Price Schedules (BBU), subject to ceiling in Contract Price variation as specified in SCC.

3.45.4.2 If the rates contained in the Price Schedules are not directly applicable to the specific Works in question, suitable rates shall be established by the Purchaser reflecting the level of pricing in the Price Schedules.

3.45.4.3 Where rates are not contained in the said Price Schedule, for the sake of reaching a reasonable rate in respect of any sort of erection work, the number of skilled, semi-skilled and unskilled labour and minimum wage rate declared by the Govt. of West Bengal and/or the rates specified on the latest PWD/CPWD Schedule, overhead, profit and consumables shall be the basis for determination of reasonable rate.

3.45.4.4 For any supply item, reasonable rates shall be reached based on current purchase rate of identical equipment purchased by PURCHASER. The Contractor shall also be entitled to be paid:
the cost of any partial execution of the Works rendered useless by any such variation, and
The cost of making necessary alterations to Equipment already manufactured or in the course of manufacture or of any work done that has to be altered in consequence of such a variation.
The Purchaser shall on this basis determine the rates or prices to enable on account payment to be included in certificates of payment.

3.45.5 Contractor to Proceed

On receipt of a variation order, the Contractor shall forthwith proceed to carry out the variation and be bound to these conditions in so doing as if such variation was stated in the Contract. The Works shall not be delayed pending the granting of an extension of the Time for Completion or an adjustment to the Contract Price under **GCC 3.45.4**.

3.45.6 Records of costs

In any case where the Contractor is instructed to proceed with a variation prior to the determination of the adjustment to the Contract Price, keeping in mind that the adjustment of Contract Price due to this variation shall be guided by **GCC 3.45.4** the Contractor shall keep the necessary records of the cost of undertaking the variation and of time expended thereon. Such records shall be open to inspection/ verification by the Purchaser at

all reasonable times.

3.45.7 **Quantity variation**

PURCHASER, during execution of the Contract, reserves the right to increase or decrease the quantity of goods and services for the items included in the Contract with variation of the total Contract Price as specified in SCC but without any change in unit price or other terms and conditions. The quantity of the individual items of goods and services may however vary up to any extent within the overall ceiling limit of the Contract Price.

3.46. EXTENSION OF TIME FOR COMPLETION

3.46.1 Delivery and installation of Equipment/Materials as per requirement of work Program shall be made by the Contractor in accordance with Time Schedule pursuant to the SCC or within such extended time to which the Contractor shall be entitled under **GCC 3.46.2**

3.46.2 **Reasons for Extension of Time for Completion**

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

a. extra or additional work ordered in writing under GCC 3.45.
b. the delay in completion of Works caused for no fault on the part of the Contractor due to orders/instructions issued by the Purchaser
c. Force Majeure as per GCC 3.43.
d. any changes in laws and regulations as provided in GCC 3.42.
e. any other matter specifically mentioned in the Contract

3.46.3 The Contractor shall give notice to the Purchaser of his intention to make a claim for an extension of time within fifteen (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.

3.46.4 The Contractor shall demonstrate to the Purchaser's satisfaction that it has used its best endeavour to avoid or overcome such causes for delay and the parties will mutually agree upon remedies to mitigate or overcome causes for such delays.

3.46.5 Notwithstanding the provisions of clause **GCC 3.46.4**. the Contractor shall not be entitled to an extension of time for completion, unless the Contractor, at the time when circumstances specified in **GCC 3.46.2** arises, has immediately notified the Purchaser in writing that it may

claim such extension as caused by such circumstances. The Purchaser on receipt of such notice may agree to extend the Contract completion period as may be reasonable and mutually agreed but without prejudice to other terms and conditions of the Contract.

3.46.6 **Earlier Completion:**

The Purchaser may require completion of the Works or part thereof earlier than the Time for Completion, as mutually agreed between the Purchaser and the Contractor. The earlier completion date so agreed, if not achieved, shall not be considered for the purpose of levy of Liquidated damages.

3.47. TERMINATION

3.47.1 Termination for Purchaser's Convenience

3.47.1.1 The Purchaser may at any time terminate the Contract for any reason by giving the Contractor a notice of termination that refers to this sub-clause **GCC 3.47.1**.

3.47.1.2 Upon receipt of the notice of termination under **GCC 3.47.1.1**, the Contractor shall either immediately or upon the date specified in the notice of termination

a. cease all further work, except for such work as the Purchaser may specify in the notice of termination for the sole purpose of protecting that part of the Works already completed, or any work required to leave the Site in a clean and safe condition
b. terminate all subcontracts, except those to be assigned to the Purchaser pursuant to paragraph (d)(ii) of sub-clause GCC 3.47.2.
c. remove all Contractor's Equipment from the Site, repatriate the Contractor's and its Sub-contractors' personnel from the Site, remove from the Site any wreckage, rubbish and debris of any kind, and leave the whole of the Site in a clean and safe condition
d. In addition, the Contractor, subject to the payment specified in **GCC 3.47.3**, shall
   i deliver to the Purchaser the parts of the Works executed by the Contractor up to the date of termination
   ii to the extent legally possible, assign to the Purchaser all right, title and benefit of the Contractor to the Works as at the date of termination, and, as may be required by the Purchaser, in any subcontracts concluded between the

Contractor and its Sub-contractors

iii deliver to the Purchaser all non-proprietary drawings, Specifications and other documents prepared by the Contractor or its Sub-contractors as at the date of termination in connection with the Works

3.47.1.3 **Risk Purchase Clause:** In case of failure of supplier, WBPDCLL at its discretion may make purchase of the materials / services NOT supplied / rendered in time at the RISK & COST of the supplier. Under such situation, the supplier who fails to supply the goods in time shall be wholly liable to make good to WBPDCL any loss due to risk purchase.

