regulatory Commission (CERC)
2. Central Electricity Authority (CEA)
3. West Bengal Electricity Regulatory Commission (WBERC)
4. Grid controller of India (POSOCO)
5. Ministry of Power (MOP)

6. Pollution Control Boards (PCB)
7. Ministry of New and Renewable Energy (MNRE)

2.14.6 Cybersecurity Consideration

The SCADA and EMS shall be designed to comply with IEC 62351 and ISO 27001 standards for cybersecurity. All data transmission shall be encrypted, and firewalls shall be installed to prevent external intrusion.

The system shall include:

- User authentication and role-based access control
- Audit trails for all operator actions and system events
- Intrusion detection and continuous monitoring of cybersecurity status
- Secure remote access with encrypted VPN tunnels

The Contractor shall prepare and submit a Cybersecurity Management Plan as part of the detailed design.

2.14.7 Codes and Standards for BESS

For battery and battery system the mandatory standards to be followed include, but not limited to:

(1) Cell / Module / Battery Level

- IEC 62933-2-1 – Electrical Energy Storage (EES) systems: Unit parameters & testing methods (duty cycle, RTE, available energy, insulation tests)
- IEC 61427-2 / IS 16270 – Secondary batteries for renewable energy storage (on-grid applications)
- IEC 62281 / UN 38.3 – Safety of lithium cells & batteries during transport
- UL 1642, IEC 62133 or UL 1973 Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries, for use in industrial applications.
- UL 1973 or IEC 62619 or IEC63056 Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications / Secondary cells and batteries containing alkaline or other non-acid electrolytes – Safety requirements for secondary lithium cells and batteries, for use in industrial applications.

(2) System-Level Battery Safety

- UL 9540 *OR* IEC TS 62933-5-1 + IEC 62933-5-2 – Safety of grid-integrated EES systems
- UL 9540A – Thermal runaway fire propagation testing (mandatory at BESS level)

(3) BESS (System level) – Performance, Safety and Acceptance Testing

- IEC 62933 series (overall reference) – Electrical Energy Storage systems
- UL 9540 / IEC TS 62933-5-1 & 5-2 – System-level safety compliance
- ILAC-accredited laboratory testing mandatory for type tests
- NFPA 855: 2023 Safety Standard for installation of Stationary Energy Storage Systems (ESS)

2.14.8 Design fabrication and construction requirements

- The methods and materials specified in this technical specification are intended to represent minimum requirements. WBS&EDCL shall not diminish the responsibility for meeting performance and other requirements stated herein. The design of the BESS shall incorporate the principle of modularity, with a view to reducing life-cycle costs and ease of replenishment of storage capacity while facilitating ease of maintenance, space requirements, and reliability. The design should also facilitate rapid and easy replacement of the unit batteries/battery packs/modules without significant downtime.
- The major equipment items shall include battery packs/modules, battery management system (BMS), PCS, output/isolation transformer, and BESS EMS. Additional equipment shall include HVAC, wiring, connectors, protective devices, grounding, junction boxes and enclosures, instrumentation, enclosures, and all other items needed for a fully functional, grid- interactive BESS to meet the requirements set forth in this specification.
- Containers for the accumulation subsystem shall comply with International Organization for Standardization (ISO) 668 shipping containers or custom-designed power equipment centres. The container or containers shall be designed to be drop-shipped onto a properly prepared pad or foundation (such as compacted soil, concrete pad or platform).
- Containers shall be designed and constructed to meet IP54 and above/NEMA 3R requirements.
- All containers and packaging of separately shipped components shall be suitable for land or sea transport, including offering suitable protection of the equipment inside against damage from weather and vibration or shock from transportation.
- The containers and their contents shall be designed to be easily prepared for transport, shipped, connected and operated at site. Containers shall be transported along with all requisite bracing and shipping stabilization equipment.

2.14.9 Design life and life cycle cost

- The designed life of the BESS shall be 15 years and cycle life shall be $\geq 7,000$ full cycles, with ≥ 70 % usable capacity at the end of specified full cycles.
- It shall be the responsibility of the Contractor to make periodic replacements/replenishments of unit batteries, when required, up to the End of Battery Life as described above. Outage time because of replacement will also be counted as an "Accountable BESS Outage" for the purpose of computing BESS Availability.
- Grid Outage hours shall be subtracted from the total no. of hours in a year
- The BESS shall be capable of unattended operation, with provision of remote monitoring and control.

2.14.10 Battery Subsystem Design Requirement

- Cell and module design shall accommodate the anticipated vibrations and shocks associated with the transportation of the BESS and shall resist deterioration due to vibrations resulting from the same. Associated hardware and paraphernalia should also be able to withstand the rigors of transportation. The transport plan shall be shared with the Employer and approved prior to dispatch.
- Labelling of the unit batteries/battery packs shall include manufacturer's name, cell type, nameplate rating, and date of manufacture, in fully legible characters and traceable to the point of origin for purpose of addressing safety issues.

2.14.11 Electrochemical storage system

- The storage system may consist of one or more-unit batteries/battery packs/racks. If the storage system consists of more than one unit battery, these may be electrically interconnected in any desirable series and parallel configuration to achieve the overall system storage and power rating requirements.
- Each electrically series-connected string of unit batteries shall include a means of disconnecting the string from the rest of the system and of providing over-current protection (during a fault). The means of disconnect shall provide for a physical interruption of the string electrical circuit, which shall be visible and accessible to maintenance personnel and shall be capable of being locked or secured in an open position.
- If the disconnect means consists of removal of a unit battery, the storage system shall be designed to allow maintenance personnel to determine that there is no current flowing in the string and provisions to ensure that the PCS is off before the unit battery is removed. Procedures for maintenance and/or field replacement of unit batteries shall neither require nor recommend removal of the unit battery without first ensuring that no current is flowing in the string circuit.
- Over-current protection, whether on the ac or dc side, in paralleled unit battery strings shall be sized and coordinated so that currents from other strings do not contribute to a fault in any unit battery string.
- Protection shall include a dc breaker, fuse, or other current-limiting device on the battery bus. This protection shall be coordinated with the PCS capabilities and battery string protection. The Contractor shall produce a fault analysis and protection coordination study for the battery dc subsystem during final design.
- Cells, wiring, switch gear, and all dc electrical components shall be insulated for the maximum expected voltages plus a suitable factor of safety.
- The BESS shall include appropriate self-protective and self-diagnostic features to protect itself and the battery from damage in the event of BESS component failure or from parameters beyond the BESS's safe operating range due to internal or external causes.
- Temperature sensors shall be incorporated in critical components within the BESS. The BESS shall alarm and go to standby/fault mode when an over-temperature condition is detected.
- Door interlock switches shall be provided for all BESS container doors. The BESS shall alarm and go to shutdown mode when a BESS Container door is opened. Doors shall be fitted with provisions for external locks.
- The battery system shall include a system to detect and alarm excessive ground leakage current levels. Ground fault detection shall be enabled for the container or, if more than one electrical series string is installed in the container, for each series string.
- The battery system shall include a monitoring/alarm system and/or prescribed maintenance procedures to detect abnormal unit battery conditions and notify proper personnel of their occurrence.
- Unit battery monitoring, whether automatic or manual, should be specified to alert the proper personnel in a timely manner that an abnormal unit battery condition exists or may exist. All alarms shall be part of the control system and shall include remote display or annunciation capability.
- The unit batteries shall be racked or shall be housed in stackable modules. The unit batteries or cells shall be arranged and installed to permit easy access for equipment and personnel. The moveable units shall be arranged and installed to permit easy access for equipment and personnel to carry out unit removal and replacement

activities. For all systems, it shall be possible to remove and replace a prematurely failed unit battery or cell (as appropriate), when system performance specifications cannot be met. The lengths and widths of all aisles and spaces into which personnel may enter in the field for operations and/or routine or unscheduled maintenance purposes, as well as egress routes from these aisles and spaces, shall conform to applicable codes and standards.

- All racks and metallic conductive members of stackable modules shall be grounded to earth. Racks shall meet the seismic load requirements and shall include means to restrain cell movement during seismic events. The Contractor shall furnish analyses and/or other data that show that the rack and cell designs are designed to meet all potential seismic vibration requirements.
- The cells and battery system shall be supplied with all required and/or recommended accessories. This includes inter-cell connectors and monitoring devices for cell temperature and cell voltage, if required.

2.14.12 BATTERY MANAGEMENT SYSTEM (BMS)

- The BMS shall pass the IEC 61508/IEC 60730 safety certifications.
- The communication protocol for the BMS can be Modbus, RS485, RS422, or other internationally used battery management communication standards.
- The BMS shall be designed to ensure automatic and unattended operation of the BESS plant.
- Uninterruptible Power Supply (UPS) or related mechanisms shall be installed to ensure the operation of the BMS for 30 minutes or more when the auxiliary power supply is interrupted.
- The BMS shall be configured to provide the necessary monitoring and control to protect the battery cells / modules / racks from unsafe or out of tolerance operating conditions.
- The BMS shall be configured to have automatic control to ensure the safe charge and discharge of the individual cells / modules / racks.
- The BMS shall be configured to have automatic control to ensure the balance between cells / modules / racks (where applicable) to ensure optimized state-of-charge (SoC), state- of-health (SoH) and life expectancy.
- The BMS shall be configured to automatically control cell / module / rack health and provide critical safeguards to protect the batteries from any damage. When necessary, it should be able to control the protective relay to separate the battery cabinet from the DC main bus circuit.
- The BMS shall monitor and report in real time on the following parameters for each lowest maintainable unit / module:
 - State-of-Charge (SoC)
 - State-of-Health (SoH)
 - Battery temperature
 - Power
 - Energy (Wh)
 - Charge current
 - Discharge current
 - DC bus voltage
 - Cell / Module / Rack voltages (minimum and maximum)
 - Cell / Module / Electrode temperatures (minimum and maximum)

The BMS shall monitor and report in real time on the operation status, warning and error conditions for each lowest maintainable unit / module:

- Operation status: power on/off, rest, discharging, charging, etc
- Warning status: charge/discharge over current, over voltage, under voltage, over temperature, cell unbalance, etc., and records warning data in real time
- Error status: charge/discharge over current protection, over voltage protection, under voltage protection, over temperature protection, under temperature protection, cell unbalance protection, etc., and records error data in real time

The following protections shall be provided, as a minimum, but not limited to:

- Over-charge protection
- Over-discharge protection
- Over-voltage protection
- Under-voltage protection
- Over-temperature protection
- Over-current protection
- Ground-fault detection
- Internal battery fault detection
- Cell balancing
- Protective devices should include for DC-side protection:
- Battery fuse for each battery cell and module (preferred)
- DC contactor for each battery rack
- Grounding over current (76G)

When any of this protection function is activated, the BMS should stop the battery module/rack to ensure system safety. The error message should also be sent to EMS.

- The margin of error of the measured voltage should be less than $\pm 0.3\%$. The sampling rate should be less than 100ms.
- The margin of error of the measured current should be less than $\pm 0.2\%$. The sampling rate should be less than 50ms.
- The margin of error of the measured temperature should be less than $\pm 0.5^{\circ}\text{C}$. The sampling rate should be less than 50ms.
- The BMS should include the recording function of the BMS parameters and should be equipped with a non-volatile memory capacity for storing 90 consecutive days of data.

2.14.13 POWER CONVERSION SYSTEM (PCS)

Minimum requirements

- The PCS shall be installed in a container/cabinet and the equipment enclosure shall comply with IP 54 or above protection and able to operate under the climate and site conditions as stipulated in site conditions given in tender.
- PCS shall be of modular design for simple maintenance on-site and fault of one PCS shall not stop the operation of other PCS.
- The PCS shall have the ability of full four quadrant (P, Q) operation ensuring bi-directional power flows.

- The PCS shall function as both an AC to DC power factor-controlled rectifier and a DC to AC inverter and can smoothly transition between these operations while in an online state.
- The PCS shall consist of solid-state electronic switches (IGBTs) along with associated control & protection, filtering, measuring instruments and data logging devices.
- The PCS shall comply with the communication methods and requirements of the EMS and BMS to be able to accept the commands from the EMS and BMS to adjust the input/output of the active power and reactive power.
- The PCS shall be cooled by air or by a liquid medium or hybrid of liquid and air cooled with final rejection of waste heat to the ambient air.
- The cooling systems shall include filtering that is adequate to keep dust from the interior of the PCS system. Replacement of filter shall not require special tools or involve more than two hours of labour at the site.
- If applicable, a liquid cooled inverter may be integrated in the “PCS container” or outdoor rated housing such that no external chiller units and coolant lines are necessary.
- The PCS shall consist of inverters, AC terminations, DC terminations and user-accessible HMI ports for local control of PCS. Emergency stop function of the PCS shall be included to stop the PCS manually on-site or remotely.
- The inverter area shall include adequately rated AC and DC circuit breakers that will safely de-energize the inverter subassemblies and facilitate a safe repair and maintenance of the device:
 1. AC circuit breaker – The AC circuit breaker shall isolate the inverter from the utility source if needed
 2. DC circuit breaker – The DC circuit breaker shall isolate the inverter from the Batteries, permitting routine maintenance to be performed on PCS.
 3. The user-accessible inverter HMI shall facilitate the local control of the inverter and the monitoring of basic operational parameters.
 4. The user-accessible AC termination area shall include bus terminal pads for connection of utility source
- The user-accessible DC termination area shall include terminations for cables from the battery pack.
- If individual PCS are galvanically connected and paralleled on the AC side, the Contractor shall conduct tests and simulation studies to determine the worst case zero-sequence current. This is typically the case when the individual battery rack/cabinet/container have the foreseeably largest difference in DC voltage: one rack/cabinet/container is fully charged, and the other is fully discharged. The Contractor shall provide a written approval by the battery cell and/or system vendor that this level of zero sequence current is not hazardous to the battery rack/cabinet/container and the DC circuit. If PCS are paralleled simultaneously on the AC and DC terminals, this level of due diligence is not necessary.

Parameter	Performance
PCS Rating	To be defined by the Contractor according to their BESS Plant design
Nominal AC Voltage	To be designed in accordance with LV/MV transformer
DC voltage range at nominal AC	To be designed in accordance with battery

voltage	rack/container/cabinet DC voltage level
Operating power factor range	1 Lag to 1 Lead (adjustable)
Operating Voltage range	+10% to -10%
Power Conversion Efficiency	≥95%
IGBT	Shall be of Infineon/ Fuji / Toshiba or equivalent Grade
Response time of PCS of any set point received at inverter	≤ 200ms or as per Application requirements
Cooling	Air/Liquid/Hybrid Liquid
Protection	Fuse on AC and DC side
Safety features	Overvoltage, Overcurrent, Overtemperature
Ground fault detection	Yes
Grid Connected/Off grid transition	Transition in both directions available for PQ control
Control Interface	CAN, Modbus RS 485, or Modbus TCP

Minimum technical requirements for PCS

- The PCS shall meet the following minimum requirements:
 1. Operate in an environment of up to 100% humidity with no condensation
 2. Harmonic Distortion shall be ≤3% THD per IEEE519 or comply with Sarawak Grid Code (Electricity (State Grid Code) Rules, 2003), Guidelines and Requirements for User System Connection to the Sarawak Grid System whichever is more stringent.
 3. Fully parameterizable for grid support
- PCS shall include the following hardware protective mechanism in-built into PCS cabinet
 1. AC Overcurrent protection with motorized disconnects
 2. DC Overcurrent protection with motorized disconnects
 3. Transient voltage surge protection for AC and DC Terminals
- PCS shall include the following Software protective mechanisms in-built into PCS control system
 1. High Voltage Ride through and Trip
 2. Low Voltage Ride Through and Trip
 3. High frequency Ride through and Trip
 4. Low frequency Ride through and Trip
 5. Battery Voltage and Current Limits
 6. Protection against excessive voltages on AC or DC PCS terminals
 7. Protection against Inadequate voltage on DC PCS terminals
 8. Protection against excessive currents on AC or DC PCS terminals
 9. Anti-Islanding protection (programmable)
 10. Comply with IEC 62305-1 Level III lightning protection requirement.
 11. Overload capability:
 12. 110% overload ≥10 minute at AC side
 13. 120% overload ≥1 minute at AC side
- PCS shall include the following software thermal protection functions
 1. Air temperature (near control board)

- 2. Inlet coolant temperature to cold plate
 - 3. Substrate temperature of all power semiconductor modules
- PCS shall have the following basic control modes at inverter level
 - 1. In Grid following mode (on grid)
 - 2. External PQ (Power) control mode.
 - 3. Power factor control mode
- PCS shall have Extended control modes (external frequency & voltage references) with the following primary control functionalities
 - 1. Load levelling / peak shaving
 - 2. Spinning reserve
 - 3. Fast Voltage support based on droops & dead band
 - 4. Fast Frequency support based on droops & dead band
 - 5. Virtual Inertia
- The PCS shall be equipped with a UPS to ensure the operation of the PCS for 30 minutes or more when the auxiliary power supply is interrupted.
- The PCS manufacturer shall qualify the Ministry of New & Renewable Energy (MNRE) Order No. 283/22/2019-Grid Solar Dated 23rd Sep 2020 for the Public Procurement (Preference to Make In India) including any amendments thereto, so as to Provide Purchase Preference (linked with local content) with respect to Renewable Energy (RE) Sector & Department for Promotion of Industry and Internal Trade (DPIIT) Notification No. P-45021/2/2017-PP (BE-II) dated 4th June, 2020 including any amendments, the procurement of PCS for the subject tender will be supplied through Class I Local Suppliers only. A 'Class-I local supplier' means a Supplier or Service Provider, whose Goods, Services or works offered for Procurement, has local content equal to or more than 50%, as defined under the above said orders.

Standards for Power Conditioning System (PCS)

For the Power Conditioning System (PCS) of BESS plant the mandatory standards to be followed include, but not limited to:

(1) Performance & Functional Testing

- IEC 61683 – Efficiency measurement of power conditioners
- IEC 62116 (Ed.2) – Anti-islanding test procedure
- IEEE 1547 / IEC 61727 / BDEW – Grid interconnection requirements
- IEEE 519-2022 – Harmonic control in power systems

(2) Safety & Converter Standards

- IEC 62477-1 – Safety requirements for power electronic converter systems
- IEC 62477-2 – Safety of converters up to 36 kV AC / 54 kV DC
- IEC 60529 – Ingress Protection (IP) testing

(3) EMC & Environmental Testing

- IEC 61000-6-2 – EMC immunity (industrial environments)
- IEC 61000-6-4 – EMC emission (industrial environments)
- IEC 60068-2-1 – Cold test
- IEC 60068-2-2 – Dry heat test

- IEC 60068-2-14 – Temperature change test
- IEC 60068-2-30 – Damp heat cyclic test

2.14.14 BESS CONTROL AND MANAGEMENT SYSTEM

- The BESS Controller should be able to receive commands from the EMS and send commands to the PCS to adjust the input/output of active power and reactive power accordingly.
- The BESS Controller should be able to send and receive information related to the BMS. The communication protocol and method should comply with the requirements of BMS and EMS.
- When a communication error occurs between the BESS Controller and Battery Management System, the BESS Controller should stop the operation of PCS and report the error information to the EMS.
- When a communication error between the BESS Controller and Energy Management System occurs or a BESS Controller self-inspection failure occurs, the BESS Controller should stop the operation of PCS.
- Should be equipped with an Uninterruptible Power Supply (UPS) to ensure the operation of the Energy Storage Controller for 30 minutes or more when the auxiliary power supply is interrupted.
- The operating temperature range is between 0°C to 50°C. If it is installed in a container, it must comply with industrial IP 54 or above waterproofing and anti-dust protection. If it is not installed in a container, it must comply with industrial IP 65 or above waterproofing and anti-dust protection.
- The BESS Controller is equipped with a memory capacity of more than 1GB and can store all accessed data over 90 days or more in the non-volatile memory.
- It can support Modbus TCP, Modbus RTU, or IEC 61850 communications. After the communication interface completes internal related connections, besides already connected ports, two Ethernet (RJ45) and two RS485 (RJ45) ports should be reserved.
- The BESS Controller and related data recording system should be equipped with time calibration functions. It should be able to receive time signals from the Energy Management System and should automatically calibrate more than once every hour.
- Equipped with data reading cycle period settings, operating records collection, event collection, and self-inspection watch dog functions.
- The BESS Controller should provide a screen to display the operating status of the Power Conversion System. The screen size should be ≥ 10 inches.

2.14.15 HUMAN MACHINE INTERFACE (HMI)

- The BESS system shall provide a local HMI in the BESS control room which will enable the system to be locally controlled while providing a view of the status of the plant and alarm conditions at the station.
- The HMI shall provide a graphical interface for monitoring and controlling of the BESS plant. The HMI shall allow the battery and electrical system to be visually presented with the appropriate status points and alarms being indicated. Preferably, IEC approved electrical components/symbols shall be used/supported on the HMI drawing tool (e.g., bi-directional converter symbol, energy storage device symbol).
- Preferably, the ability to access settings and configure BESS subsystem components is possible via the HMI.
- The HMI system shall be rated for 24/7 continuous use.

- All interactions (viewing and control) of the HMI shall be done via a display (non-touch/touch).
- The life expectancy of the HMI hardware shall be greater than 15 years. The Contractor shall provide the life expectancy of the BESS HMI offered as part of their Tender submission.
- Fan-less, redundant solid-state drives shall be provided.
- For safety requirements, the HMI from which the Employer / 3rd party operator can monitor and control the BESS system shall be located in an environment that is free of any equipment that may cause any harm to the operator during their operating hours (e.g., switches, inverters, battery banks).
- All incorrect operations shall be indicated to the operator by appropriate text messages on the HMI screen.
- All control functions relating to output data (e.g. control of primary plant) shall include a confirmation window prior to execution to ensure accidental operations are avoided.

2.14.16 ENERGY MANAGEMENT SYSTEM (EMS)

- 1) Energy Management System (EMS) system shall be a controller-based system along with required accessories and communication links for integrated, real-time monitoring, efficient operation and control of active power, reactive power as well as voltage at the interconnection point of PV arrays and BESS.
- 2) EMS shall be integrated with the SCADA described to acquire/monitor real time data of various equipment of Plant facilities and have in built logic/programming to monitor, control, and optimize the performance of Plant facilities as per specification. The Contractor shall provide complete EMS system with all accessories, auxiliaries and associated equipment and cables for the safe, efficient and reliable operation of entire Plant facilities and its auxiliary systems. The Contractor shall include in his proposal all the Industrial Grade Hardware, Software, Panels, Power Supply, HMI, Gateway, Networking equipment and associated Cable etc. needed for the completeness even if the same are not specifically appearing in this specification
- 3) The following operation modes of BESS can be set from the EMS system.
 - Automatic mode: This means that a part of the power quantity of the BESS behaves according to the selected operation mode.
 - HMI mode or manual mode: in this mode, the operator has the possibility to:
 - ✓ Select the operation point
 - ✓ Direct control of active and reactive set points of the PCS.
 - ✓ Command of the balance of plants
 - OFF-mode: A BESS is not producing any power. The system is disconnected from the grid.
 - STANDBY-mode: the BESS is connected to the grid, but the IGBT's in the PCS system are
 - in off-state (i.e. open switching)
 - Also, the performance of every application mode will be controlled and adaptable by this system.
- 4) This energy management strategy will be operated by the SCADA in the Main Control Room. Any failure in the process or the control system including instrumentation must be detected and logged. This means that the instrumentation, electronic and electrical equipment shall include those failure detections.
- 5) Communication with the SCADA system must be possible to receive set points and transmit set points for each application mode. The SCADA should be able to remotely control the BESS. The

EMS should allow the SCADA at least the following:

- Change the operation mode of each BESS independently
 - Start/Stop each application mode appointed to a BESS.
 - Change the application mode of each BESS (multiple modes can be selected together)
 - Select the amount of power dedicated to each selected application mode.
 - Specifically, for following use cases: o Power ramp rate control
 - Power Curtailment
 - Change the set points for the SOC management
 - Direct control of active and reactive set point of a PCS
 - Adapt the parameters needed for the operation of every application mode
 - The Communication protocol shall be MODBUS TCP. Other solutions can be proposed but are subjected to the approval of the client.
- 6) The EMS monitors grid and Plant facility variables and should be programmable for selecting the optimum-operating mode of the whole plant w.r.t. active and reactive power, grid voltage, grid frequency, etc. Additionally, it can receive external set points and automatically adapt the Plant Facility behaviour to the new settings.
- 7) The EMS shall perform following functionality to Control the Plant facilities.
- Communication with grid or SCADA
 - Communications with PV Inverters, BESS and other power units
 - Measuring and processing of the electrical magnitudes at EMS (voltage, current, PF)
 - Control capability of PV Inverters, BESS and other power units
- 8) The EMS shall allow following operation modes for the Plant facilities.
- a) Reactive Control (Q Control, setting point of reactive power Q at EMS)
 - b) Power Factor Control (PF Control, setting point of $\cos(L)$ at EMS)
 - c) Voltage Control (V closed loop control, setting point of V at EMS)
 - d) Voltage Droop (Reactive power vs Voltage programmable curve or droop)
 - e) Apparent Power Control (S Lim, setting point of S Lim at EMS)
 - f) Active Power Limitation (P Lim, setting point of P Lim at EMS)
 - g) Power Ramp Rate Control (setting point of maximum % Pn/min)
 - h) Frequency Regulation (Power vs Frequency programmable curve or droop)

In addition to these operating modes, the EMS shall be prepared to work under voltage dips, allowing the inverters to inject the corresponding reactive power to provide the corresponding voltage support at the EMS. The EMS can receive the target values specified by grid operators using a standard protocol (i.e. Modbus TCP/IP) and over different communication media.

All technical manuals, reference manuals, user's guide etc. in English required for modification/editing/addition/deletion of features in the software of the EMS System shall be furnished. The Contractor shall furnish a comprehensive list of all system/application software documentation after system organization for Employer's review and approval. All The software listings for application software, Project data files etc. shall be submitted by the Contractor. All the EMS Software with license Key shall be handed over to the Owner. All the hardware and software shall be licensed to WBSEDCL.

2.14.17 POWER PLANT CONTROLLER

- 1) Power Plant Controller (PPC) shall be provided with two processors (main processing unit and memories), one for normal operation and one as hot standby. In case of failure of working PPC processor, there shall be an appropriate alarm and simultaneously the hot standby PPC processor shall take over the plant control function automatically. The transfer from main processor to standby processor shall be totally bump less and shall not cause any plant disturbance whatsoever. It shall be possible to keep any of the PPC processors as master and other as standby. The standby processor shall be updated in line with the changes made in working processor.
- 2) SCADA and PPC networks shall be suitably designed, so that PPC shall directly and independently able to control the individual solar inverter. Provisions shall be enabled for the PPC to take voltage and current of POI as a reference to Power Plant Controller for giving command to individual PCUs. Detailed control logic in the PPC shall be finalized during detailed engineering stage. The control logic and setting of the PPC shall be in line with latest CEA (Technical Standards for Connectivity to Grid) and as per RLDC requirement.
- 3) Suitable PQ meters (class-A type) at plant final output for measurement of required electrical parameters (active power, reactive power, power factor, voltage, current, frequency, etc.) shall also be provided for this purpose.
- 4) The PPC shall comply with cyber security guidelines issued by the Central Government, from time to time, and the technical standards for communication system in Power Sector laid down by the Authority.
- 5) The Contractor shall provide the UPS/ DC Power supply of suitable rating to cater all the load requirements of PPC and its auxiliaries.

2.14.18 SCADA AND ENGINEERING ACCESS

- 1) A single SCADA system shall be designed to work in a hybrid mode for both PV power plant and BESS plant. Both the plants can be independently monitored and controlled through the same SCADA system.
- 2) The Contractor shall propose the data/signal acquisition & monitoring scheme. The proposal submission by the Contractor must demonstrate complete redundancy in ensuring the data acquisition scheme is fully reliable. The main and redundant units shall always work as hot and hot standby mode. In the case of losing the main/active units, the redundant units shall take over the functionality of the active units instantaneously, without causing loss of data. The Contractor must be

responsible for full redundancy at the different levels of the SCADA/fibre/communication and protection interface between the BESS and Plant End Substation, including the auto change over or network switching.

- 3) BESS plant data integration into the Substation RTU shall be achieved via Protocol TCP/DNP3 and Serial Communication Linkages. The Contractor shall include supply, installation and laying of the Armoured Single mode Optical Fibre Cables with redundancy (i.e. at minimum two (2) armoured multimode optical fibre cables, with automatic switchover capability and full redundancy for the no. of cores) between the new Remote Interface Panels of the Contractor in the BESS Control Building and the RTUs in the Substation Control Building. The Works shall also include the above cable terminations at both ends.
- 4) The Contractor shall install and mount the Fibre Optic Patch Panel on the termination box (supply and installation of termination box is the scope of the Contractor) near the RTU and the Patch Cord shall be provided and connected to Fibre Optic Converters with RS232 converters to RTU.
- 5) The Contractor shall be responsible to provide the Fiber Optic Converters.
- 6) No Supervisory/SCADA Interface Cubicle (SIC) is required within the BESS Control Building. All hardwiring signals within the BESS plant shall be converted to communication protocol.
- 7) Back-to-back testing with the RTU with the Contractor's installed system shall be carried out prior to installation. The Contractor shall state the minimum duration for testing to sort out the interface via DNP3.
 - Complete list of all DNP3 I/O Points shall be provided before the back-to-back testing.
 - The EMS and BMS shall be Slave and provide the Slave Address.
 - Substation RTU shall be MODBUS/DNP3 Master.
 - Analog value shall be 16 bits.
 - Communication: 9600 baud, 8 bit, No parity, 1 Stop bit.
 - The Local Area Network (LAN) must be completely redundant and segregated.
 - The Contractor shall be fully responsible for all necessary interfacing and termination works such as provision of RS232 Converters, laying of armoured fibre optic cables, etc as required.
 - All signal processing and data acquisition within Plant End Substation Control Building only accept the use hardwiring scheme (especially the relays).
 - The Contractor shall provide remote communication capabilities for the BESS plant. The BESS plant shall be interfaced with the Employer's SCADA system. In addition, the BESS plant shall provide performance data and alarms to the SCADA system.

2.14.19 EMS / BESS SCADA GATEWAY

- 1) SCADA system shall seamlessly integrate 50 MW PV power plant into single automated management system improving availability, performance and reliability.
- 2) SCADA features shall include real-time monitoring as well as historical data trends, alarms, events and user acknowledgement. Additionally, its device level communication shall allow users to perform advanced fault analysis and diagnosis, reducing system downtime. SCADA shall have provision for Automatic report generation.
- 3) SCADA system shall have flexible and user-friendly Human Machine Interface (HMI) which enables safe operations with cyber security features, including secure communication and user access management, complying with most industrial communication standards. It shall have ability to monitor and control both distributed energy resources and substation equipment using TCP/DNP3.0 protocol.
- 4) SCADA-HMI graphics control requirements. The Contractor must comprehensively design an English Human-Machine Interface (HMI), which shall be used by the dispatch personnel of the control room. The interface must include the following pages to increase convenience:
 - a) System operation page
 - b) BESS system operation page
 - c) Story of Event (SOE) page
 - d) Control and operation parameter setting page
 - e) Operation curve page
- 5) SCADA BESS library shall be purposely designed for battery energy storage systems. Its user interface helps operators to visualise all critical components of the system and enables quick operational decisions. SCADA shall have the following features but not limited to:
 - a) Monitors and controls entire battery energy storage fleet
 - b) Optimised user interface for battery parameter management
 - c) Integral safety features to ensure correct sequence of operation
 - d) Dedicated graphical symbols package for greater visibility of the plant
 - e) Intelligent control system that supports system stability and availability
 - f) Built-in features to communicate with any external SCADA software packages
 - g) Enables automatic recharge of energy storage
 - h) SoC management

2.14.20 INVERTER DUTY TRANSFORMER & AUXILIARY TRANSFORMER

The BESS plant shall be equipped with

- a) Inverter Duty Power transformers connected to the upstream of PCSs and to the downstream of 33 kV switchgear
- b) Redundant BESS auxiliary transformer shall feed to redundant auxiliary LV busbar/switchgear and shall be used for BESS plant auxiliary loads. The BESS auxiliary transformer shall be either oil type or dry type with Off Circuit Tap Changer (OCTC).

Inverter transformer and auxiliary transformer, wherever applicable, shall comply with the latest edition of the following standards and codes including amendments as mentioned in the table below:

Standards

Standard	Description
IS 2026, IEC 60076 IS 11171, IEC 60076	Specification of Power Transformers Dry-Type Power Transformers
IS 2099, IEC 60137	Bushings for alternate voltage above 1000
IS 335, IEC 60296	Insulating oil
IS 3639	Fittings and Accessories for power transformers
IS 12063	Degree of protection provided by enclosures
CBIP	Latest edition
CEA Regulation	Latest Edition

Technical specifications

Parameters	Inverter Transformer	Auxiliary Transformer
VA Rating	As per system design requirement	
Voltage Ratio	33 kV / Inverter output voltage	As per system design
Duty, Service & Application	BESS Inverter duty transformer, Continuous duty	Continuous application (Outdoor/ Indoor)
Winding	As per system design requirement	2
Winding Material	Copper	Copper
Frequency	50 Hz	50Hz
Nos. of Phase	3	3
Vector Group & Neutral earthing	As per system/ inverter manufacturer requirement	Dyn11
Cooling	ONAN	ONAN / AN
Tap Changer	OCTC, No. of steps shall be as per system requirement	
Impedance at 75°C	As per Inverter Manufacturer requirement	As per system requirement
Permissible Temperature rise over an ambient of 50°C (irrespective of tap)		
Top Oil	50°C	As per IS/IEC
Winding	55°C	As per IS/IEC
SC withstand time (thermal)	2 second	2 second
Short Circuit Apparent power	As per system requirement	
Termination	As per system requirement	

Bushing rating, Insulation class (Winding & bushing)	36 kV – porcelain bushings 3.6 kV – epoxy bushings	As per the system requirement
Noise level	As per NEMA TR-1	
Loading Capability	Continuous operation at rated MVA on any tap with voltage variation of +/-3%, also transformer shall be capable of being loaded in accordance with IEC 60076-7	
Flux density	Not to exceed 1.9 Wb/sq.m. at any tap position with combined frequency and voltage variation from rated V/f ratio by 10% corresponding to the tap. Transformer shall also withstand following over fluxing conditions due to combined voltage and frequency fluctuations: a) 110% for continuous rating b) 125% for at least one minute c) 140% for at least five seconds. Bidder shall furnish over fluxing characteristic up to 150%	
Air Clearance	As per IS/IEC	

Construction

- 1) The transformer shall be provided with conventional single compartment conservator with prismatic toughened glass oil gauge. The top of the conservator shall be connected
- 2) to the atmosphere through indicating type cobalt free silica gel breather with transparent enclosure. Silica gel shall be isolated from atmosphere by an oil seal. Inverter transformers shall be provided with Magnetic Oil Gauge (MOG) with low oil level alarm contact.
- 3) It is the responsibility of the Contractor to ensure that the inverter transformer comply with all the requirements of inverter provided by the inverter manufacturer.
- 4) Inverter Transformer shall be designed for at least 5% total harmonic distortion (THD) to withstand distortion generated by the inverter as well as possible outside harmonics from the network.
- 5) The transformer shall be suitable for continuous operation with a frequency variation of $\pm 3\%$ from nominal frequency of 50 Hz without exceeding the specified temperature rise.
- 6) Inverter Transformer shall have shield winding between LV & HV windings. Each LV winding must be capable of handling non-sinusoidal voltage with voltage gradient as specified by the inverter manufacturer. Also, shield winding shall be taken out from tank through shield bushing and the same shall be brought down to the bottom of the tank using copper flat and support insulator for independent grounding.
- 7) Neutral earthing of inverter transformer shall be as per the recommendations of inverter manufacturer. Even if neutral earthing is not required, neutral bushing shall be brought outside the tank for the testing purpose. It shall be covered with MS sheet and a sticker "For testing purpose only. Do not earth". Neutral bushing of auxiliary transformer shall be brought outside the tank for earthing.
- 8) Transformer shall have 150 mm dial type Oil Temperature Indicator (OTI) and Winding Temperature Indicator (WTI) with alarm and trip contacts. All indicators shall have accuracy of 1.5%. For inverter transformers, WTI shall be provided for all the windings.