In case of items demanding services at site like erection and commissioning, vendor should send his servicemen /representatives within 7 days from the service call. In case a vendor fails to attend to the service call, WBPDCL at its discretion may also make arrangements to attend such service by other parties at the RISK & COST of the supplier. Under such situation the supplier who fails to attend the service shall be wholly liable to make good to WBPDCL any loss due to risk purchase / service including additional handling charges due to the change.

3.47.1.4 In the event of termination of the Contract under **GCC 3.47.1.1**, the Purchaser shall pay to the Contractor the following amounts:

a. the Contract Price, properly attributable to the parts of the Works executed by the Contractor as of the date of termination
b. the costs reasonably incurred by the Contractor in the removal of the Contractor's Equipment from the Site and in the repatriation of the Contractor's and its Sub-contractors' personnel
c. any amounts to be paid by the Contractor to its Sub-contractors in connection with the termination of any sub-contracts, including any cancellation charges
d. costs incurred by the Contractor in protecting the Works and leaving the Site in a clean and safe condition pursuant to paragraph (a) of **GCC. 3.47.1.2**

the cost of satisfying all other obligations, commitments and claims that the Contractor may in good faith have undertaken with third parties in connection with the Contract and that are not covered by paragraphs (a) through (d) above

3.47.2 Termination for Contractor's default

3.47.2.1 The Purchaser, without prejudice to any other rights or remedies it may possess, may terminate the Contract forthwith in the following circumstances by giving a notice of termination and its reasons thereof to the Contractor, referring to this **GCC 3.47**:

a. if the Contractor becomes bankrupt or insolvent, has a receiving order issued against it, compounds with its creditors, or, if the Contractor is a corporation, a resolution is passed or order is made for its winding up (other than a voluntary liquidation for the purposes of amalgamation or reconstruction), a receiver is appointed over any part of its undertaking or assets, or if the Contractor takes or suffers any other analogous action in consequence of debt

b. if the Contractor assigns or transfers the Contract or any right or interest therein in violation of **GCC. 3.48** if the Contractor, in the judgment of the Purchaser has engaged in corrupt or fraudulent practices in competing for or in executing the Contract

For the purpose of this Clause:

"**corrupt practice**" means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the process or in Contract execution.

"**fraudulent practice**" means a misrepresentation of facts in order to influence a process or the execution of a Contract to the detriment of the Purchaser and includes collusive practice among bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Purchaser of the benefits of free and open competition.

3.47.2.2 **If the Contractor:**

a. has abandoned or repudiated the Contract
b. has without valid reason failed to commence Works promptly
c. persistently fails to execute the Contract in accordance with the Contract or persistently neglects to carry out its obligations under the Contract without just cause
d. refuses or is unable to provide sufficient materials, services or labour to execute and complete the Works in the manner specified in the Program furnished under GCC.20 (at rates of progress that give reasonable assurance to the Purchaser that the Contractor can attain Completion of the Works by the Time for Completion as extended.

Then the Purchaser may, without prejudice to any other rights it may possess under the Contract, give a notice to the Contractor stating the nature of the default and requiring the Contractor to remedy the same. If the Contractor fails to remedy or to take steps to remedy the same within fifteen (15) days of its receipt of such notice, then the Purchaser may terminate the Contract forthwith by giving a notice of termination to the Contractor that refers to this clause GCC 3.47.2.

3.47.2.3 Upon receipt of the notice of termination under **GCC 3.47.1** or **GCC 3.47.2** the Contractor shall, either immediately or upon such date as is specified in the notice of termination

a. cease all further work, except for such work as the Purchaser may specify in the notice of termination for the sole purpose of protecting that part of the Works already executed, or any work required to leave the Site in a clean and safe condition
b. terminate all subcontracts, except those to be assigned to the Purchaser pursuant to paragraph (d) of GCC 3.47.2.3
c. deliver to the Purchaser the parts of the Works executed by the Contractor up to the date of termination
d. to the extent legally possible, assign to the Purchaser all right, title and benefit of the Contractor to the Works and to the Equipment/Materials as at the date of termination, and, as may be required by the Purchaser, in any subcontracts concluded between the Contractor and its Sub-contractors
e. deliver to the Purchaser all drawings, Specifications and other documents prepared by the Contractor or its Sub-contractors as at the date of termination in connection with the Works

3.47.2.4 The Purchaser may enter upon the Site, expel the Contractor, and complete the Works itself or by employing any third party. The Purchaser may, to the exclusion of any right of the Contractor over the same, take over and use with the payment of a fair rental rate to the Contractor, with all the maintenance costs to the account of the Purchaser and with an indemnification by the Purchaser for all liability including damage or injury to persons arising out of the Purchaser's use of such Equipment/ Materials, any Contractor's Equipment owned by the Contractor and on the Site in connection with the Works for such reasonable period as the Purchaser considers expedient for the supply and installation of the Works.