- 9) The radiators shall be detachable type, mounted on the tank with shut off valve at each point of connection to the tank, lifts, along with drain plug/ valve at the bottom and air release plug at the top.
- 10) Marshalling Box shall be of sheet steel, dust and vermin proof provided with proper lighting and thermostatically controlled space heaters. The degree of protection shall be IP 55. Marshalling Box of all transformers shall be preferably Tank Mounted. One dummy terminal block in between each trip wire terminal shall be provided. At least 10% spare terminals shall be provided on each panel. The gasket used shall be of neoprene rubber. Wiring scheme (TB details) shall be engraved in a stainless-steel plate with viewable font size and the same shall be fixed inside the Marshalling Box door.
- 11) Buchholz relay, double float type with alarm and trip contacts, along with suitable gas collecting arrangement shall be provided.
- 12) Inverter transformer shall be provided with spring operated Pressure Relief Device (with trip contacts) with suitable discharge arrangement for oil. For Auxiliary transformers, diaphragm type explosion vent shall be provided.
- 13) Filter valve at top the tank and drain cum sampling valve at bottom of the tank shall be provided.
- 14) All external surface of the transformer shall be painted with two coats of epoxy- based paint of colour shade RAL 7032. Internal surface of cable boxes and marshalling box shall be painted with epoxy enamel white paint. The minimum dry film thickness (DFT) shall be 100 microns.
- 15) LV and HV cable box shall be provided with disconnecting chamber to facilitate the movement of transformer without disturbing cable box and termination.
- 16) Air release plug, bi-directional wheel/skids, cover lifting eyes, transformer lifting lugs, jacking pads, towing holes, core and winding lifting lugs, inspection cover, rating plate, valve schedule plate, accessories and terminal marking plates, two nos. of earthing terminals shall be provided.
- 17) Rain hoods to be provided on Buchholz, MOG & PRD. Entry points of wires shall be suitably sealed.
- 18) The accessories listed above are indicative only. Accessories which are not mentioned above but required for satisfactory operation of the transformers are deemed to be included in the contract without extra charges.
- 19) Fire-protection for inverter transformer shall be provided in accordance with relevant CEA regulations as amended time to time.
- 20) Auxiliary Transformer (s) shall be connected Low voltage side of the Inverter Transformer through XLPE cable. A suitable Oil / Air bushing at HV end of the transformer shall be provided. LV side shall be connected to AC distribution board(s) through suitable size cables.

2.14.21 CONTAINER FOR BESS AND EQUIPMENT

- 1) The BESS container and equipment container should be either **20-foot** container or **40- foot** container with height no more than 4.2 meters (including the base).
- 2) The BESS container must comply with the ISO 12944 with required corrosion protection and to ensure design life of at least 15 years.
- 3) The BESS container shall have at least an **IP 54 rating or more** and suitable for conditions as stipulated in Design climate and site conditions.

- 4) The safety for the entirety of the BESS Containers shall follow the UL9540 standards.
- 5) The spacing between BESS containers must follow the NFPA855 regulation.
- 6) If there is any partition within the BESS container, it must be made of fire rated material. The main structures of BESS container and equipment container must not be cut for have their original integrity compromised. There should be sufficient indoor battery space for the required energy storage battery rack, fire protection, internal environment, and SCADA facilities. All facilities must be assembled by independent racks.
- 7) If the BESS container and equipment container need to be machined or perforated, the integrity and structure of the container must not be damaged.
- 8) The equipment container (including air conditioner outdoor unit) must undergo rust- proof and salt mist resistance treatment.
- 9) Battery pack (or battery module, battery cabinet) must be stably fastened in the BESS container. There must be fastening rack fixed to the wall of container (or on the ceiling or on the floor).
- 10) The structures of the minimum unit battery pack (with the series / parallel connection of several smallest series / parallel units) and the maximum unit battery pack (with series / parallel connection of several smallest units) must be explained, and the structural diagrams must be attached.
- 11) There should be independent power supply for the auxiliary power consumption (such as fire protection and air conditioning) by other equipment in the energy storage battery container and equipment container. The air conditioning system must be equipped with backup redundancy to prevent failure of a signal air conditioner from causing the operation failure of the entire system. The cooling power of backup air conditioning equipment, and the calculation must be provided.
- 12) There must be cooling or temperature control system inside the BESS container to keep the battery temperature and humidity in the proper operating temperature range.
- 13) The BESS container and equipment container must be placed in the site specified. The container placement space design drawing must be provided to WBSEDCL to be approved before the construction.
- 14) Safety devices of battery energy storage and equipment containers
- 15) The BESS container must be equipped with an emergency interrupting kill switch must be installed outside the container. The emergency interrupting switch must be equipped with protective facilities (for example, it must be protected by a plastic box) to prevent accidental presses.
- 16) Container must be equipped with equipment grounding system.
- 17) For flood detection warning, at least 4 detectors should be evenly arranged at the top/ bottom of the container, and communication functions are required.
- 18) The BESS container must be able to detect hazardous gases (including, at a minimum, hydrogen, carbon monoxide, carbon dioxide, and the gas generated when the cell's pressure relief valve is activated) and have alarms and communication functions.

- 19) The BESS container must be equipped with a pressure relief valve to prevent the internal combustion and exploding.
- 20) Air conditioning equipment of BESS containers
- 21) The equipment must be able to be controlled/monitored by the EMS.
- 22) The air-conditioning facilities of the BESS container must cover the battery room, be able to maintain the temperature of the battery room for optimal operation, and be able to be controlled/monitored by the energy storage management system. The settings must include, at a minimum, the air conditioning equipment operating status, start and stop, and temperature, and it must be able to monitor the current temperature.
- 23) The equipment container must be equipped with ventilation equipment, which must comply with the fire safety regulations for containers. For example, if the container is equipped with PCS, transformers, and other equipment that generate heat during operation, the design and allocation of the equipment should meet the heat dissipation requirements of the equipment, and the design documents should be attached.
- 24) Fire extinguishing devices of BESS and equipment containers
- 25) BESS containers must be equipped with automatic fire-fighting facilities that comply with national fire-fighting standards.
- 26) Fire protection system for BESS shall be simulated and provided as per Very Early Smoke Detection Alarm (VESDA), if applicable or as per OEM requirements.
- 27) The fire extinguishing agent Novec 1230 / Aerosol can be used.
- 28) Fire alarm / detection devices should at least include Smoke detection (at least 2 detectors), temperature detection (at least 2 detectors), humidity detection, human detection, and CCTV, and the devices must offer remote monitoring.
- 29) A UPS must be installed, which will allow the fire monitoring system to operate for twenty-four hours in the event of a power outage.
- 30) Electricity consumption data must be collected for all the fire fighting, air conditioning, monitoring, and lighting facilities in the container by electric meters, which can transmit the information to the BESS controller through communication methods. The electricity consumption information of the air conditioning equipment must be provided separately.
- 31) The Contractor shall be responsible for the implementation of the lifting and pipeline and wiring of the container. The outlet of the power line and communication pipeline shall be handled according to the design of the concrete foundation.

2.14.22 THERMAL MANAGEMENT SYSTEM

- 1) The Contractor shall install a Liquid Cooling System and other thermal management system (if required) to ensure the operating parameters of all system components are maintained. The Cooling shall also be appropriately designed to manage any necessary ventilation for the correct operation of the BESS Plant and for a safe operating environment for operation personnel.

- 2) The Contractor shall supply and install a Liquid Cooling System for the enclosures containing battery cells to maintain the batteries inside their temperature operating envelope in accordance with warranty conditions for all BESS site conditions. Such systems should minimize parasitic energy requirements. End of life heat load shall be accounted for Liquid Cooling System design and supply for the battery enclosures/building.
- 3) The Contractor shall have to install Liquid cooling system for the enclosures containing battery cells to maintain the batteries inside their temperature operating envelope in accordance with warranty conditions for all BESS site conditions.
- 4) Alarms for signalling internal failures of critical HVAC/Liquid cooling systems shall be sent to the SCADA system.

2.14.23 FIRE SUPPRESSION SYSTEM

- 1) In addition to clean agent fire extinguishers, the Contractor must consider dry hose in battery containers/rooms with water connection gates outside the battery rooms/containers by viewing the required safety distance to operate the hydrant valves during fire incidents due to thermal runaway. Hydrant valves and piping system shall be designed to operate using external fire extinguisher vehicles/local water tanks arrangement.
- 2) The fire suppression system design and associated alarms shall have an automated operation considering that the BESS will be unattended.

2.14.24 UNINTERRUPTIBLE POWER SUPPLY (UPS)

The UPS should adhere to the following standards:

Standard/Code	Description
IEC 62040-1	Uninterruptible power systems (UPS) - Part 1: General and safety requirements for UPS
IEC 62040-2	Uninterruptible power systems (UPS) – Part 2: Electromagnetic compatibility (EMC) requirements
IEC 62040-3	Uninterruptible power systems (UPS) - Part 3: Method of specifying the performance and test requirements

The Uninterrupted Power Supply (UPS) system shall be designed to supply power to following loads (but not limited to).

- 1) Data logger / SCADA
- 2) Fire Detection/ Alarm Panel
- 3) HMI of SCADA
- 4) Emergency Lighting
- 5) Inverter's Auxiliary supply (if applicable)
- 6) HT panel auxiliary
- 7) CCTV
- 8) PCS

The battery sizing shall account for suitable temperature correction factors, ageing factors of 1.25,

design margin of 1.1 & depth of discharge of 80%.

The UPS shall automatically provide continuous, regulated AC power to critical loads under normal and abnormal conditions, including loss of input AC power.

The UPS shall meet the following minimum specifications.

Parameter	Specification
Topology	Online double conversion UPS
Overall efficiency	> 90%
Input	
Voltage	230 V $\pm$ 10% AC for UPS rating of less than 5 kVA 415 V $\pm$ 10% AC for UPS rating of 5 kVA and above
Frequency	50 $\pm$ 5%
Power factor	0.95
Output	
Voltage	415V $\pm$ 1% AC (3 Phase)
Frequency	50 Hz
Power factor	0.8
Battery	
Type	Sealed, Maintenance-Free (AGM) battery
Capacity	100% UPS load for 2 hours
Monitoring and communication	
LED Indication	Yes
Local Display	LCD / LED
SCADA communication	RS-485 Interface Port/TCPIP

- The UPS shall be forced air cooled by internally mounted fans. The fans shall be redundant in nature to ensure maximum reliability. The fans shall be easily replaceable without the use of special tools.
- The Contractor shall provide the Operation & Maintenance Manual and mandatory spare parts list along with the equipment.
- UPS shall be warranted for minimum of 5 (five) years and batteries shall be warranted for a minimum of 2 (two) years against all material/ manufacturing defects and workmanship from the date of supply.
- Routine tests and acceptance tests on final product shall be done as per QAP approved by the Employer.
- On completion of installation and commissioning of the equipment on site tests shall be carried out with the max. available load, which does not exceed the rated continuous load. An on-site test procedure shall be submitted by the Contractor include a check of controls and indicators after installation of the equipment.

2.14.25 33 KV HT SWITCHGEAR PANEL

- 1) The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable IS/IEC standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering.
- 2) The Contractor shall select the voltage level of HV Switchgear as per the system requirement. The indoor/outdoor switchgear system shall include Requisite nos. incoming panels from field units, and outgoing panels to Power/Inverter transformers or the outgoing lines depending on the evacuation voltage & system requirement, panels for HV/415 V Auxiliary Transformer, Bus couplers breakers and associated equipment
- 3) The HV switchgear panels located indoor (Main pooling Panel) / outdoor (ICOG/Inverter station) shall be complete with cubicles, protection, metering, bus- bar system, cabling, wiring and other accessories, comprising of HV Vacuum circuit breaker, AC bus bars (including N-bus bar), Current transformers, Potential transformers, Multifunction meters and other necessary equipment as per system requirements The HV Switchgear panel if placed outdoor at inverter station shall be placed on the platform and shall be of outdoor duty with minimum IP-55. The quantities shall be finalized during detail engineering based on the proposed configuration.

Rating and Functional Characteristics

- Type of Circuit Breaker - Suitable Type
- Highest system Voltage - 36kV
- Rated operating voltage - 33kV
- Rated frequency - 50HZ
- Number of Poles – Three
- Short time rating for Bus Bars, circuit breakers, transformers and switchgear assembly - As per system requirement
- Busbar Material – Aluminium
- Rated/minimum power frequency Withstand voltage - 70kV
- Rated lightning impulse Withstand voltage- 140kV
- Rated Current Bus bar - 1250A or above as per design
- Minimum Creepage distance - 31mm/KV
- Rated Normal Current - 1250A or as per System requirement
- AUX Contacts - As required plus 6NO and 6NC contacts per pole as spare.
- Noise Level-Maximum 140 dB at 50m distance from base of circuit breaker
- No. of Incoming/Outgoing feeder – as per system requirements.
- System Fault current – As per system requirements.
- The maximum capacity of 33 kV feeder shall not be more than 30 MW.
- Circuit Breaker protection against
 - Over Current
 - Earth fault
 - Under voltage & over voltage protection
 - Under frequency & over frequency
 - DC supply failure
 - AC supply failure

2.14.26 33 KV AC CABLES

Standards and codes:

- 1) IS:7098 (Part -I) - Cross linked polyethylene insulated PVC sheathed cables for working voltages up to and including 1100 V.
- 2) IS:7098 (Part -II) - Cross linked polyethylene insulated PVC sheathed cable for (Part - II) working voltage from 3.3 kV up to & including 33 kV.
- 3) The cables shall be suitable for laying on racks, in ducts, trenches, conduits, overground cabling and underground (buried) installation with chances of flooding by water.
- 4) All cables shall be flaming retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.
- 5) Cables shall be armoured type if laid in switchyard area or directly buried.
- 6) Cable lengths shall be considered in such ways that straight through cable joints are avoided.

Construction Details

- 1) Conductor - Aluminium conductor used in power cables shall have tensile strength as per relevant standards. Conductors shall be stranded
- 2) INSULATION - XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250° C. PVC insulation shall be suitable for continuous conductor temperature of 70°C and short circuit conductor temperature of 160°C.
- 3) ARMOUR - For single core armoured cables, armouring shall be of copper/aluminium wires/ formed wires. For multicore armoured cables, armouring shall be of galvanised steel
- 4) OUTERSHEATH - Outer sheath shall be of PVC as per IS: 5831 & black in colour for power cables. In addition to meeting all the requirements of Indian standards referred to, outer
- 5) Sheath of all the cables shall have the following FRLS properties. Oxygen index of min. 29 (as per IS 10810 Part-58). Acid gas emission of max. 20% (as per IEC-754-I). Smoke density rating shall not be more than 60 % (as per ASTM D-2843).

2.14.27 LT POWER CABLES:

- 1) LT Power & control cables shall be of minimum 1100 volts grade XLPE /PVC insulated conforming to IS 1554 / IS 7098 (Part-I) for utilization voltages less than equal to 415 V.
- 2) 1.1 kV grade XLPE power cables shall have compacted aluminium conductor, XLPE insulated, FRLS properties, PVC inner-sheathed (as applicable), armoured/ unarmoured, PVC outer-sheathed conforming to IS:7098. (Part-I). Cables which are directly buried shall be armoured.
- 3) 1.1 kV grade PVC power cables shall have aluminium/copper conductor (compacted type for sizes above 10 sq.mm), PVC Insulated, FRLS properties, PVC inner sheathed (as applicable) armoured/ unarmoured, PVC outer-sheathed conforming to IS:1554 (Part-I).

2.14.28 LT control cables

Conductor of control cables shall be made of stranded, plain annealed copper. Outer sheath shall be of PVC as per IS: 5831 & grey in colour for control cables. Cores of the cables shall be identified by colouring of insulation.

2.14.29 LT SWITCHGEAR

- 1) Standards and Codes – IEC 60947/IS 13947
- 2) 3-phase, 50 HZ, 415 V switchgear system shall consist of various LT metal enclosed Switchgear boards complete with suitably rated equipment including, Draw out type incoming air circuit breaker (if required), required no. of MCCBs, Current transformers, of Potential transformers, of Multifunction meters, AC bus bars (including N-Bus bar), Local control switches, Indicators (LED Type) as per requirement, all necessary auxiliaries for control and supervisory circuits, and other necessary associated equipment All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP-55 for outdoor LT panels and IP-42 for indoor panels as per IS/IEC60947.

As a minimum requirement is mentioned below:

- Busbar material – Aluminium Material
- Voltage level – as per system requirement
- Fault level – As per system requirements.

2.14.30 AUXILIARY POWER SUPPLY SYSTEM

- 1) All non-critical auxiliary loads shall be fed directly from ACDB. However, emergency, and important load shall be fed from suitable sized Uninterrupted Power Supply (UPS) or Battery system. Input AC supply for Uninterrupted Power Supply (UPS) and Battery Charger shall be fed from ACDB.
- 2) The AC Power Supply System shall be designed and installed by vendor and be adequate to supply for all AC power requirements for BESS Plant, subjected to Employer approval.
- 3) The Contractor shall design and supply all other equipment needed to satisfy the requirements of technical Specification.

2.14.31 BATTERY CHARGER

- 1) Adequate capacity DC battery Bank (s) shall be provided with minimum 2 Hours of back-up time at suitable locations as per system requirements for emergency control supply of inverters, control & protection system, Fire Detection/ Alarm Panel, SCADA System, Operation of Equipment, emergency lighting, CCTV, and other requirements.
- 2) Adequate capacity battery charger (Float Cum Boost Charger-FCBC) with relevant IS/IEC standards & protection and automatic change over system shall be provided to charge the battery bank(s) along with relay circuit, fuses, annunciations.
- 3) DC power supply Distribution panel/board shall be supplied along with the Charger (FCBC) as per relevant IS standards. Control Room DC Battery Bank & DC supply system design, calculations and detailed explanations along with drawing shall be provided to the Employer for review.

General requirements

- 1) DC Batteries the batteries shall have the following specifications: -
- 2) Type: VRLA batteries.

- 3) Rating: As per system Requirement.
- 4) Standard – IS: 1651-1979; performance as per IS8702
- 5) Container: Plastic Resin, ABS or PP
- 6) Terminal Posts: Designed suitably to accommodate external bolted connections.

2.14.32 CABLING SYSTEM

- 1) Inter Plant Cabling: Interplant cabling for main routes shall be laid in Cable trenches/cable trays/buried/duct banks.
- 2) Cable Trays, Fittings & Accessories: Cable trays shall be ladder/perforated type as specified complete with matching fittings (like brackets, elbows, bends, reducers, tees, crosses, etc.) accessories (like side coupler plates, etc. and hardware (like bolts, nuts, washers, G.I. strap, hook etc.) as required. Cable trays shall have standard width of 150 mm, 300 mm & 600 mm and standard lengths.

2.14.33 OUTDOOR/INDOOR ILLUMINATION

- 1) Emergency lighting systems shall be provided for plant applications such as at room, Security Room(s) etc.
- 2) Normal AC Lighting System of 415 V, 3-Phase, 4-wire, will be fed from Lighting Distribution Boards (LDBs), which in turn will be fed from the 415 V, Main AC Distribution Board.
- 3) Rooms shall be equipped with power outlet circuits with necessary breakers/switches, protective and indicating devices shall be provided for each socket/cubicle.
- 4) Adequate no. of switchboards (with 3-pin sockets), portable socket cubicles, distribution boards, lighting accessories, lighting poles for streetlights etc., shall be provided by the Contractor.
- 5) The illumination system shall be properly wired, earthed and connected with suitable grade cables, as applicable.

Lux level shall be as below requirements:

- Rooms – 300 Lux
- General Rooms – 100 Lux
- Street Lighting – 20 Lux
- Switchyard – 50 Lux

2.14.34 MONITORING, METERING, CONTROL AND PROTECTION SYSTEMS

The scope of Works related to Monitoring, Metering, Control and Protection Systems shall include but not limited to the following:

Control System:

- a) Supply, install and commissioning of Tap Changer Control Cubicle (RTCC) with AVR for the Inverter Duty Power Transformer.
- b) Design, supply, delivery and installation of BMS, EMS and BESS Controllers. Please refer to Hybrid Energy Management System (EMS) Requirements for more information on BESS control system
- c) The operation and status information of the BESS, BMS, and PCS can be captured remotely from the SDC through the EMS, communication lines, and related

communication equipment. The related control functions and parameters can be set, and commands can be sent to the BESS Plant to control operations. Local/remote control selection facilities shall be provided with interlocking schemes. Detail scheme shall be agreed and finalized with the Employer after Contract Award.

- d) Human Machine Interface (HMI) for BESS to provide local, centralized operator control of the BESS Plant. All performance data and any abnormal condition requiring operator action or intervention or maintenance on any of the BESS Plant subsystems shall be annunciated at the BESS control room, Switchyard control room and the State Dispatch Centre (SDC). In short, one local HMI for each BESS container, one remote HMI at Switchyard control room and one remote HMI at SDC.
- e) Complete set of new control, protection and indication multicore cables, screen cable and auxiliary power cables for all equipment supplied for BESS plant and SCADA Plant Interface Cubicle. All cable terminations must be finished with insulated crimp type of cable lugs.
- f) All other equipment needed to satisfy the functional and technical requirements for a complete, safe and reliable operational BESS Plant.

Protection and Monitoring System:

- g) SCADA Interfacing/marshalling cubicles for termination of all signals for the State Dispatch Centre
- h) Complete set of new control, protection and indication multicore cables, screen cable and auxiliary power cables for all equipment supplied for BESS plant and SCADA Plant Interface Cubicle. All cable terminations must be finished with insulated crimp type of cable lugs.
- i) Adequate protection shall be provided for the complete BESS Plant, as per manufacturer's recommendations to ensure all equipment is fully protected from being overstressed and shall ensure the protection is properly coordinated.
- j) Any and all other equipment needed to satisfy the functional and technical requirements for a complete, safe and reliable operational BESS Plant

Metering System:

- k) The Metering System shall be of high precision, connected to the monitoring system and compliant with the latest edition of CEA Guidelines.
- l) Measuring points and measuring equipment for interlocking and protection purposes shall be separate and not combined with measuring equipment for monitoring or automatic control equipment.
- m) High accuracy (of Class 0.2 or higher) main and check energy metering equipment and associated CTs and VTs of 0.2s and 0.2 accuracy classes respectively shall be provided for the record of gross power and energy imported and exported. Separate CT core and VT winding shall be provided for main and check meters.
- n) The electrical metering, control, indication, monitoring shall be included in the EMS and BESS Plant Control Room.
- o) All equipment necessary for such monitoring, indication, control, metering including but not limited to CTs, VTs, transducers, auxiliary contacts, marshalling and termination facilities, cables shall be provided.

2.14.35 EMERGENCY POWER SUPPLY SYSTEM:

- a) The Contractor shall include emergency power supplies to ensure the safe and controlled operation or shutdown of the BESS Plant in the event of loss of all electrical supplies without damage to any equipment, as well as to maintain safe auxiliary power in case of blackout.
- b) The Contractor shall install the required emergency power supply system as per local and international standards to feed the critical systems of the Facility which purpose is to protect personnel and property of the Facility, including but not limited to:
 - i) Monitoring system and communication means
 - ii) Control system to allow a safe shut-down of the Facility
 - iii) Safety systems: firefighting and detection system, etc.
 - iv) Security and surveillance systems: cameras, public announcement system (for MCR), etc
 - v) Emergency and escape route lighting

2.14.36 COMMUNICATION EQUIPMENT

The scope of Works related to Communication Equipment shall include design and provision of the following BESS plant and facilities, but not limited to:

- 1) A link between the Control Room (around 300m from BESS site area) and all requirement equipment to be installed in the Control Room for cable power feedback and/or other required PCS controller signals will be included in the Contractor scope of work.
- 2) All necessary equipment required to interface with the Employer's communication network
- 3) The interfacing between the BESS Plant and Switchyard Control Room will be via Fibre- optic cables.
- 4) The BESS shall be capable of communicating over a standard protocol – TCP/DNP 3.0, furnished and installed by the Contractor, which shall permit communication to the SDC, or an alternative command and control centre delegated by the Employer. This will allow Employer or SDC to monitor and control such parameters as battery voltage, current, temperature, state of charge and state of health at the containers/cabinet's levels; as well as allow to control charging, discharging and other functions of BESS, as necessary. The Battery Management System (BMS) shall connect and transfer data to switchyard control Room.
- 5) The Contractor shall provide the communication protocol manuals for the BMS, PCS, EMS, and other related explanatory documents.
- 6) The PCS shall communicate with the controller via standard protocol defined by vendor, e.g. Modbus, RS485, RS422, etc. In case of Modbus communication, all Modbus detail shall be provided.
- 7) The BESS shall have a maintenance port (serial, WIFI, Bluetooth, etc.) to allow monitoring and control BESS at local level via a PC.
- 8) Digital protection signalling equipment shall be provided for command type protection schemes in compliance with the latest requirement.
- 9) Provision of telecontrol telecommunication service shall comply with technical Specification and Transmission design practices.
- 10) Voice communication link shall be established between the BESS Plant, switchyard Control Room and SDC.

- 11) Installation, testing and commissioning of the communication cables and equipment shall comply with the latest version of Telecommunication Guideline and manufacturer's recommendation.
- 12) All communication equipment associated works shall comply with all the relevant technical requirements for communication system and associated equipment

2.14.37 EARTHING AND LIGHTNING PROTECTION

- 1) Earthing of plant shall be as per IS 3043 and IEEE 80 for substation earthing.
- 2) The Site earth resistivity tests shall be carried out to determine the number of earthing points after the award of the Contract. The number of rods and earthing points finally determined shall be submit to the Employer's approval.
- 3) Complete earthing electrode and any additional earthing system to make the scope complete for the BESS site area shall be provided. Any damages to the existing earthing system shall be replaced and made good. The size of the new underground earth mat conductor shall be finalized based on sizing & calculation.
- 4) Earthing system for the BESS site area. Any new design consideration for the proper earthing of the BESS Plant would be required as part of the Contract. All existing earthing conductors, which will be cut by the Contractor for performing the work covered under the scope of this project, shall be reinstated up to the full satisfaction of the Employer.
- 5) In the situation requiring foundation, the foundation shall not be reinforced with steel due to circulating currents. The foundation shall be reinforced with glass fibre bars or concrete mix with glass fibres.
- 6) The fence shall be provided with proper earthing to eliminate step, touch or transfer potential hazards due to the circulating current. The fences shall be designed so as not to introduce hazardous touch and transfer potentials, and these hazards shall be adequately controlled
- 7) Complete earthing electrode system buried in the ground and embedded in the concrete of the building for the complete substation, with risers.
- 8) Above ground/surface earthing system for the complete substation.
- 9) Connection of all equipment supplied under this Contract (including all panels) to the earthing system.
- 10) Contractor shall provide lightning protection for room/ shed/ shelter/ enclosure, per IS/ IEC 62305.

2.14.38 DECOMMISSIONING/END OF LIFE WASTE MANAGEMENT

- 1) All waste generated during construction and operation shall be segregated, stored, and disposed of according to Indian regulations. Hazardous waste, including oils, solvents, and chemicals, shall be collected in secure containers and disposed of at licensed facilities.
- 2) For batteries, an end-of-life management plan shall be prepared by the Contractor in accordance with Indian law and international standards. The plan shall cover recycling, safe disposal, and potential return-to-manufacturer schemes.
- 3) The Contractor must ensure compliance with all applicable national legalization on waste treatment.
- 4) This process must be developed, documented and financed during system development to prevent a stranded resource to be left without any support or commitment for decommissioning.
- 5) The Contractor shall specify the recyclability of the BESS components. A strategy and guide must be provided on how to decommission, dispose and (to the extent of possibility) recycle the BESS at the end-of-life indicating temporary storage, transportation, disposal sites, etc. in accordance with national legislation.
- 6) Where applicable, disposal and recycling regulations for compounds and components in electrochemical BESS must be followed. Materials must be disposed of according to national

requirements.

- 7) Where national legislation or requirements is lacking or incomplete, European Union regulations should be used as a guideline.
 - a. Batteries Directive 2006/66/EC
 - b. Waste Framework Directive 2008/98/EC
- 8) The costs for all the scopes as specified in the decommissioning/end of life strategy and guide as well as the associated works shall be provided during tender submission and breakdown in the price schedule of each item shall be provided. The Employer in its sole discretion may elect to include the service in the Scope of Works of this Turnkey Contract as stipulated in Project details.

NOTE:

Any item/equipment not mentioned in the Technical Specification, but required for successful completion of the project shall be deemed to be a part of the scope of the work and the same shall be included by the bidder in their Bill of Quantity (BOQ).

1. All equipment, materials and services whether explicitly stated or Not in Technical Specifications or anywhere in the tender documents but that are necessary for the successful commissioning of Plant as per latest statutory regulations/ procedures/ clarifications/ Advisories/ OMs/ Guidelines/ standard issued by bodies like CERC/ SERC, CEA, RLDC/NLDC/SLDC, CTU/STU, MNRE, other Ministry etc shall be deemed to be included in the scope of work of the Contractor and bidder shall comply the same.
2. "The Contractor shall ensure that all Plant, Materials, and Works supplied and installed under this Contract comply fully with all applicable Indian Standards (IS) published by the Bureau of Indian Standards (BIS) and any relevant Quality Control Orders (QCO) issued by the Government of India. This obligation shall extend to all materials, equipment, sub-assemblies, and components, including those supplied by sub-contractors or imported.

2.14.39 ACCEPTANCE TESTS FOR BESS PLANT

The following procedures will govern the factory acceptance tests (FAT) and site acceptance test (SAT) for BESS plant and components:

- FAT procedure to be submitted by bidder and approved by WBSEDCL
- FAT to be witnessed by WBSEDCL
- FAT to be completed before dispatch
- Any non-conformity to be rectified at no extra cost
- Independent lab certification mandatory for critical subsystems

SYSTEM-LEVEL BESS ACCEPTANCE TEST BEFORE COMMISSIONING

1) Functional & Operational Tests

The complete BESS (Battery + BMS + PCS + EMS + Auxiliaries) shall be tested as an integrated system. This test shall be conducted at the site before commissioning if not already conducted at factory before despatch.

Tests to be performed:

- Verification of all operating modes:
 - Charging
 - Discharging
 - Idle / Standby

- Emergency shutdown
- Verification of automatic, local and remote operation
- Verification of start-up and shutdown sequences
- Verification of interlocks and permissive logic
- Verification of fail-safe behavior during abnormal conditions

Acceptance intent:

To demonstrate that the BESS operates exactly as designed under all duty cycles and use cases defined in the specification.

POWER & ENERGY PERFORMANCE

The complete BESS (Battery + BMS + PCS + EMS + Auxiliaries) shall be tested power, performance and efficiency of the BESS plant. This test shall be conducted at the site before commissioning if not already conducted at factory before despatch.

- Demonstration of operation at:
 - Rated power
 - Partial power
- Verification of:
 - Rated MW output
 - Rated MWh energy capability
- Simulation of charge–discharge duty cycle
- Measurement and validation of:
 - Round Trip Efficiency (RTE)
 - Energy throughput

Acceptance intent:

To confirm compliance with declared power, energy and efficiency parameters.

SAFETY & CATASTROPHIC FAILURE RESPONSE

The complete BESS plant shall be tested for safety and response to catastrophic failure. This test shall be conducted at the site before commissioning if not already conducted at factory before despatch.

- Demonstration of:
 - Emergency stop functionality
 - Battery isolation under fault
 - PCS tripping on abnormal grid conditions
- Verification of safety logic during:
 - Over-voltage
 - Over-current
 - Over-temperature
 - Loss of grid
- Review of thermal runaway mitigation philosophy
- Submission of third-party safety certification reports

Acceptance intent:

To ensure safe response of the BESS during fault or emergency scenarios.

BATTERY ACCEPTANCE TESTS

As per MNRE Order No. S.O. 492 (E) Solar Systems, Devices and Components Goods Order, 2025 dated 27 January 2025, it is mandatory to follow Indian standard "IS 16270: 2023 - Secondary Cells and Batteries for Solar Photovoltaic Applications - General requirements and methods of test" and IS 16822:2019/ IEC 62620: 2014 - Secondary Cells and Batteries Containing Alkaline or Other Non-Acid Electrolytes — Secondary Lithium Cells and Batteries for Use in Industrial Applications for procurement of storage battery.

These following tests are to be conducted as per IS/IEC standards as mentioned above and elsewhere in this document. These test shall be conducted at the site before commissioning if not already conducted at factory before despatch. When tests are conducted at the factory certificates and undertaking by the OEM with test procedures and results shall be provided. The Employer shall have right to ask the Contractor to carry out certain tests at site (SAT) even after FAT is carried out earlier.

CELL / MODULE LEVEL

Mandatory tests (as per IS 16270/IS 16822:2019/ IEC 62933-2-1 / IEC 61427-2):

- Duty cycle test
- Available energy (capacity) test
- Round-trip efficiency test
- Insulation resistance test
- Visual and dimensional inspection
- Verification of labeling and traceability

Acceptance intent:

To verify that supplied cells/modules meet declared electrical and safety performance.