3.47.2.5 Upon completion of the Works or at such earlier date as the Purchaser thinks appropriate, the Purchaser shall give notice to the Contractor that such Contractor's Equipment will be returned to the Contractor at or near the Site and shall return such Contractor's Equipment to the Contractor in accordance with such notice. The Contractor shall thereafter without delay and at its cost remove or arrange removal of the same from the Site.

3.47.2.6 The Purchaser shall not be liable to make any further payments to the Contractor until the costs of execution and all other expenses incurred by the Purchaser in completing the Work or its turnkey work Package, as the case may be, have been ascertained.

If the Cost of Completion when added to the total amounts already paid to the Contractor as at the date of termination exceeds the total amount which would have been payable to the Contractor for the execution of the Work or work Package, as the case may be, the Contractor shall upon demand, pay to the purchase the amount of such excess. Any such excess shall be deemed a debt due by the Contractor to the Purchaser shall be recoverable accordingly. If there is no such excess the Contractor shall be entitled to be paid the difference (if any) between the value of the Work or its work package and the total of all payment received by the Contractor as a the date of termination.

3.47.2.7 If the Purchaser completes the Works, the cost of completing the Works by the Purchaser shall be determined.

If the sum that the Contractor is entitled to be paid, pursuant to **GCC 3.47.2.6** , plus the reasonable costs incurred by the Purchaser in completing the Works, exceeds the Contract Price, the Contractor shall be liable for such excess.

The Purchaser and the Contractor shall agree, in writing, on the computation described above and the manner in which any sums shall be paid.

3.47.2.8 No account shall be taken of any increased cost which results from the Contractor's default or negligence.

3.47.3 In this clause **GCC 3.47**, the expression "Works executed" shall include all work executed, Installation Services provided, any and Equipment/ Material acquired (or subject to a legally binding obligation to purchase) by the Contractor and used or intended to be

used for the purpose of the Works, up to and including the date of termination.

3.48. ASSIGNMENT & SUB-CONTRACTING

3.48.1 The whole of the works included in the Contract shall be executed by the contractor and the contractor shall not directly or indirectly transfer, assign or underlet the contract or any part, share or interest therein without the written consent of the Purchaser.

3.48.2 No sub-contracting shall relieve the Contractor from the full and entire responsibility of the Contract or from the active superintendence of the work during their progress.

3.48.3 The contractor has to engage specialized agencies / personnel depending upon the nature and complexity of the work with the prior approval of the Purchaser.

To this regard, the contractor has to submit the completion certificates / required documents of similar type of works executed by the subcontractor/ specialized agencies to establish the sub-contractor's/specialized agencies' workmanship. Also the contractor has to submit drawings done by the specialized agency for approval of Purchaser before procuring and installing the item. This does not in any way relieve the contractor of his obligations to get the quality work and architectural design as desired by the Purchaser.

3.49. JOINT AND SEVERAL LIABILITY

3.49.1 If the Contractor has formed a Consortium of not more than 2 (two) persons for implementing this Solar Power Project:

(a) These persons shall, without prejudice to the provisions of this Agreement, be deemed to be jointly and severally liable to the WBPDCL for the performance of the Agreement; and

(b) The Contractor shall ensure that no change in the composition of the Consortium is effected without the prior consent of the WBPDCL

3.49.2 In case of Consortium, without prejudice to the joint and several liability of all the members of the Consortium, the Lead Member shall represent all the members of the Consortium and shall at all times be liable and responsible for discharging the functions and obligations of the Contractor. The Contractor shall ensure that each member of the Consortium shall be bound by any decision, communication, notice,

action or inaction of the Lead Member on any matter related to this Agreement and the WBPDCL shall be entitled to rely upon any such action, decision or communication of the Lead Member only. The WBPDCL shall have the right to release payments solely to the Lead Member and shall not in any manner be responsible or liable for the inter se allocation of payments among members of the Consortium.

If member of the consortium fails to perform satisfactorily then the Lead Member will be liable and responsible for completion of the project.

3.49.3 Issue of LOA and Contract agreement will be conferred with the Lead Member only.

SECTION –IV

SPECIAL CONDITION OF CONTRACT (SCC)

The following Special Conditions of Contract are supplementary, to the General Conditions of Contract. Whenever there is a conflict, the provisions herein shall prevail over those in the General Conditions of Contract.