BATTERY STRING / RACK

- Verification of:
 - String voltage and current
 - Polarity correctness
 - Mechanical integrity
- Functional testing of:
 - String protection devices
 - Fuses / DC breakers
- Verification of insulation coordination

BATTERY SAFETY & TRANSPORT CERTIFICATION

- Submission of certificates for:
 - UN 38.3 / IEC 62281 (transport safety)
 - UL 9540A or equivalent (thermal runaway propagation)
- Review of test reports issued by ILAC-accredited laboratories

Acceptance intent:

To ensure compliance with international battery safety and transport requirements.

BATTERY MANAGEMENT SYSTEM (BMS)

1) Monitoring & Measurement

- Verification of:
 - Cell voltage monitoring
 - Module voltage monitoring
 - String current measurement
 - Cell and module temperature sensing
- Verification of:
 - SOC calculation
 - SOH estimation

2) Control & Protection

- Demonstration of:
 - Cell balancing functionality
 - Over-voltage protection
 - Under-voltage protection
 - Over-temperature protection
- Verification of emergency isolation logic

3) Communication

- Verification of communication with:
 - PCS
 - EMS / SCADA
- Validation of alarms and fault reporting
- Verification of data logging and storage

Acceptance intent:

To ensure that the BMS can safely manage and protect the battery system.

Power Conditioning System (PCS)

1) Electrical Performance

- Measurement of:
 - Euro efficiency (IEC 61683)
 - AC voltage and frequency range
 - Active power control
 - Reactive power control
- Verification of:
 - Four-quadrant operation
 - Power factor control
 - DC injection limits

2) Protection & Grid Compliance

- Functional testing of:
 - AC over-current protection
 - DC over-current protection
 - Over / under voltage protection
 - Over / under frequency protection

- Demonstration of:
 - LVRT / HVRT response
 - Anti-islanding functionality
 - Synchronization & re-synchronization logic

3) Environmental & Safety (Certification Based)

- Review of test certificates for:
 - EMC (IEC 61000 series)
 - Temperature endurance (IEC 60068 series)
 - Ingress protection (IEC 60529)

Acceptance intent:

To validate PCS performance, protection, and grid-compliance capability.

EMS / SCADA

1) Functional

- Demonstration of:
 - Real-time monitoring of BESS parameters
 - Control of PCS and battery operations
- Verification of:
 - Alarm and event handling
 - Historical data storage and retrieval
- Validation of:
 - Remote command execution
 - Report generation

Communication & Time Synchronization

- Verification of communication with:
 - PCS
 - BMS
 - Energy meters
 - Protection relays
- Verification of GPS-based time synchronization

Acceptance intent:

To confirm complete supervisory control and monitoring functionality.

2.14.40 SPARE PARTS AND INVENTORY MANAGEMENT

- 1) The Contractor shall provide the recommended spare parts for the BESS plant, as well as special or dedicated tools required for the assembly, maintenance, and repair of the BESS plant. The Contractor shall provide a list of recommended spare parts and dedicated tools, as well as their prices, when submitting tender. The provision of spare parts shall be deemed to be included in the Contract Price.
- 2) The scope of spare parts and special tools must be coordinated with twelve (12) year operation and maintenance service agreement and shall serve as part of the contract as a deliverable.
- 3) An inventory of the spare parts should be prepared at the time when the BESS is turned over to The Employer and again at the end of the operation and maintenance service agreement. Any shortages should be replenished by the Contractor so that the spare parts inventory is at its 100% level at the end of the operation and maintenance service agreement, which can allow for another cycle of maintenance and shall be deemed to be included in the Contract Price.
- 4) The Contractor shall provide at least one set of spare parts kit for the BESS plant. BESS major equipment: control, protection, metering, local control system, remote control system, protection relay and special tools with recommended spare parts (Breakdown in price schedule of each item shall be provided and shall be deemed to be included in the Contract).
- 5) The Contractor shall not use the contractually delivered spares during the start-up phase (i.e. during the installation and commissioning).
- 6) Start-up spares to be used by the Contractor during the installation and commissioning period shall be separated from the main spares.
- 7) The Contractor shall, where practical, look at optimizing the design to allow the number of spares to be reduced through common designs.
- 8) For Special Tools and Maintenance / Test Equipment, the Contractor shall provide all special tools and equipment for maintenance/testing, required to assemble/ dismantle, maintain, adjust, calibrate, test, etc, the Work furnished under the Contract. The Contractor 's Proposal shall include a complete list of special tools and maintenance/test equipment to be provided. The same requirements as specified above for the spare parts shall be applicable to the list of special tools and maintenance/test equipment.
- 9) All special tools and maintenance/test equipment not specified by the Contractor and found to be necessary for testing and/or maintenance of the BESS Plant shall be deemed to be included in the Contract Price.
- 10) All spare electronic modules and transducers (where possible) are to be tested and calibrated before completion of commissioning, as well as any software versions noted and detailed. The functionality of all electronic modules, transducers and relays is to be demonstrated by inserting these spare parts into the BESS control and protection systems and proving that the BESS operates correctly.
- 11) The spare HMI unit shall be tested and shown to be completely functional for minimum set- up in case a replacement is required.
- 12) Other than the items in (a) above, a spare parts strategy detailing costs of recommended spare parts and their storage shall be also submitted for the installed BESS plant. The spares strategy may form part of the service and maintenance agreement offered by the Contractor as detailed in Operations and Maintenance agreement.
- 13) It is the Contractor 's responsibility, based on the particular design for the BESS; to provide adequate spare parts to meet the performance guarantee, reliability and availability requirements and this must be included in the Contract Price. The spare parts shall be furnished at the same time and as the part of this BESS supply. All spare parts offered must be of the same quality as, and completely interchangeable with the original parts.
- 14) The Contractor is required to submit separate details of any special test equipment, tools, gauges and jigs for installation, testing, re-commission, operation and maintenance of the BESS Plant as well as to locate and rectify faults, and this must be also included in the Contract Price.

- 15) The following supply lists shall also be included.
- a. Any special software programs used by the Contractor in the diagnostics or analysis of the BESS system and control, protection and monitoring.
 - b. Tools and instrumentation suitable for dismantling, re-assembling and checking for equipment that requires periodic checking.
 - c. A complete set of finished hardened spanners to fit every nut and bolt head on the equipment supplied. All special tools and other hand operable devices required for the adjustment and maintenance of the equipment shall be supplied too.
 - d. If the Contractor uses any special tools or test equipment during the installation, testing and commissioning of the BESS plant, but not listed in the tender submission, The Employer may elect that these items be supplied as part of the Scope of Work with no increase in the Contract Price.

2.14.41 EQUIPMENT AND MATERIALS WARRANTY

- 1) The Contractor shall provide a warranty for the entire BESS and its constituent equipment.
- 2) At a minimum, the Contractor shall provide an unconditional, 12 (twelve) year warranty on all BESS equipment. The warranty shall cover all parts and equipment including battery nominal capacity ratings to meet the End of Battery Life condition described above.
- 3) Warranty replacement shall be required for individual unit batteries that degrade in performance to the point at which the BESS cannot meet the requirements specified in this specification up to the End of Battery Life and/or for unit batteries that materially degrade the availability, reliability, safety, or functionality of the BESS.
- 4) The warranty shall guarantee the availability of battery replacements delivered to the site within 2 weeks of notification during the battery warranty period. This period, shall, however, not be considered part of the Accountable Outage period for assessing BESS availability.
- 5) Additional warranty requirements are as follows:
 - a. The warranty shall specify the terms and conditions of the warranty, including operating conditions requirements, procedures that must be followed, and all maintenance requirements.
 - b. The warranty shall provide an explicit statement as to the warranted cycle life and the warranted calendar life of the battery.
 - c. The warranty shall include a simple and easy to understand proration formula, if any, to be used in crediting the Employer for unused life or capacity of equipment replaced or repaired.
 - d. The warranty shall specify the scope of service associated with software updates.
 - e. The warranty shall specify the scope of service included in replacement or repair of the equipment.
 - f. The warranty shall specify all labour, materials, shipping charges, and other Employer expenses not included in the warranty.

2.14.42 INSTALLATION TESTING AND COMMISSIONING

- 1) Installation, testing and commissioning of equipment procured and supplied as per above technical specifications
- 2) Ownership of packing materials (except of mandatory spares) shall be of the Contractor. Responsibility of removal and disposal of the packing material shall be in the scope of the Contractor.
- 3) Pre-commissioning checks and tests for all equipment.
- 4) Synchronization and Commissioning of plant.
- 5) Any other works related to installation, testing and commissioning not mentioned but required to complete the Solar Power Plant facilities in all respect.
- 6) All costs associated with the Plant Testing and Commissioning shall be borne by the Contractor.

2.14.43 PERFORMANCE GUARANTEE TEST (PGT)

The Performance Guarantee Test (PGT) shall be conducted after the successful completion of the trial run of 07 days. The purpose of the PGT is to verify compliance of the BESS with the guaranteed performance parameters defined in these specifications.

General Requirements

The Contractor shall prepare and submit detailed test procedures for the PGT, including instrumentation, methodology, and acceptance criteria, for approval by the Employer. All measurements shall be carried out using calibrated equipment and witnessed by the Employer or its appointed representatives.

Parameters to be Verified

The following performance parameters shall be tested and demonstrated:

a) Usable Energy Capacity

- Minimum of 40 MWh usable AC energy at the Point of Common Coupling at the time of commissioning.
- Discharge at rated power until usable capacity is reached.

b) Power Capability

- Continuous discharge at 10 MW for four hours at rated ambient conditions.
- Ability to sustain the rated power for the full duration without derating.

c) Round-Trip Efficiency

- AC-to-AC round-trip efficiency of at least 83 percent (including auxiliary consumption) under reference test conditions.
- Efficiency curves provided by the Contractor shall be validated at three operating points: partial load, rated load, and near end of discharge.

d) Response Time

- Active power response to grid frequency events shall be within 200 ms.
- Verification of frequency control mode and ramp rate control functions.

e) Reactive Power and Voltage Regulation

- Verification of continuous reactive power capability across the defined P-Q range.
- Demonstration of voltage regulation at the 33 kV bus.

f) System Availability

- Demonstration of continuous operation over the test period with minimum availability of 95 percent.

2.14.44 TEST DURATION

The PGT shall be conducted over a continuous period of minimum 30 days, during which the plant shall be operated under normal grid conditions. The Employer reserves the right to extend the test period if interruptions or failures occur.

2.14.45 SYSTEM AND PERFORMANCE WARRANTY

System Warranty

The EPC Contractor shall provide a comprehensive system warranty covering all equipment, materials, and workmanship for a period of twelve years from the date of issuance of the Taking Over Certificate.

The warranty shall include:

- Free repair or replacement of defective parts, components, or equipment
- Coverage of defects arising from design, manufacturing, installation, or commissioning
- All costs related to transportation, labour, and materials associated with warranty repairs
- Warranty extension for any component replaced or repaired during the warranty period, at least equal to the remaining warranty period or twelve months, whichever is longer

The system warranty shall apply to all major equipment including batteries, PCS, EMS/ SCADA, transformers, HVAC, fire suppression, auxiliary systems, and all civil works delivered under the contract.

Performance Warranty

The Contractor shall guarantee the following performance parameters of the BESS for the period specified (12 years of O&M period):

a) **Energy Capacity**

- At least 70 percent of initial usable energy capacity (40 MWh) shall remain available at the end of twelve years under the agreed operating profile.

b) **Power Capability**

- The system shall be capable of discharging the full rated power of 25 MW for at least four hours throughout the warranty period.

c) **Round-Trip Efficiency**

- The system shall maintain an AC-to-AC round-trip efficiency of not less than 83 percent (including auxiliary consumption) at reference test conditions during the warranty period.

d) **Response Time**

- Active power response time shall remain less than 200 ms throughout the warranty period.

e) **System Availability**

- Annual availability shall not fall below 95 percent, excluding planned maintenance periods agreed with the Employer.

2.14.46 VERIFICATION AND ENFORCEMENT

Performance guarantees shall be verified through periodic testing and monitoring of SCADA/EMS data. A minimum of one test will be conducted in a year and additional tests may be conducted as and when required based on demand to check performance variation. The Employer reserves the right to conduct independent performance verification at any time during the warranty period.

If the BESS fails to meet the guaranteed performance levels, the Contractor shall implement corrective measures at no cost to the Employer. If corrective measures are insufficient, the Contractor shall provide compensation in the form of additional capacity, system upgrades, or financial remedies as agreed with the Employer.

2.14.47 ACCEPTANCE CRITERIA

The BESS shall be deemed to have passed the PGT if all performance parameters listed above meet or exceed the guaranteed values specified clause 12 of GCC. Any deficiencies observed shall be rectified by the Contractor at no cost to the Employer, and the relevant test shall be repeated until compliance is achieved.

2.14.48 REPORTING

At the conclusion of the PGT, the Contractor shall prepare a comprehensive test report, including all data, results, and analysis. The report shall be submitted to the Employer within 14 days of test completion for review and approval.

2.14.49 Decommission Plan

General Principles

The Contractor shall prepare a decommissioning plan for the BESS facility, covering all major components including batteries, PCS, transformers, HVAC, fire suppression, and auxiliary systems. The plan shall ensure safe dismantling, recycling, and disposal of equipment at the end of the system's operational life.

The decommissioning plan shall be submitted as part of the project documentation and updated during the O&M period if required by changes in technology, regulations, or industry practice.

Batteries and Electrical Equipment

Special consideration shall be given to the safe handling and disposal of Lithium Iron Phosphate (LFP) batteries. The plan shall include:

- Removal and transportation procedures in compliance with international and Indian regulations
- Recycling of battery cells, modules, and racks through certified recycling facilities
- Provisions for safe temporary storage of batteries before final treatment
- Documentation of compliance with hazardous waste rules and international shipping standards

Transformers, switchgear, cabling, and other electrical components shall be dismantled and recycled or disposed of in accordance with Indian standards and environmental regulations.

Civil Works and Infrastructure

Civil works including foundations, control buildings, drainage systems, and access roads shall be dismantled or rehabilitated as agreed with the Employer. Where feasible, materials such as concrete and steel shall be recycled or reused.

The site shall be restored to a safe condition, suitable for alternative use, or left in a condition agreed with local authorities and the Employer.

Environmental and Safety Measures

The decommissioning process shall comply with all applicable environmental, health, and safety regulations. Specific measures shall include:

- Use of trained and certified personnel for handling hazardous materials
- Spill and fire prevention measures during dismantling
- Proper disposal of oils, chemicals, and fire suppression agents
- Continuous monitoring of environmental parameters during dismantling

Reporting

The Contractor shall prepare a final decommissioning report documenting:

- Quantities and destinations of recycled and disposed materials
- Compliance with relevant regulations and standards
- Environmental monitoring results during decommissioning
- Certification of completion by the Employer or an appointed auditor

SECTION: VI

FORMS & PROFORMAS

Form – I
CHECK LIST

Sl. No.	Scanned Copy of Documents to be uploaded	Name of folder	To be submitted in cover	Submitted (Y/N)
1	Check List (Form – I)	Forms	Statutory cover (Technical proposal)	
2	Application for Tender (Proforma – 1)	Annexure	Statutory cover (Technical proposal)	
3	Power of Attorney i.r.o. the person authorised to sign	Company Details	Non-Statutory cover (Technical proposal)	
4	Bidder's general information (Form – II)	Company Details	Statutory cover (Technical proposal)	
5	Earnest Money Deposit (Scanned copy)/Bank Guarantee for EMD (Proforma-6)	Drafts	Statutory cover (Technical proposal)	
6	Confirmation for No Deviation Sheet (Proforma – 4)	Annexure	Statutory cover (Technical proposal)	
7	Tender Document with Stamp & Signature by authorised person.	NIT	Statutory cover (Technical proposal)	
8	Addenda / corrigenda & Pre-Bid response/minutes , if published	NIT	Statutory cover (Technical proposal)	
9	Format of Letter of Bid (Form – III)	Forms	Statutory cover (Technical proposal)	
10	Pro-forma for undertaking to be submitted by the Bidders (Form – IV)	Forms	Statutory cover (Technical proposal)	
11	Statement of orders executed (Form – VI)	Forms	Statutory cover (Technical proposal)	
12	<u>Technical Credential :</u> i) Order(s)/Contract Agreement(s) issued by the purchaser ii) Commissioning Report (s) and Completion Certificate(s) iii) Satisfactory operation of Solar PV Plant (Proforma-8) iv) Satisfactory Operation of BESS Plant v) Month wise power generation data from last one year from the bid submission start date, signed by the Purchaser/ Ordering authority on Plant Owner's Letter Head vi) Grid Synchronization/Connectivity Certificate/JMR data from License of the grid	Credential	Non-Statutory cover (Technical proposal)	