4.1 DEFINITION

4.1.1. Purchaser means The West Bengal Power Development Corporation Limited (WBPDCL).

4.1.2. Site means the project site. The details of the site is shown below:

Capacity of the Plant	10MW
Selected Location	Sagardighi Thermal Power Station, in Murshidabad District, West Bengal.
Latitude:	24° 36′ North
Longitude:	88° 11′ East
Altitude:	37 meters
Nearest Major Towns	Ajimganj, Jangipur, Raghunathganj
Nearest police station:	Sagardighi PS (10 km from site)
Nearest hospital:	Raghunathganj (14 km from site)
Nearest substation of SEB	Raghunathganj (5 km from site)
Solar insolation:	4.85 kWh/m^2/day
Seismic Zone	Zone-III as per IS 1893-1984.
Access by Road	From National Highway (NH-34).
Access by Rail	Manigram R.S. on Bandel-Barhawara branch line.
Access by Sea	Nearest port is Kolkata.
Access by Air	Netaji Subhas Chandra Bose International Airport at Dum Dum in Kolkata.

4.1.3. Engineer In Charge

The Director (Projects), WBPDCL Corporate office, Kolkata or his authorised Engineer will be Engineer In Charge.

4.1.4. Controlling Officer

The General Manager of SgTPP or his authorized Engineer will be Controlling Officer

4.1.5. Project Manager

Project Manger will be selected from the Corporate office and will be finalized in the kick off meeting at the Corporate office of WBPDCL.

4.1.6. Paying Officer

The Deputy General Manager (F&A), WBPDCL Corporate office, Kolkata

4.2 CONTRACT PERFORMANCE GUARANTEE

4.2.1. Within fifteen days (15) from date of LOA, the Contractor shall furnish Performance Guarantee to the Purchaser amounting to 10% of the accepted Tender Value including GST in the form of Bank guarantee from nationalized bank. The (Earnest Money Deposit) EMD shall be returned on submission of the Performance Guarantee of success full bidders.

4.2.2. **Release of Contract Performance Bank Guarantee (PBG):** 100% after the completion of defect liability period i.e. 5 years after successful commissioning of the Project.

4.2.3. Contract agreement will be executed after submission of PBG, deposited EMD shall be returned.

4.3 PAYMENTS

Following terms of payment shall be applicable –

4.3.1. Security Deposit (SD)

a) 5% of the bill value shall be deducted from every bill. SD will be released after the payment of final bill.

b) No Interest is payable on the Security Deposit.

4.3.2. Performance Security:

10% of contract value will be retained and it will be released in five equal installments every year in the defect liability period subject to compliance of following conditions by the contractor:

Integrated project performance of **Net Minimum Guaranteed** Generation (NMGG) solar energy at rate of **1.52MU/MW** annually **with degradation of 1%** for any reason, from second year onwards. If generated units fall short, then **Rs.6.50** per unit of short fall will be deducted from WBPDCL payments every year up to 5th year.

4.3.3. Total Integrated System Warranty/Contract Performance Guarantee

a. After completion of the project the 10% contract performance bank guarantee (PBG) will be the total integrated System warrantee.

b. PBG will be returned to the contractor after successful completion of the defect liability period as well as O&M period.

4.3.4. PAYMENT TERMS

4.3.4.1 Within forty-five (45) days after receiving an application for payment, duly complete in all respects, the Purchaser shall pay the amount certified after issue of each certificate of payment to the Contractor at his principal place of business.

4.3.4.2 Mobilization Advance:

i. 10 % of the Contract Price (Supply & Erection contract) will be paid as Mobilization advance to the contractor against submission of Mobilisation Advance Bank Guarantee (**ABG-Annexure-3**) equivalent to 110 % of the Mobilisation Advance, subject to the conditions mentioned below. Unconditional acceptance of the LOA.

ii. Taking over of site from WBPDCL

iii. Execution of Contract Agreement

iv. Submission of Performance Bank Guarantee

v. Submission of duly authenticated Activity Schedule in MS Project showing the entire execution of work.

vi. The Bank Guarantee shall be valid for a total period of 12 (twelve) months plus a claim period of 3 (three) months from the bid opening date.

vii. Mobilization advance, so paid shall be recovered as mentioned in the **Payment Schedule (clause SCC 4.3.4.6)**.

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

The mobilization advance will be recovered with interest at the Base Rate of State Bank of India, the base rate as applicable on the date of advance payment shall be considered for computation of interest. The closing date for calculation of levy of Interest shall be the date of issuance of Material Received Certificate (MRC) and Erection Completion Certificate.

The levy of Interest may be waived off subject to the condition that the contractor submits claims against supplies and services as payable as per **clause no.4.3.4.6** within a period of 90(ninety) days from the date of LOA. The payable claim amount must be more than the initial advance paid.

4.3.4.3 Supply of Materials:

Payment for supply of material at site will be given as per the **Payment Schedule (clause SCC 4.3.4.6)** given below after satisfactory acceptance by Purchaser of the supplied materials along with the relevant following documents mentioned:

I. **Deduction:-**

a) Statutory deductions like TDS, GST if any shall be deducted.

b) Adjustment of any excess / short payment made in the earlier bills, at the time of making payments.

c) Electricity and Water charges will be recovered as per tender terms.

d) Value of chargeable materials if any issued by the Purchaser.

e) Any other recovery if due as per tender terms & conditions.

f) 5% of the bill value as Security Deposit.

II. **Documents:-**

a) Computerized detailed measurements, Running Accounts Bills and Final Bill will be Prepared by contractor and submitted to WBPDCL for verification and approval.

b) Document for claiming subsidy from MNRE should be submitted to WBPDCL for release of first RA bill.

c) WBPDCL gate entry documents./MRC(Material Receive at Certificate)

d) Relevant test, type test, joint inspection reports warranty and guarantee Certificate for the items supply as per quality criteria mentioned in tender document.

e) Copy of Performance guarantee for contract execution from nationalized bank valid till completion of work for 10% of purchase order value.

f) Labor License (as per statutory requirements).

g) EPF Code Registration number with RPFC.

h) Insurance – Contractor's All Risk (CAR) Policy.

i) Workmen compensation policy, Proof for PF deduction and remittance.

j) Third Party Liability Insurance for four consecutive occurrences each occurrence of 5.0 lakh.

k) GST or Other tax invoice, Service Tax registration number.

l) Indemnity Bond (ANNEXURE-5) in standard pro forma to indemnify the Purchaser against all risks arising during the performance of the contract.

m) Proof of deployment of project engineers as specified in SCC.

n) Challans / receipts of taxes paid to statutory authorities i.e., GST, Custom duties etc.

o) A Certificate towards the effect that minimum Technical and Safety man power was employed for the work execution Certified by the WBPDCL representative as per the Tender Clauses.

p) Undertaking for compliance of all labor laws.

4.3.4.4 Payment of Bills for installation, erection, testing, integration, successful commissioning of integrated system in total and ready for handing over to WBPDCL

Payment for the Bill amount for the materials quoted will be paid as per the **Payment Schedule (clause SCC 4.3.4.6)** after joint inspection / measurements by the Purchaser for installation, erection, testing, integration, successful commissioning of integrated system in total and ready for handing over to WBPDCL by the contractor and submission of following document :

I. Deduction:-

a) Deduction of the Value of chargeable materials if any issued by the Purchaser.

b) Statutory deductions like TDS, GST, Custom duties if any.

c) Charges for Electricity and Water charges provided by WBPDCL.

d) Any other recovery if due as per tender terms & conditions.

e) 5% of the bill value as Security Deposit.

f) Adjustment towards any excess / short payment made in the earlier bills.

II. Document:-

a) Relevant test, type test, joint inspection reports warranty and guarantee Certificate for the items installed, integrated & commissioned as per quality criteria mentioned tender document.

b) WBPDCL gate entry documents if any.

c) Proof of deployment of project engineers as specified in SCC.

d) Challans / receipts of taxes paid to statutory authorities i.e., GST, Customs Duties etc

e) A Certificate towards the effect that minimum Technical and Safety man power was employed for the work execution Certified by the WBPDCL representative as per the Tender Clauses.

f) Undertaking for compliance of all labor laws.

g) Valid Indemnity Bond in standard pro forma indemnifying the Purchaser against all risks arising during the performance of the contract.

h) Valid Workmen compensation policy, Proof for PF deduction and remittance.

i) Valid Insurance – Contractor's All Risk (CAR) Policy.

j) Valid Labor License (as per statutory requirements).

k) MNRE–Govt of India format project complication certificates / documents to WBPDCL.

l) Computerized detailed measurements, Running Accounts Bills and Final Bill will be prepared by contractor and submitted to WBPDCL for verification and approval.

m) A Certificate issued by the WBPDCL that total supply and erection works are complete in all aspects.

4.3.4.5 Payment of Bill – Performance testing of total integrated system – final Payment / bill:

Payment for materials bill shall be paid as per the **Payment Schedule as per clause SCC 4.3.4.6** after performance testing of total integrated system for two months in all respect. The final bill complete in all respect shall be submitted by the contractor within 60 days from the completion of the work. The bill should be accompanied with the following documents.

I. Deduction:-

a) Statutory deductions like GST and other tax and duties if any shall be deducted WBPDCL reserves the right to adjust any excess / short payment made in the earlier bills, at the time of making payments.

b) Adjustment of any excess / short payment made in the earlier bills, at the time of making payments.

c) Electricity and Water charges will be recovered as per tender terms.

d) Value of chargeable materials if any issued by the Purchaser.

e) LD if any and other recovery if due as per tender terms & conditions.

II. Document:-

a) Computerized detailed measurements, Running Accounts Bills and Final Bill will be Prepared by contractor and submitted to WBPDCL for verification and approval.

b) Validated of Total Integrated System Warranty PBG/Contract PBG valid for **72 months with 90 days claim period** for the value equivalent to 10% of the total final project value from nationalized bank.

c) Proof of project completion and relevant documents as per MNRE format for release of subsidy by MNRE, Govt of India to WBPDCL.

d) Job completion certificate by WBPDCL (**Annexure-6**).

e) No claim certificate on Purchaser's prescribed pro forma - if any deduction is to be made for short fall, Purchaser shall record the same in this document.

f) Site clearance certificate by WBPDCL.

g) Indemnity certificate towards labor payment and all statutory payments.