	Substantiate timely completion of the work and Satisfactory operation of Solar PV Plant and BESS Plant in support of minimum eligibility criteria as per Clause no. 4.2 of NleT			
13	Net Minimum Guaranteed Generation (Vide Proforma – 5)	Declaration	Non-Statutory cover (Technical proposal)	
Sl. No.	Scanned Copy of Documents to be uploaded	Name of folder	To be submitted in cover	Submitted (Y/N)
14	Bill of Material (Vide Proforma – 9)	Declaration	Non-Statutory cover (Technical proposal)	
15	List of Orders in hand with financial information	Declaration	Non-Statutory cover (Technical proposal)	
16	List of key personnel available and proposed to be engaged for the project mentioning their experience and qualification	Declaration	Non-Statutory cover (Technical proposal)	
17	Proof of Company Incorporation / Trade Licence	Company Details	Non-Statutory cover (Technical proposal)	
18	Electrical Contractor License	Certificates	Non-Statutory cover (Technical proposal)	
19	Labour License	Certificates	Non-Statutory cover (Technical proposal)	
20	PF registration certificate	Certificates	Non-Statutory cover (Technical proposal)	
21	ESI Certificate	Certificates	Non-Statutory cover (Technical proposal)	
22	JV/Consortium Agreement and power attorney for JV/Consortium (Proforma-2 & 3)	Declaration	Non-Statutory cover (Technical proposal)	
23	PAN Card details	Certificates	Non-Statutory cover (Technical proposal)	
24	GST registration certificate	Certificates	Non-Statutory cover (Technical proposal)	
25	Professional Tax Registration certificate	Certificates	Non-Statutory cover (Technical proposal)	
26	Income Tax Returns (ITRs) and GST Returns (where applicable) for the preceding three (03) Financial Years	Financial Information	Non-Statutory cover (Technical proposal)	
27	Summary statement of average annual turnover (Form – V)	Forms	Statutory cover (Technical proposal)	
28	Evidence of Access to or Availability of Credit/Facilities (Proforma – 7)	Financial Information	Non-Statutory cover (Technical proposal)	
29	Audited Report on Annual Accounts for last three Years.	Financial Information	Non-Statutory cover (Technical proposal)	

30	Order(s)/Contract Agreement(s) issued by the purchaser in support of financial eligibility criteria as per clause No.4.3 of NleT	Financial Information	Non-Statutory cover (Technical proposal)	
31	Project Proposal with Time Schedule	Declaration	Non-Statutory cover (Technical proposal)	
32	Any other documents, if found necessary	Declaration	Non-Statutory cover (Technical proposal)	

Form-II

Bidder's General Information

(To be submitted on the Letter Head of the Bidding Company)

Sr. No.	Description	Remarks
1	Name of the Bidder (<i>Incase of JV/ Consortium, name of all the members to be indicated and lead member to be identified</i>)	
2	Status of the Firm	
3	Mailing Address of Registered Office	
4	Mailing Address of Operation Office	
5	E-mail	
6	Web site	
7	Authorized Contact Person(s) with Name, Designation, Address and Mobile Phone No., E-mail address / Fax No. to whom all references shall be made	
8	Year of Incorporation	
9	Number of Years in Operation	
10	ISO Certification Yes/No	
11	Name of the Banker	
12	Branch Details of Bank	
13	Type of Account with Account Number	
14	IFSC Code	
15	Permanent Account Number (PAN) of the Bidder	<i>(Copy of PAN Card to be enclosed)</i>
16	GST ID	<i>(Copy of GST Regd. Card to be enclosed)</i>
17	PF Registration Number with Details	<i>(Copy of PF Registration to be enclosed)</i>
20	ESI Registration Number with Details	<i>(Copy of ESI Registration to be enclosed)</i>
21	Have the Bidder/ Company ever been debarred by any Govt. Dept./ Undertaking for undertaking any work	Yes/No <i>(If answer is YES, please providing details)</i>
22	Reference of any document information attached by the Bidder other than specified in the tender.	
23	Whether the Bidder wishes to form a Project Company for execution of work	Yes/No
24	Bidding company is listed in India	Yes/No
25	Whether company is MSME as on the bidding date	Yes/No

(Signature of Authorized Signatory)
With Stamp

Form – III
Format of Letter of Bid

LETTER HEAD OF BIDDER (AS ENROLLED ONLINE ON e-Tendering PORTAL OF NIC)

To,
The Chief Engineer,
Solar Power Generation Department (SPGD)
3rd Floor, Data Centre Complex, Street No. 41, Action Area-I, New Town,
Kolkata – 700163
West Bengal

Sub: Letter of Bid for the work_____

Ref: 1. NleT No _____ dated _____

2. Tender Id No. _____

Dear Sir,

We offer to execute the whole work in Turnkey Basis in accordance with the conditions of the NIT document as available in the website. The details of the EMD being submitted by us has been furnished on-line.

This Bid and your subsequent Letter of Acceptance / Work Order shall constitute a binding contract between us.

We hereby confirm our acceptance of all terms and conditions of the NIT document unconditionally.

Dated-----

SIGNATURE OF THE TENDERER WITH SEAL

Form – IV

PROFORMA FOR UNDERTAKING TO BE SUBMITTED BY THE BIDDER

(To be executed on non-Judicial stamp paper of requisite value)

(For genuineness of the information furnished on-line and authenticity of the documents produced before Tender Committee for verification in support of his eligibility)

I _____, Partner/Legal Attorney/
Accredited Representative of M/s _____,
solemnly declare that:

1. We are submitting Tender for the Work _____ against Tender
NleT. No. _____
2. None of the Partners of our firm is relative of employee of West Bengal State Electricity Distribution Company Limited (WBSEDCL).
3. All information furnished by us in respect of fulfilment of eligibility criteria and qualification information of this Tender is complete, correct and true.
4. All documents/ credentials submitted along with this Tender are genuine, authentic, true and valid.
5. If any information and document submitted is found to be false/ incorrect any time, department may cancel my Tender and action as deemed fit may be taken against us, including termination of the contract, forfeiture of all dues including Earnest Money and banning / delisting of our firm and all partners of the firm etc.
6. Should this Bid be accepted, I/We* also agree to abide by and fulfil all the terms and conditions of provisions of the above mentioned Bidding Documents.

Signature along with Seal of Company.....

(Duly authorized to sign the Tender on behalf of the Contractors)

Name.....

Designation.....

Name of Company.....

(IN BLOCK LETTERS)

WITNESS

Signature.....

Date.....

Name & Address.....

.....

.....

.....

.....

Telephone No.....

Fax No.....

E-mail.....

***Strike out whichever is not applicable**

Form – V

Certificate Regarding Summary Statement of Yearly Turnover

FORMAT OF CHARTERED ACCOUNTANT CERTIFICATE FOR FINANCIAL CAPABILITY OF THE BIDDER (To be submitted on the Letter Head of the Chartered Accountant)

Ref.No._____Date:_____

To,
The Chief Engineer,
Solar Power Generation Department (SPGD)
3rd Floor, Data Centre Complex, Street No. 41, Action Area-I, New Town,
Kolkata – 700163

Sub: Bid for “Design, Engineering, Procurement, Supply, Installation, Construction, Testing and Commissioning including warrantee obligation, Operation and Maintenance for twelve (12) years of a 50 MW (AC) Solar PV Power Plant and 10 MW / 40 MWh Battery Energy Storage System (BESS) located at Jungle Sundari Karmanagari – II, Raghunathpur Block - II, Mouza – Raibandh-42, in Purulia District, West Bengal”

Dear Sir / Madam,

We have verified the Annual Accounts and other relevant records of M/s.....
(Name of the bidder) and certify the following.

Further, we certify that the Financially Evaluated Entity (ies) had an Annual Turnover

A. ANNUAL TURNOVER OF LAST 3 YEARS:

FY	Amount (Currency)
Year 1:	
Year 2:	
Year 3:	

And

Net worth (strike out whichever is not applicable) of INR Crore computed as per instructions provided in this tender based on unconsolidated audited annual accounts as per last FY.

B. FINANCIAL DATA FOR LAST AUDITED FINANCIAL YEAR:

Description	Year
	Amount (Currency)
1. Current Assets	
2. Current Liabilities	
3. Working Capital (Current Assets- Current liabilities)	
4. Net Worth (As mentioned under Annexure to BDS)	

Yours faithfully

(Signature and stamp (on each page) of Authorized Signatory of Bidding Company.

Name:

Date:

Place:

Signature and stamp (on each page) of Chartered Accountant/Statutory Auditors of Bidding Company.

Name: Date:

..... Place:

.....

Notes:

Audited consolidated annual accounts of the Bidder may also be used for the purpose of financial criteria provided the Bidder has at least 50% equity in each company whose accounts are merged in the audited consolidated accounts and provided further that the financial capability of such companies (of which accounts are being merged in the consolidated accounts) shall not be considered again for the purpose of evaluation of the Bid.

Form – VI

STATEMENT OF SIMILAR TYPE OF ORDERS EXECUTED DURING LAST FIVE YEARS

Sl. No.	Name of the Installed Plants/ Project	Financial year	Order No. and date	Name of Owner/ order issuing authority	Plant Capacity (MW)	Ordered value (Rs.)	Completion Time	Completion Certificate	Performance Report	Grid Synchronization Certificate & Generation Data

Remarks, if any :

.....
SIGNATURE OF THE TENDERER WITH OFFICE SEAL

Proforma: 1

APPLICATION FOR TENDER

(To be submitted on official letter head by the bidder)

Ref. No.....

Dated:

To

The Chief Engineer,

Solar Power Generation Department (SPGD)

3rd Floor, Data Centre Complex, Street No. 41, Action Area-I, New Town,
Kolkata – 700163

NIT No: - SPGD/WBSEDCL/.....

Dear Sir,

Having examined the Statutory, Non-statutory of NIT and Tender documents, I/we hereby like to state that I/we willfully accept all your conditions and offer to take up the work as per Tender Document. No. stated above. I/We also agree to guarantee to replace or repair any defect, whenever it is detected, in the equipment/materials to the satisfaction of the owner in conformity with the conditions of contract, specifications, drawings, bill of quantities and addenda.

Dated this _____ day of _____ 20____

Full name of applicant: _____

Signature: _____

In the capacity of: _____

Duly authorized to sign bids

For & on behalf of (Name of Firm): _____

(In block capitals or typed)

Office address:

Telephone no(s) (office): _____

Mobile No: _____

Fax No: _____

E mail ID: _____

.....
SIGNATURE OF THE TENDERER WITH OFFICE SEAL

Proforma: 2

JOINT VENTURE OR CONSORTIUM AGREEMENT

[Please mention as applicable]

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

THIS AGREEMENT executed on this..... day of..... Two Thousand
BETWEEN a company incorporated
under the laws of INDIA and having its Registered Office at
..... (hereinafter called the "Party No.1" which expression shall include its
successors, executors and permitted assigns) and M/s.....a company incorporated
under the laws of and having its Registered Office at
..... (hereinafter called the "Party No.2" which expression shall include its
successors, executors and permitted assigns) and M/s a Company
incorporated under the laws of and having its Registered Office at
..... (hereinafter called the "Party No.3" which expression shall include its successors,
executors and permitted assigns) for the purpose of making a bid and entering into a
contract [hereinafter called the "Contract" {in case of award}] against the Specification
No..... for (*insert name of the package along with project name*)
.....of West Bengal State Electricity Distribution Company Limited, a Company
incorporated under the Companies Act of 1956 having its Registered Office at Vidyut
Bhavan, Block-DJ, Sector – II, Bidhannagar, Kolkata – 700 091 (hereinafter called the
"Employer").

WHEREAS the Party No.1 and Party No.2 have entered into an Agreement dated.....

AND WHEREAS the Employer invited bids as per the above mentioned Specification for the
design, manufacture, supply, erection, testing and commissioning of Equipment/ Materials
stipulated in the Bidding Documents under (*insert name of the package along with project
name*)

AND WHEREAS Clause 4.2 & 4.3 of NlET (documents establishing the eligibility of Bidder)
forming part of the Bidding Documents, inter-alia stipulates that an Undertaking of two or
more qualified manufacturers as partners, meeting the requirements of Qualification
Criteria in Clause 4.2 & 4.3 of NlET, as applicable may bid, provided, the Joint Venture/
Consortium fulfils all other requirements of NIT and Qualification Criteria in Clause 4.2 &
4.3 of NlET and in such a case, the Bid Forms shall be signed by all the parties so as to
legally bind them and severally liable to perform the Contract and all obligations hereunder.

The above clause further states that the Contract performance guarantee will be as per the
format enclosed with the Bidding Documents without any restrictions or liability for either
party.

AND WHEREAS the bid is being submitted to the Employer vide proposal

No.....dated by Party/Parties in accordance with the requirements of
Clause 4.2 & 4.3 of NlET (documents establishing the Qualification of Bidder) has been
signed by all the parties.

NOW THIS UNDERTAKING WITNESSETH AS UNDER:

In consideration of the above premises and agreements all the parties do hereby declare and
undertake:

1. In requirement of the award of the Contract by the Employer to the Joint
Venture/Consortium, the Parties do hereby undertake that M/s..... the Party
No.1, shall act as Lead Partner and further declare and confirm that we the parties

to the Joint Venture/Consortium shall jointly and severally be bound unto the Employer for the successful performance of the Contract and shall be fully responsible for the design, manufacture, supply and successful performance of the plant in accordance with the Contract.

2. In case of any breach or default of the said Contract by any of the party or parties to the Joint Venture/ Consortium, the party(s) does hereby undertake to be fully responsible for the successful performance of the Contract and to carry out all the obligations and responsibilities under the Contract in accordance with the requirements of the Contract.
3. Further, if the Employer suffers any loss or damage on account of any breach in the Contract or any shortfall in the performance of the equipment in meeting the performances guaranteed as per the specification in terms of the Contract, the Party(s) of THESE PRESENTS undertake to promptly make good such loss or damages caused to the Employer, on its demand without any demur. It shall not be necessary or obligatory for the Employer to proceed against Lead Partner to THESE PRESENTS before proceeding against or dealing with the other Party(s), the Employer can proceed against any of the parties who shall be jointly and severally liable for the performance and all other liabilities/obligations under the Contract to the Employer.
4. The financial liability of the Parties of this Deed of Undertaking to the Employer, with respect to any of the claims arising out of the performance or non-performance of the obligations set forth in this agreement, read in conjunction with the relevant conditions of the Contract shall, however not be limited in any way so as to restrict or limit the liabilities or obligations of any of the Parties of this agreement.
5. It is expressly understood and agreed between the Parties to this agreement that the responsibilities and obligations of each of the Parties shall be as delineated in GCC to this agreement. It is further undertaken by the parties that the above sharing of responsibilities and obligations shall not in any way be a limitation of joint and several responsibilities of the Parties under the Contract.
6. This agreement shall be construed and interpreted in accordance with the provisions of the Contract.
7. In case of an award of a Contract, the parties to this agreement do hereby agree that it shall be jointly and severally responsible for furnishing a Contract performance security in the form of Bank Guarantee from a nationalized bank in favour of the Employer in Indian currency.
8. It is further agreed that this Bank Guarantee shall be irrevocable and shall form an integral part of the bid and shall continue to be enforceable till the Employer discharges the same or upon the completion of the Contract in accordance with its provisions, whichever is earlier. It shall be effective from the date first mentioned above for all purposes and intents.

IN WITNESS WHEREOF, the Parties to this Deed of Undertaking have through their authorized representatives executed these presents and affixed Common Seals of their companies, on the day, month and year first mentioned above.

Common Seal of

has been affixed in my/ our
presence pursuant to Board of

Director's Resolution dated

Name

Designation Signature

.....

WITNESS :

I.

II.

For Lead Company/Lead Partner
(Party No.-1)

For and on behalf of M/s

.....

(Signature of the authorized
representative)

Common Seal of has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated Name

Designation Signature WITNESS :

For Party No.-2

For and on behalf of M/s.....

(Signature of the authorized representative)

I.

II.

Common Seal of

has been affixed in my/ our
presence pursuant to Board of
Director's Resolution dated

For Party No.-3

For and on behalf of M/s.

.....

..... Name

.....

Designation

(Signature of the authorized
representative)

Signature

WITNESS :

I.

II.

Note:

1. For the purpose of executing this agreement, the non-judicial stamp papers of Rs.100/- shall be purchased on behalf of Joint Venture/Consortium.
2. The Undertaking shall be signed on all the pages by the authorized representatives of each of the parties.
3. The nomenclature of this agreement be treated as standardized format for parties being companies incorporated under Companies Act. 1956/2013.

But other entities like partnership firm/ LLP may also eligible for participation in the bid as part of joint venture/ Consortium under relevant laws of India.

Proforma: 3

SPECIMEN COPY

**Power Of Attorney For Lead Member Of JV/Consortium
[Please mention as applicable]**

(To be executed on Non-Judicial Stamp Paper)

KNOW ALL MEN BY THESE PRESENTS THAT WE, the Parties whose details are given hereunder have formed a Joint

Venture/Consortium under the laws of INDIA and having our Registered Office(s)/Head Office(s) at..... (hereinafter called the 'Joint Venture' which expression shall unless repugnant to the context or meaning thereof, include its successors, administrators and assigns) acting through M/s

.....being the Lead Company or Lead Partner do hereby constitute, nominate and appoint M/s..... a Company incorporated under the laws of and having its

Registered/Head Office at as our duly constituted lawful Attorney (hereinafter called "Attorney" or "Authorized Representative" or "Partner In-charge") duly represented by Shri/Ms to exercise all or any of the powers for and on behalf of the Joint Venture/consortium in regard to Specification No..... Package the bids for which have been invited by West Bengal State Electricity Distribution Company Limited, having its Registered Office at Vidyut Bhavan, Block-DJ, Sector – II, Bidhannagar, Kolkata – 700 091 (hereinafter called the 'Employer') to undertake the following acts :

- i) To submit proposal and participate in the aforesaid Bid Specification of the Employer on behalf of the "Joint Venture/Consortium".
- ii) To negotiate with the Employer the terms and conditions for award of the Contract pursuant to the aforesaid Bid and to sign the Contract with the Employer for and on behalf of the "Joint Venture/Consortium".
- iii) To do any other act or submit any document related to the above.
- iv) To receive, accept and execute the Contract for and on behalf of the "Joint Venture/Consortium".

It is clearly understood that the Lead Company/Lead Partner shall ensure performance of the Contract(s) and if one or more Partner fail to perform their respective portions of the Contract(s), the same shall be deemed to be a default by all the Parties.