h) Copy of the insurance policy. (Workmen compensation act and contractors all risk policy).

i) Operation and Maintenance manuals and testing and commissioning reports with Guarantee and Warranty certificates.

j) Statutory Compliance certificate towards payment of insurance, GST and other taxes if any applicable.

k) A compliance Certificate should be submitted towards deployment of Technical & Safety man power as per the relevant Tender Clauses.

l) Proof of deployment of annual maintenance & operation manpower for operation of the plant.

m) Valid Workmen compensation policy, Proof for PF deduction and remittance for AMC personal.

n) Valid Insurance – Contractor's All Risk (CAR) Policy for AMC personnel.

o) Valid Labor License (as per statutory requirements) for AMC personnel.

p) Relevant test, type test, joint inspection reports warranty and guarantee Certificate for the items installed, integrated & commissioned as per quality criteria mentioned tender document.

q) WBPDCL gate entry documents if any.

r) Undertaking for compliance of all labour laws.

s) Valid Indemnity Bond (ANNEXURE-5) in standard pro forma indemnifies the Purchaser against all risks arising during the performance of the contract.

t) Final acceptance certificate issued by WBPDCL /Purchaser.

4.3.4.6 Payment Schedule:

Sl. No.	Work Head	Pattern of Release of Billing Amount
1	**Mobilization Advance**	**10%** of the total contract price of Supply and Erection & Commission will be paid as Mobilization advance to the contractor against submission of Mobilisation Advance Bank Guarantee (**ABG**) equivalent to 110 % of the Mobilization Advance , subject to the conditions mentioned in the Clause No. SCC 4.3.4.2 above. The mobilization advance will be recovered as per the sub clause mentioned

Sl. No.	Work Head	Pattern of Release of Billing Amount
		in Sl. No. 2 (i) & 3(i) below. NOTE:- (1) For **supply of material**, submission of Mobilisation Advance Bank Guarantee (**ABG**) should be equivalent to 110 % of the Mobilization Advance **excluding GST**. (2) For **Erection & Commissioning**, submission of Mobilisation Advance Bank Guarantee (**ABG**) should be equivalent to 110 % of the Mobilization Advance **including GST**.
2	**Contract for Supply of Material**	i. 65% of the contract value will be given after material received at site (Mobilization Advance paid and interest as per Clause 4.3.4.2 will be recovered proportionately from bills under this phase of payment).
		ii. 15% of the contract value will be paid after completion of the erection of the material
		iii. 10% of the contract value after successful completion of the commissioning and all testing and release of 5% security deposit as per clause No.4.3.1 which is the final bill
		iv. 10% of the Contract value will be retained for Performance warranty as per clause no.SCC 4.3.2..
		v. 5% of the Security Deposit (SD) will be deducted from the bill of sl. No. i to iii.
3	**Contract for Erection & Commissioning**	i. 65% of the contract value will be given after erection of the material (Mobilization Advance paid and interest as per Clause 4.3.4.2 will be recovered proportionately from bills under this phase of payment).
		ii. 15% of the contract value will be paid after completion of the Commission of the material
		iii. 10% of the contract value after successful completion of the commissioning and all testing and release of 5% security deposit as per clause No.4.3.1 which is the final bill.
		iv. 10% of the Contract value will be retained for Performance warranty as per clause no.SCC 4.3.2.

Sl. No.	Work Head	Pattern of Release of Billing Amount
		v. 5% of the Security Deposit (SD) will be deducted from the bill of sl. No. i to iii.

4.3.5. Performance Penalty:

a) Integrated project performance of minimum solar energy to be generated 1.52MU/MW annually with degradation of 1% for any reason, from second year onwards. If generated units fall short, then Rs.6.50 per unit of short fall will be deducted from WBPDCL payments every year up to 5th year.

b) Penalty will be deducted from retained Performance Security but if Performance Security ended then penalty will be recovered by invoking PBG

c) WBPDCL reserves the right to adjust any excess / short payment made in the earlier bills, at the time of making payments.

4.3.6. Defects Liability Period:

Defect liability period is 60 calendar months from the date of Issue of Final completion certificate/Acceptance of work by WBPDCL.

4.3.7. INCREASE IN COST:

Quoted prices are firm and no escalation charges on any account are allowed in this work. No claim will be entertained on this account in future.

4.3.8. DISALLOWANCE OF PAYMENT:

If payment has been made for any item but later on some defect is noticed, Purchaser is authorized to disallow payment of the subsequent bill till rectification /replacement of the item.

4.4 ESCALATION

No Escalation shall be paid on any account.

4.5 LIQUIDATED DAMAGES

0.5% of contract value per week of delay up to a maximum of 10% (Ten percent) of the Contract value from the stipulated date of completion.

4.6 NOTICES

For the purpose of all notices, the following shall be the address of the Purchaser and the Contractor.

PURCHASER:

The Director (Projects)
The West Bengal Power Development Corp. Ltd.
Bidyut Unnauan Bhaban, Plot No. 3/C LA-Block,
Sector-III, Bidhannagar,Kolkata-700 106

CONTRACTOR:

_____

_____

(To be filled in at the time of Signing of the Contract)

4.7 LABOUR

4.7.1. The Contractor shall make his own arrangements for the engagement of all staff and labor, local or other, and for their payment, housing, food, transport etc. No labor to stay at site.

4.7.2. The Contractor shall, if required by the Purchaser deliver to the Purchaser a return in detail, in such form and at such intervals as the Purchaser may prescribe, showing the staff and the numbers of the several classes of labor from time to time employed by the Contractor on the Site and such other information as the Purchaser may require.

4.7.3. Compliance with labor regulation: During continuance of the contract, the Contractor shall abide at all times by all existing labor enactments and rules made there under, regulations, notifications and bye-laws of the State or Central Government or local authority and any other labor law (including rules), regulation by laws that may be passed or notifications that may be issued under any labor law in future either by the State or the Central Government or the local Authority. The Contractor shall keep the Purchaser indemnified in case any action is taken against the Purchaser by the competent authority on account of contravention of any of the provisions of any Acts or rules made there under, regulation or notifications including amendments. If the Purchaser is caused to pay or reimburse, such amount as may be necessary to cause or observe, or for non-observance of the provisions stipulated in the notifications/bye laws/Acts/Rules /regulations including

amendments, if any, on the part of the Contractor, the Purchaser shall have the right to deduct from any money due to the Contractor including his amount of performance security. The Purchaser shall also have right to recover from the Contractor any sum required or estimated to be required for making good the loss or damage suffered by the Purchaser

4.7.4. The employees of the Contractor and the Sub-Contractor in no case shall be treated as the employees of the Purchaser at any point of time.

4.7.5. No labor shall stay at site. Temporary storage space provision should be made by contractor.

4.7.6. The rates shall be complete in all respects i.e. inclusive of all taxes, local taxes, work contract tax, Insurance charges nothing on any account shall be paid over the approved rate.

4.7.7. All specialized and specific jobs shall be carried out by approved agencies/vendors only.

4.7.8. The Contractor shall arrange temporary drinking water and sanitation facilities for his workmen.

4.7.9. Minimum Wage as applicable

i. The contractor shall pay not less than fair wages to laborers engaged by him on the work.

ii. "Fair" wages means wages whether for time or piecework notified by the Government from time to time for the locality of work.

iii. The contractor shall not-with-standing the revisions of any contract to the contrary cause to be paid to the labor directly engaged on the work including any labor engaged by the sub-contractor in connection with the said work, as if the laborers had been directly employed by him.

iv. In respect of labor directly or indirectly employed in the works for the purpose of the contractors part of the agreement the contractor shall comply with the rules and regulations on the maintenance of suitable records prescribed for this purpose from time to time by the Government. He shall maintain his accounts and vouchers on the payment of wages to the laborers to the satisfaction of the Purchaser.

v. The Purchaser shall have the right to call for such record as required to satisfy himself on the payment of fair wages to the laborers and shall

have the right to deduct from the contract amount a suitable amount for making good the loss suffered if any by the worker or workers by reason of the "fair wages" clause to the workers.

vi. The contractor shall be primarily liable for all payments to be made and for the observance of the regulations framed by the Govt., from time to time without prejudice to his right to claim indemnity from his sub-contractors.

vii. As per contract labor (Regulation and abolition) Act.1970 the contractor has to produce the license obtained from the licensing officers of the labor department along with the tender viii. Any violation of the conditions above shall be deemed to be a breach of his contract.

viii. Equal wages are to be paid for both men and women if the nature of work is same and similar.

ix. The contractor shall arrange for the recruitment of skilled and unskilled labor local and imported to the extent necessary to complete the work within the agreed period as directed by the Purchaser.

x. The Contractor/Sub-contractor9s) to be engaged by the contractor subsequently, must have its own PF & ESI Code.

4.8 SAFETY MEASURES

The contractor shall take necessary precautions for safety of the workers and preserving their health while working in such jobs, which require special protection and precautions. The Purchaser has standard safety guidelines for the Contractor. The Contractor is to be followed the above guidelines which will be provided with placement of the Award of Contract.

4.9 FIRE FIGHTING MEASURES

i. The contractor shall provide and maintain adequate firefighting equipment and take adequate fire precaution measures for the safety of all personnel and temporary and permanent works and shall take action to prevent damage and destruction by fire of trees shrubs and grasses.

ii. Separate payment will not be made for the provision of fire prevention measures.

4.10 DEPLOYMENT OF MANPOWER

The contractor shall deploy the following minimum man power at site to take instructions from WBPDCL Staff & Report the site activities on day to day basis execution of quality work and maintain all statutory records as per Govt. norms/as directed by the Purchaser.

4.10.1. One Graduate Engineer (Electrical) with suitable experience of 8 years and one junior Engineer Diploma (Electrical) of 5 years experience, two nos of ITI and at least some unskilled manpower for day to day operation the contractor shall furnish the name, bio data, experience of the personal intended to be posted at site at the start of work. Site Engineers are to be deployed irrespective of the Contractor or the Director / Manager of the contracting company being an Engineer himself. Attendance register should be kept at the office of WBPDCL designated engineer.