It is expressly understood that this Power of Attorney shall remain valid binding and irrevocable till completion of the Defect Liability Period in terms of the Contract.

The Joint Venture/Consortium hereby agrees and undertakes to ratify and confirm all the whatsoever the said Attorney/Authorized Representatives/Partner in-

charge quotes in the bid, negotiates and signs the Contract with the Employer and/or proposes to act on behalf of the Joint Venture/Consortium by virtue of this Power of Attorney and the same shall bind the Joint Venture/Consortium as if done by itself.

IN WITNESS THEREOF the Partners Constituting the Joint Venture as aforesaid have executed these presents on this..... day of under the Common Seal(s) of their Companies.

for and on behalf of the Parties of Joint Venture/Consortium

.....
.....
.....

The Common Seal of the above Partners of the Joint
Venture: The Common Seal has been affixed there unto in the
presence of: WITNESS

1.

Signature.....

Name

Designation

Occupation
2.

Signature.....

Name

Designation

Occupation

- Note:**
1.

For the purpose of executing the Agreement, the non-judicial stamp papers of appropriate value shall be purchased on behalf of Joint Venture/Consortium.
2.

The Agreement shall be signed on all the pages by the authorized representatives of each of the parties.

Proforma-4

No Deviation Confirmation

(To be submitted on the Letter Head of the Bidding Company)

Ref.No._____ Date: _

From: *(Insert name and address of Bidding Company)*

Tel.#:

Fax#:

E-mail

address# To,

The Chief Engineer,

Solar Power Generation Department (SPGD)

3rd Floor, Data Centre Complex, Street No. 41, Action Area-I, New

Town, Kolkata –700 163

Sub: Bid for the Tender for Design, Engineering, Procurement, Supply, Installation, Construction, Testing and Commissioning including warrantee obligation, Operation and Maintenance for twelve (12) years of a 50 MW (AC) Solar PV Power Plant and 10 MW / 40 MWh Battery Energy Storage System (BESS) located at Jungle Sundari Karmanagari – II, Raghunathpur Block - II, Mouza – Raibandh-42, in Purulia District, West Bengal”.

Dear Sir / Madam,

We understand that any 'deviation/ exception' in any form may result in rejection of bid. We, therefore, certify that we have not taken any 'exception/ deviation' anywhere in the bid and we agree that if any 'deviation/ exception' is mentioned or noticed, our bid may be rejected.

Place: [Signature of Authorized Signatory of

Bidder] Date: Name:

Designation:

Seal:

Proforma – 5

Declaration Sheet – For Net Minimum Guaranteed Generation

(To be submitted on official letter head by the bidder)

We

.....
..... declare that the 50 MW (AC) Solar PV Plant at
.....District, West Bengal offered by us within the scope of this
tender, will generate minimum 78.00_MU/year measured in the Net Meter
installed at the outgoing feeder of the 33 kV Switchyard of the Power Plant.
The Net Minimum Guaranteed Generation shall be calculated after considering
the Auxiliary Consumption for the plant.

The Net Minimum Guaranteed Generation shall be reduced @ 0.8% per year.

In case we fail to produce the Net Minimum Guaranteed Generation as stated
above, the provisions of penalty according to Clause No. 29 of the General
Conditions of Contract of this tender shall be applicable.

I hereby certify that I am duly authorized representative of the Bidder whose name
appears above my signature.

Bidder's Name:

Authorised Representative's Signature.....

Proforma: 6

Bank Guarantee For Earnest Money Deposit/Bid Security

(The non-Judicial stamp paper of Rs 100/- should be in the name of issuing bank)

Ref.....

Bank Guarantee No.....

Date.....
.....

To

The Chief Engineer,
Solar Power Generation Department (SPGD)
3rd Floor, Data Centre Complex, Street No. 41, Action Area-I, New
Town, Kolkata – 700163
West Bengal

Dear Sirs,

In accordance with Invitation to bid under your Bid
No..... M/s.....
..... having its

Registered/Head
Office at..... (Hereinafter called the
'Bidder') wish to participate in the said Bid
of.....and you, as a special
favour have
agreed to accept an irrevocable and unconditional Bank Guarantee for an
amount of..... (.....in
words.....) Valid
upto.....on behalf of Bidder in lieu of the Bid
deposit required to be made by the bidder, as a Condition precedent for
participation in the said Bid.

We, the.....Bank

.....(Name)
at.....(Address) having our
Head Office at
.....Guarante

e
and undertake to pay immediately on demand by West Bengal State Electricity
Distribution Company Ltd., the Amount
of..... In
words.....) Without any reservation, protest, demur and
recourse. Any such demand made by said 'Owner' shall be conclusive and
binding on us irrespective of any dispute or difference raised by the Bidder.

This Guarantee shall be irrevocable and shall remain valid upto 06(six) calendar
months with a claim period of 3(three) months from the date of opening of
Technical Bid.

If any further extension of this guarantee is required, the same shall be
extended to such required period (not exceeding one year) on receiving

instruction from M/son whose behalf this guarantee is issued.

In witness where of the Bank, through its authorized office, has set its hand and stamp on this.....day of.....20.....at.....

WITNESS

.....
(Signature)

.....
(Signature)

.....
(Name)

.....
(Name)

.....
(Official Address)

.....
(Official Address)

Proforma: 7

Evidence of Access To Or Availability Of Credit/ Facilities (To be given by banker of bidder)

BANK CERTIFICATE

This is to certify that M/s
..... (FULL NAME
AND ADDRESS) who are submitting their Bid to
.....against their tender specification vide
Ref. No..... and
date..... is our customer for the past
.....years.

Their financial transactions with our bank have been satisfactory. They enjoy the following fund based and non fund based limits including guarantees, L/C and other credit facilities with us against which the extent of utilization as on date is also indicated below:

Sl. No.	TYPE OF FACILITY	SANCTIONED LIMIT AS ON DATE	UTILIZATION AS ON DATE.....

This letter is issued at the request of M/s.....

Sd/-

Name of Bank

..... Name of authorized

Signatory

.....

..... Designation

.....

.....

Phone No

Address

SEAL OF THE BANK

Proforma: 8

Satisfactory Operation of Solar PV Plant / BESS Plant (On Plant Owner's Letter Head)

Date: __/__/____

TO WHOMSOEVER IT MAY CONCERN

This is to certify that the (plant detail and location) was commissioned on (Date of commissioning) by (Bidder Details) against the LOI/ WO No. (Details of LOI/ WO with complete scope).

The project is under operation since the date of commissioning and has been working satisfactorily as per the estimated output.

The cumulative generation (Net) of the Solar plant recorded for the previous year is (Number of units generated) and the Performance Ratio is__.

Regards,

Signature & SEAL of Authorized Person

Proforma: 9

Bill of Materials (BOM)

(To be completed & submitted with the Bid)

Name of the Work: Design, Engineering, Procurement, Supply, Installation, Construction, Testing and Commissioning including warrantee obligation, Operation and Maintenance for twelve (12) years of a 50 MW (AC) Solar PV Power Plant and 10 MW / 40 MWh Battery Energy Storage System (BESS) located at Jungle Sundari Karmanagari – II, Raghunathpur Block - II, Mouza – Raibandh-42, in Purulia District, West Bengal

Sl. No.	Items	Unit	Quantity	Description / Specification proposed
1	Survey & Land Development	L.S	1	
2	Solar Modules Minimum 600 Wp Mono-Crystalline	MWp	60	
3	Copper Solar Cable (6 sq. mm.) of applicable voltage grade to lay Strings upto Combiner Boxes suitable for Ground Mounted solar plant	LOT	1	
4	SCADA compatible String Combiner/Monitoring Box as per design.	LOT	1	
5	Armoured Cable in cable trench/Tray from Combiner Boxes to Inverters, calculated for a maximum voltage drop of 1.50 % in DC from photovoltaic modules to solar inverter suitable for Ground Mounted solar plant	LOT	1	
6	Earthing system of the photovoltaic field with bare Cu conductor and earthing rods	LOT	1	
7	Solar Inverters with Data Logger (SCADA Cloud based configuration)	LOT	1	
8	XLPE Cable of required voltage grade to be used from Solar Inverter to Three Winding Transformer	LOT	1	
9	Multi Winding Inver Duty Transformers with necessary protections	LOT	1	

10	33 kV XLPE Cable to be used from Three Winding Transformer to 33 kV Switchyard	LOT	1	
Sl. No.	Items	Unit	Quantity	Description / Specification proposed
11	Indoor C&R Panel	LOT	1	
12	Foundation for MMS	LOT	1	
13	Control Room (Consisting of ACDB, annunciation, protection, metering, synchronization, DC Battery Bank with float & boost charger, DCDB, computer, Office Room, Conference Room, 2000 L water tank, security cabin, utility area etc.)	LOT	1	
14	33 kV Switchyard (Consisting of 33 kV Bus, VCB, Isolator, LA, CT, PT, Station Auxiliary Transformer etc.)	LOT	1	
15	Earthing for Switchyard & Control Rooms (CR)	LOT	1	
16	Control Monitoring and Data Acquisition System (SCADA)	LOT	1	
17	Uninterrupted Power Supply (UPS) System of required capacity for MCR & each LCR	LOT	1	
18	Smoke detector for CR	LOT	1	
19	Foam type fire extinguisher for CR	LOT	1	
20	CO ₂ type fire extinguisher for CR	LOT	1	
21	33 kV VCB, outdoor type	LOT	1	
22	33 kV Isolator without E/S	LOT	1	
23	33 kV Isolator with E/S	LOT	1	
24	30 kV Lightning Arrestor	LOT	1	
25	Auxiliary Transformer (33/0.433KV)	No.	1	
Sl. No.	Items	Unit	Quantity	Description / Specification proposed
26	LTDB	LOT	1	
27	DC Battery, Battery Charger and DCDB	LOT	1	

28	Weather Station (anemometer, temperature & radiation sensors with data logger)	LOT	1	
29	Ventilation System	LOT	1	
30	Air Conditioning System	LOT	1	
31	Peripheral/Yard lighting System	LOT	1	
32	Module Mounting Structure	LOT	1	
33	Module Cleaning Arrangement	LOT	1	
34	Cable Tray & Trench	LOT	1	
35	Internal Road & pathways	LOT	1	
36	Drainage System	LOT	1	
37	Communication System	LOT	1	
38	Surveillance System	LOT	1	
39	Watch Tower	LOT	1	
40	Fencing across the perimeter	LOT	1	
41	Signage	LOT	1	
42	Tool Kit & Measuring Instruments (provide detailed list)	LOT	1	
43	Spares as required for maintenance works	LOT	1	
44	BESS Containers incl. Racks, Batteries, BMS, EMS	LOT	1	
45	Power Conversion System (PCS)	LOT	1	
46	Inverter Duty Transformers (ITD)	LOT	1	
47	33 KV XLPE Cables	LOT	1	
48	33 KV Switchgears	LOT	1	
49	XLPE Cable of required voltage grade to be used from PCS to IDT	LOT	1	
50	Auxiliary Transformers (33/0.433KV)	Nos.	1	

N.B.: Any other item required for commissioning of the plant shall be incorporated.

Proforma: 10**BANK GUARANTEE FOR CONTRACT PERFORMANCE**

(To be executed in non-judicial stamp paper of Rs. 100/-)

Ref......**Bank Guarantee No.**..... **Date...**

To
 The Chief Engineer,
 Solar Power Generation Department (SPGD)
 3rd Floor, Data Centre Complex, Street No. 41, Action Area-I, New Town,
 Kolkata – 700163

West Bengal

Dear Sirs,

In consideration of West Bengal State Electricity Distribution Company Ltd.,
 (herein after referred to as the "Owner" which expression shall unless repugnant to
 the context or meaning thereof include its successors, administrators and assigns)
 having awarded to M/s.....with
 registered/Head office
 at.....(Hereinafter referred
 to

as "Contractor" which expression shall unless repugnant to the context or
 meaning thereof include its successors, administrators, executors and assigns),
 a Contract issued by Owner's
 Letter of Award
 No.....dated
 for...

.....(scope of work)
 and

the same having been acknowledged by the Contractor, resulting in a
 Contract bearing No.....dated

Contractor having agreed to provide a Contract Performance Guarantee for the
 faithful performance of the entire Contract including net minimum guaranteed
 generation equivalent to Rs..... (.....in
 words.....) being (10%) (Ten percent) of the total contract value
 (aggregating Proforma A, B, C, D, E and F).

We.....

..... (Name & Address) having its
 Head Office at.....(hereinafter
 referred to as the "Bank", which expression shall, unless repugnant to the
 context or meaning thereof, include its successors, administrators, executors
 and assigns) do hereby guarantee and undertake to pay the Owner, on demand
 any or all monies payable by the
 Contractor to the extent of
 Rs.....(.....in words.....)
 as aforesaid at any time up to.....* (day/month/year)
 without any demur, reservation, contest, recourse or protest and/or without any
 reference to this Contractor.

Any such demand made by the Owner on the bank shall be conclusive and binding notwithstanding any difference between the Owner and the Contractor or any dispute pending before any Court, Tribunal, Arbitrator or any other authority. The Bank undertakes not to revoke this guarantee during its currency without previous consent of the Owner and further agrees that the guarantee herein contained shall continue to be enforceable till the Owner discharges this guarantee.

The Owner shall have the fullest liberty without affecting in any way the liability of the Bank under the guarantee from time to time to extend the time for performance or the Contract by the Contractor. The Owner shall have the fullest liberty, without affecting this guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor and to exercise the same at any time in any manner and either to enforce or to for bear to enforce any covenants, contained or implied in the Contract between the Owner and the Contractor or any other course or remedy or security available to the Owner. The Bank shall not be relieved of its obligations under these presents by any exercise by the Owner of its liberty with reference to the matters aforesaid or any of them or by reason of any other act of omission or commission on the part of the Owner or any other indulgences shown by the Owner or by any other matter or thing whatsoever which under law would, but for this provision have the effect of relieving the Bank.

The bank also agrees that the Owner at its option shall be entitled to enforce this guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and not withstanding any security or other guarantee the Owner may have in relation to the Contractor's liabilities.

Notwithstanding anything contained herein above our liability under this guarantee is restricted to Rs.....
(.....in words.....) and it shall remain in force upto and including**(day/month/year) and shall be extended from time to time for such period as may be desired M/s.....on whose behalf

this guarantee has been given.

Unless a demand or claim is lodged on us within and including.....*(day/month/year) we shall be discharged from all liabilities thereafter.

Dated this.....day
of.....20.....at..... WITNESS

.....	
(Signature)	(Signature)
.....	
(Name)	(Name)
(Official Address)	(Official Address)

Attorney as per Power

Of Attorney No.....

Date.....

*** Till 3 (three) months after the validity of the Bank Guarantee.**

**** Upto 3 (three) months after the expiry of warranty/guarantee period.**

Notes:

1. The stamp paper of appropriate value shall be purchased in the name of issuing bank.
2. The sum shall be 10% (ten percent) of the total contract value (aggregating Proforma A, B, C, D, E and F).

The performance Bank Guarantee/ Contract Performance Bank Guarantee shall be valid as per terms of contract. A period of three (3) months should be added as claimed period from the last date of validity of the Bank Guarantee.

Proforma: 11
CONTRACT AGREEMENT

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

Articles of agreement made on this..... day of in the year between West Bengal State Electricity Distribution Company Limited (A Government of West Bengal Enterprise) having its head office at Vidyut Bhavan, Block-DJ, Sector-II, Kolkata-700091 hereinafter referred as 'WBSEDCL' (which expression shall unless excluded by or repugnant to the context be deemed to include its successors and assigns) of the ONE PART,

AND

.....Herein after referred to as the 'CONTRACTOR' (Which expression shall unless excluded by or repugnant to the context be deemed to include his heirs, executors, administrators, representatives and assigns) of the OTHER PART.

WHEREAS the WBSEDCL invited tenders vide Tender Notice Nodated..... (Annexed hereto) for "(Project name)"

AND WHEREAS in pursuance of such invitation for tenders, the contractor submitted a tender vide nodated..... (Annexed hereto).The Techno-commercial part of which was opened on.....And the Price bid was opened on.....(The tender offer is in custody of the Company at present).

AND WHEREAS AFTER consideration of the tender submitted by the contractor with clarification(s), if any, the WBSEDCL accepted the said tender submitted by the contractor and placed Letter of Award no dated (Annexed here to).

NOW, THEREFORE, the WBSEDCL and the contractor agree as follows:

1. The Contractor agrees to undertake the work of "....." as per Letter of Award nodated referred to above.
2. The WBSEDCL agrees to pay the Contractor as per order no dated referred to above.
3. Both the Contractor and the Company agree that for the purpose of jurisdiction of court in regard to any dispute arising out of this agreement, this agreement shall be deemed to have been executed within the jurisdiction

of the original side of the High Court, Kolkata.

IN WITNESS WHEREOF the parties have hereunder affixed their signature on the day, month and year written as above.

SIGNED, SEALED AND DELIVERED

.....
Contractor

1).....
Witness Witness

2).....
Witness

.....
WBSEDCL

1).....

2).....
Witness

Proforma: 12**INDEMNITY BOND**

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

BY THE PRESENT INDEMNITY BOND EXECUTED by us on this.....Day of20....., We having Registered Office at

..... (herein after called "OBLIGOR/OBLIGORS" which expression shall mean and includes my/our successors legal representatives, assigns) do hereby binds ourselves and also our entity after having the power to bind so with

the promise and undertaking in favour of the West Bengal State Electricity Distribution Company Limited, a company incorporated under Companies Act 1956 having Registered Office at Vidyut Bhavan, Block-DJ, Sector-II, Salt Lake City, Kolkata-700091 (hereinafter called as OBLIGEE, which expression shall mean and include it's legal representative, administrators assigns.

WHEREAS OBLIGOR/OBLIGORS has/have been awarded the project under letter no..... dated issued by the OBLIGEE after having observing necessary formalities, the details of which is described in the schedule given here under as per letter mentioned herein-above.

AND WHEREAS according to the condition of the contract the OBLIGOR/OBLIGORS are under obligation to execute this Indemnity Bond before the commencement of actual execution and OBLIGOR/OBLIGORS is/are aware that unless this Indemnity Bond is executed in accordance with the condition of contract before the actual execution in accordance with law the OBLIGEE shall have the power to deem that actual work has been stated within the meaning of the contract before the execution of this Indemnity Bond.

Now this indenture witnesses that We the OBLIGOR/OBLIGORS do hereby undertake:

1. THAT the OBLIGEE shall not be held responsible for any type of accident which may take place during the course of work undertaken by the OBLIGOR/OBLIGORS.
2. THAT the OBLIGOR/OBLIGORS will take/adopt all safety norms in respect of each and every workmen labour personnel according to the rules and laws relating to welfare of workers to the satisfaction of the OBLIGEE IN ALL CASES.
3. That the OBLIGOR/OBLIGORS undertakes/undertake to engage only those labour worker or any other personnel whether skilled or unskilled or any other person whether in technical management or non-managerial or any other capacity in the area covered under Employee' State Insurance Act, 1948 who has/have insurance coverage within the meaning of Employees' State Insurance Act and further undertakes NOT to engage any person in the area covered under Employees State Insurance Act., who does/do not has/have insurance coverage within the meaning of Employees' State Insurance Act,1948.
4. THAT the OBLIGOR/OBLIGORS undertakes/undertake to indemnify and

keep harmless the OBLIGEE from all claims, action, proceedings and of risk, damage, danger to any person whether belonging to/or not belonging to OBLIGOR/OBLIGORS.

5. THAT the OBLIGOR/OBLIGORS shall keep harmless the OBLIGEE from all claims, compensation, damages, any proceedings in respect of any of its employee/workmen under the Employee Compensation Act or any other laws for the time being in force.
6. THAT in case of Joint Venture OBLIGOR/ OBLIGORS shall undertake to Indemnify OBLIGEE from all losses or damages that OBLIGEE may sustain due to dispute/disputes that may arise between the Constituents of the JV.
7. THAT the OBLIGOR/OBLIGORS is/are aware and accept that for the persistent or repeated violation of any condition mentioned in this Indemnity Bond, the OBLIGEE shall have right to terminate the contract of work issued by the OBLIGEE to OBLIGOR/OBLIGORS as per relevant provisions of the Tender Document.

SIGNED AND DELIVERED

BY THE OBLIGOR/OBLIGORS

Signature

.....

..... WITNESS:

1) Name & Designation

Signature

2) Name & Designation

Signature

Proforma: 13
EXTENSION OF BANK GUARANTEE

Ref...... **Date**.....

To
 The Chief Engineer,
 Solar Power Generation Department (SPGD)
 3rd Floor, Data Centre Complex, Street No. 41, Action Area-I, New Town,
 Kolkata – 700163

West Bengal

Sub: Extension of Bank Guarantee No for
 Rs..... favoring yourselves, expiring on.....on
 account of M/s.....in respect
 of
 Contract No.....dated..... (Hereinafter
 called original Bank Guarantee).

Dear Sirs,

At the request of M/s.....,
 we.....Bank, branch office at..... and
 having its Head Office at.....do hereby extend
 our liability under the above mentioned Bank Guarantee
 No..... dated..... for a further period of
(Years/Months)
 from.....to expire on..... Expect as provided
 above, all other terms and conditions of the original bank guarantee
 No.....dated..... shall remain unaltered and binding.

Please treat this as an integral part of the original bank guarantee to which it
 would be attached.

Yours Faithfully,

For.....

Manager/Agent/Accountant.....

Power of Attorney No.....

Dated.....

SEAL OF BANK

NOTE: The non-judicial stamp paper of appropriate value shall be purchased
 in the name of the bank who has issued the Bank Guarantee.

Proforma: 14
FORMAT FOR PRE-BID QUERIES

To
The Chief Engineer,
Solar Power Generation Department (SPGD)
3rd Floor, Data Centre Complex, Street No. 41, Action Area-I, New Town,
Kolkata – 700163

Sub: Pre-Bid queries

Ref. Tender No. : -----

Dear Sir,

Having examined the General and Special Conditions of Contract and the Terms of Reference including all attachments thereto, the receipt of which is hereby duly acknowledged, we have some queries and the same are submitted as per the format provided in the tender documents.

Sl. No.	Clause No.	Existing provision	Clarification Required	Suggested text for the amendment	Rationale for the Clarification or amendment

Authorised Signatory
(Seal and Designation)

Proforma: 15
ANNUAL GENERATION BANK SECURITY

(To be executed on non-judicial stamp paper of Rs. 100/-)

Beneficiary: *[Insert name and Address of Purchaser]*

Date: *[Insert date of issue]*

PERFORMANCE GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that *[Insert name and address of Contractor, which in the case of a joint venture shall be the name and address of the joint venture]* (hereinafter called "the Contractor") has entered into Contract No. *[Insert contract reference number]* dated *[Insert contract date]* with the Beneficiary for the execution of *[Insert brief description of the Works]* (hereinafter called "the Contract").

We further understand that, pursuant to the provisions of the Contract, the Contractor is required to furnish an Annual Generation Bank Security to secure its obligation to achieve the minimum guaranteed annual net energy generation for the relevant Contract Year(s), as specified in the Contract.

Waiving all objections and defences, we, as Guarantor, hereby irrevocably and independently undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of *[Insert guarantee amount and currency in words and figures]* upon receipt by us of the Beneficiary's first written demand, supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Contractor has failed to achieve the minimum guaranteed annual net energy generation in accordance with the provisions of the Contract, without the Beneficiary needing to prove or to show grounds for the demand or the sum specified therein.

Payment under this guarantee shall be effected to and for the account of:

Account Name: WBSEDCL

Bank Name: State Bank of India Bank

Branch: Bikash Bhaban G.O.C. Account

Number: 36548991592 IFSC Code:

SBIN0007816

This guarantee shall expire not later than *[Insert expiry date]*, unless extended in accordance with the Contract. Any claim for payment under this guarantee must be received by us in writing or by authenticated electronic communication on or before the expiry date.

It is understood that the Beneficiary shall return this guarantee to us upon its expiry or upon payment of the total amount claimed hereunder, whichever occurs earlier.

Place, Date

Guarantor's authorized signature(s)

Proforma: 16
BESS PERFORMANCE SECURITY

(To be executed on non-judicial stamp paper of Rs. 100/-)

Beneficiary: *[Insert name and Address of Purchaser]*

Date: *[Insert date of issue]*

PERFORMANCE GUARANTEE No.: *[Insert guarantee reference number]*

Guarantor: *[Insert name and address of place of issue, unless indicated in the letterhead]*

We have been informed that *[Insert name and address of Contractor, which in the case of a joint venture shall be the name and address of the joint venture]* (hereinafter called "the Contractor") has entered into Contract No. *[Insert contract reference number]* dated *[Insert contract date]* with the Beneficiary for the execution of *[Insert brief description of the Works]* (hereinafter called "the Contract").

We further understand that, pursuant to the provisions of the Contract, the Contractor is required to furnish a BESS Performance Security to secure its obligations relating to the performance of the Battery Energy Storage System as specified in the Contract.

Waiving all objections and defences, we, as Guarantor, hereby irrevocably and independently undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of *[Insert guarantee amount and currency in words and figures]* upon receipt by us of the Beneficiary's first written demand, supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Contractor has failed to comply with the BESS performance requirements under the Contract, without the Beneficiary needing to prove or to show grounds for the demand or the sum specified therein.

Payment under this guarantee shall be effected to and for the account of: Account Name: WBSEDCL

Bank Name: State Bank of

India Bank Branch: Bikash

Bhaban G.O.C. Account

Number: 36548991592 IFSC

Code: SBIN0007816

This guarantee shall expire not later than *[Insert expiry date]*, unless extended or partially released in accordance with the provisions of the Contract. Any claim for payment under this guarantee must be received by us in writing or by authenticated electronic communication on or before the expiry date.

It is understood that the Beneficiary shall return this guarantee to us upon its expiry or upon payment of the total amount claimed hereunder, whichever occurs earlier.

Place, Date

Guarantor's authorized signature(s)

List of Spares

(Annexure-I)

Item	UOM	Quantity
Solar PV Array		
PV Module of Installed Module Rating	Nos.	100
MC4/MC6 Connector	Nos.	500
ESE type LA	Nos.	2
String Monitoring Box		
String Combiner Box	No	5
Power-SPD	No	10
Communication- SPD	No	10
Solar Inverter		
DP MCB	No.	10
DC Input fuse link with holder	No.	10
Control fuse link with holder	No.	10
Cooling Fan	No.	2
DC Surge Arrestor Suppressor Device	No.	10
AC Surge Arrestor Suppressor Device	No.	10
Control & IGBT stack	No	2
Inverter Duty Transformer		
HV Bushing	No	1
LV Bushing	No	1
Winding Temperature Indicator (WTI)	No	1
Oil Temperature Indicator (OTI)	No	1
Gas Operated Relay (GOR)	No	1
Pressure Relief Device (PRV)	No	1
Magnetic Oil gauge (MOG)	No	1
Transformer Oil	Barrel	10
Buchholz Relay	No	1
C&R Panel	UOM	Quantity
Digital MFM	Nos.	2
MCB 16A DP	Nos.	4
MCB 6A DP	Nos.	6
LED Indicating Lamps, 110V DC (6 colours)	Nos.	12
Breaker Position Switch	Nos.	4
Local remote switch	Nos.	4
18-window Annunciator (4 colours)	Nos.	2
LED Indicating Lamps, 30 V DC (4 colours)	Nos.	8
VCB		
Motor Assembly	No	1
Shunt Opening Coil	No	4
Closing Coil	No	4
Auxiliary Switch	No	2
CB Closing Spring	No	1
Vacuum Interrupter	Nos	2

Auxiliary Transformer		
Bushing & support Insulator (each type)	Set	1
Other Switchyard Items		
33kV OD CT	Nos	1 for each rating (both Metering & Protection)
33kV OD PT	Nos	1 (both Metering & Protection)
42 kV LA	Nos	2
Battery & Battery charger		
Indicating lamp	Set	1
Indicating Instruments	Set	1
Auto/Manual Selector switch	No	2
Shunt Resistor	Set	1
Semi Conducting type fuse	No	1
Auxiliary Fuse	No	1
Fuse	No	1
Indicating Instruments	No	1
ACDB		
LED Indicating lamps(Red, Yellow, Blue)	No	3
MCB 6A DP	No	6
MCB 16A TPN	No	2
Indicating Instruments(MFM, Voltmeter, Ammeter)	No	3
CT	No	6
UPS		
Input fuse	No	3
Battery Fuse	No	2
Control Fuse	No	3
DC Capacitor	No	1
Fan	No	1
Street light Luminaries	No	20
High Mast Flood Light	No	10
Cables & Conductors		
DC cable 1C*300/400sq. mm.	Mtr.	1000
AC cable 1C*300/400 sq. mm.	Mtr.	500
33KV 1C*300 sq. mm.	Mtr.	500
RS-485 Communication Cable	Mtr.	500
OFC Cable	Mtr	1000
ACSR Conductor for Bus	Mtr	200

Tools			
1	Digital Multimeter, 1500V DC	2	Nos
2	Digital Clamp Meter, 1500V, 400A AC/DC	2	Nos
3	Hand Operated Megger 5 kV	1	Nos
4	Phase Sequence Meter	1	Nos
5	Earth Resistance Tester	1	Nos
6	Nose Plier	4	Nos
7	Monkey Plier	2	Nos
8	Wire Striper	4	Nos
9	Screw Driver Set	1	No
10	Insulation Tape	10	Roll
11	Double ended spanner set as sizes, 10-11, 12-13, 14-15, 16-17, 17-18	2	No
12	Crimping Tool with dye range 4-400 sqmm cable, Mechanical gear power hand operated	1	Nos
13	Measuring Tape, 5 m & 50 m	2	Nos
14	Allen key set	1	Nos
15	Adjustable spanner 2-inch size	1	Nos
16	Hammer	2	Nos
17	Rough File Kit	5	Set
18	Cutting Plier	2	Set
19	Vacuum Cleaner of Industrial type	1	No
20	Blower for Panel Cleaning	2	Set
21	Laser Beam Thermometer	1	Set
22	Drilling Machine	1	Set
23	Grass Cutting Machine	2	Set
24	Safety PPE	1	Set
25	First Aid Box	2	Set
26	Ladder	1	No



West Bengal State Electricity Distribution Company Limited

(A Govt. of West Bengal Enterprise)

Registered Office: Vidyut Bhavan, Bidhannagar, Block-DJ, Sector-II, Kolkata-700 091

WBSEDCL CIN: U40109WB2007SGC113473, website: www.wbsedcl.in

Office Order No: 2571

Dated: 07.05.2026

Subject: Standardized Format of Factory Capability Assessment Report

It has been observed that the capability of factories of new/promotional bidders has long been assessed by the P&C Department, and reports are submitted in varied formats.

In order to ensure uniformity, proper documentation, and traceability across WBSEDCL, it has been decided that henceforth all concerned departments shall conduct factory capability assessments in a standardized manner.

Accordingly, capability assessment of any new factory associated with new/promotional bidders shall be carried out strictly based on the attached "*List of Documents for Capability Assessment of Factory*" to be submitted by the bidder. The assessment report shall be prepared in the prescribed format titled "*Capacity/Capability Verification of the Factory*".

All concerned departments are hereby advised to strictly comply with the above instructions without any deviation.

Digitally signed by
AVIJIT KUMAR LATUA
Date: 07-05-2026
12:37:56

(A.K.Latua)

Director (HR)

List of Documents Required for Capability Assessment of Factory

1. Factory License/registration certificate
2. Company incorporation documents (CIN, MOA, AOA, LLP, Private, Partnership, Proprietorship etc.)
3. Tax registration (GST with Constitution of Business, PAN, Professional Tax etc.)
4. MSME (UDYAM Registration Certificate)/Large Scale Industry documents
5. Factory Layout Drawing (with Plant and Machines)
6. Total Area of Factory, Covered area, uncovered area
7. Store Area and Test Area (Laboratory)(within the covered area)
8. Relevant Land documents of Factory
9. Consent to establish/operate from respective Pollution Control Board
10. Fire License
11. Manpower Details (Technical, non-technical, skilled, unskilled, Laboratory Technician, Quality Control, etc.)
12. List of Purchase Orders executed in last three financial year.
13. Manufacturing Process Flow Document & Quality Assurance Programme (QAP)
14. List of Plant and machineries available at factory for production of the offered material/equipment
15. Material(s) Lifting Mechanism available at factory
16. List of measuring and Testing Equipments/machineries available at factory mentioning make, year of manufacturing, validity of calibration etc.
17. Valid calibration certificates of each of the measuring and Testing Equipments/machineries as mentioned under Sr.No.16.
18. Source of Raw Materials with Test Reports , invoices etc.
19. Stock Statement of raw material as on date
20. Monthly production capacity for the last one financial year
21. Manufacturing Capacity Reports/Certificate
22. Drinking Water, Washroom for male/female(both) and First Aid Arrangements
23. Waste Disposal Procedures
24. Valid BIS Certificate for the offered material/equipment (if applicable)
25. Valid Trade License, ISO certificate (if applicable)
26. Source of Power supply with supporting document
27. Power back up (DG) details with supporting documents
28. Communication facility available at Factory with supporting documents
29. Declaration by the company (bidder) of not being Blacklisted/Debarred/Put on Holiday Listing (Format attached: **Format I or Format II** : To be submitted on bidder's letterhead)
30. Safety measures for workmen and officers during production and testing activities.

Name , Signature of Factory Representative with Seal

(On the Bidder's Letterhead)

Declaration of not being blacklisted/Debarred/Put on Holiday list

Certified that our Company, M/sis not blacklisted/ debarred/ suspended or put on holiday list by any Statutory/Regulatory/ Government Authorities / State Electricity Utility/ PSU in India.

It is certified that the information furnished above is true to the best of my knowledge and belief.

Bidders Name:

Signature of the Tenderer:

Designation:

Seal of the Company

Date:

(On the Bidder's Letterhead)

**Self-declaration by Proprietor of the Bidding Company for not being
blacklisted/Debarred/Put On Holiday list**

I hereby confirm and declare that, none of the other concerns of which I am a Proprietor /Managing Partner are blacklisted/ debarred/ suspended or put on holiday list by any Statutory/ Regulatory/Government Authorities/State Electricity Utility/PSU in India.

It is certified that the information furnished above is true to the best of my knowledge and belief.

Signature of the Proprietor:

Name

Designation:

Seal of the Company:

Date:

(On the Bidder's Letterhead)

Declaration regarding no litigation against WBSEDCL

We hereby declare that, no legal litigation/arbitration is pending/ongoing against WBSEDCL in any court/Forum against/by the bidder or its sister concern/Director/Partner/Proprietor.

If it is found at any stage of tendering, our offer will be rejected and I/We don't have any objection on the same.

Bidder's Name:

Signature of the Tenderer :

Designation:

Seal of the Company

Date:

THE END