4.10.2. The Contractor shall maintain supervisor staff to Labor ratio as per standard government / CPWD norms.

4.10.3. The Contractor may employ more number of site Engineers other than above mentioned Engineers to get quality workmanship and maintain all statutory.

4.11 QUANTITY OF WORK

The quantities of work shall be mentioned in the LOA.

4.12 PROJECT MANAGEMENT

4.12.1. CONTRACTOR'S ORGANISATION

The Contractor shall supply to the Purchaser and the Project Manager a chart showing the proposed organization to be established by the Contractor for carrying out work on the Facilities within twenty-one (21) days of the Effective Date. The chart shall include the identities of the key personnel and the curricula vitae of such key personnel to be employed shall be supplied together with the chart. The Contractor shall promptly inform the Purchaser and the Project Manager in writing of any revision or alteration of such an organization chart.

4.12.2. PROGRESS REPORT

Monthly progress report of the previous month along with photographs of work progress shall be submitted to the Purchaser before the 7th day of every month. Format for the monthly report will be finalized in the .Kick Off meeting.

4.12.3. PROJECT REVIEW MEETING

Progress of the project will be evaluated in the Project Review Meeting (PRM) in every month. Date of the PRM will be informed by the Purchaser to the entire contractor.

4.12.4. SPECIAL PROJECT REVIEW MEETING

Special Project Review Meeting (SPRM) will be held after completion of the each milestone mentioned in the data sheet (approved network by the Purchaser). In this meeting the total time taken for complete the milestone will be finalized/evaluated and if any delay occurs then delay contribution will be calculated and minuted by both Contractor as well as Purchaser.

4.13 ACCIDENT OR INJURY TO WORKMEN

4.13.1. WBPDCL shall not be responsible for any injury or loss of life of any worker of the contractor that may take place while on work. Any compensation or expenditure towards treatment for such loss of life or injury shall be the sole responsibility of the contractor.

4.13.2. The contractor is solely responsible for any damage injury or accident that may occur to any of his personnel working under this contract. He will not claim any compensation from WBPDCL.

4.14 REGULATIONS & STANDARDS

The installation shall confirm in all respects to the Indian Standard Code of Practice for Electrical Installations. It shall also be in conformity with the current Indian Electricity Rules and Regulations and requirements of the local Electric Supply Authority in so far as these become applicable to the installation. Wherever the specifications of this tender document calls for higher standard of material and/or workmanship than those required by any of the above codes and regulations then this specifications shall take precedence over the said regulations and standards.

4.15 INSPECTION AND TESTING

4.15.1. Required Inspection charges at the Factory are under scope of Contractor.

4.15.2. Inspection & Testing for Imported items like Inverters, Floaters etc may be done at Manufacturer local testing facilities / at the works of the contractor in India as desired by the contractor. In such case the contractor shall provide full set up for inspection and routine test of the item.

4.16 DESIGN AND ENGINEERING

4.16.1. The optimum system design and sizing of the equipments of the PV power plants shall be done by using design software PV- Syst /PV–Sol or any other modern tools by using the meteorological data base of Meteonorm.

4.16.2. The contractor shall develop the general layout drawing of Array Yard, Inverter, AJB, Grid Interfacing panel, Single line diagram and other drawing as may be required. All designs & drawings are to be developed based on specification given in the tender, relevant BIS unless otherwise specified.

4.16.3. The Power Plants shall have to be designed considering optimal usage of space without compromising the effect of shadow, cooling, accessibility, losses, protection, security and safety etc.

4.16.4. Document to be submitted during approval of the Design and Drawing:

During approval of drawing and design of the PV Power Plant the documents have to be submitted by the contractor which shall be includes but not limited as follows:

1) Power plant design document
2) PV Array and other component layout drawing of the PV Power Plant
3) Drawing of different equipments of PV power Plant
4) Design and drawing of PV Module mounting floater along with the anchoring arrangement of PV array as per technical specification.
5) List of Equipments and Component and its capacity and manufacturer name to be used in the PV Power Plants
6) Type test report of PV Module mounting floater, Inverters, PV Module, Cables , Components of Array JB, Inverter LT Panel, Grid Inter facing Pants etc
7) Technical catalog of the Equipments and Component.

4.17 COMPLETION OF WORK

The Contractor shall assist the beneficiaries and liaison with the DISCOMs if necessary for installation of Net Meter by the DISCOM and complete the formalities for availing net metering benefit to make the power plant is operational from the date of commissioning.

4.18 TRAINING OF OWNER'S ENGINEER

Contractor will arrange for training on Operation and maintenance of owners engineer in a floating solar power plant, capacity not less than 1MW and which

is in successful operation since last three years or capacity not less than 5MW which is in successful operation since last two years from the date of LOA. Expenses for Transportation, Boarding, Lodging for Thirty Two man days (four man for eight days) to be born/arranged by the contractor. Contractor will also facilitate for arrangement of visas for the country to be visited.

The Contractor will also arrange for training at site for the end users.

4.19 TAKING OVER

The work shall be taken over by WBPDCL upon successful completion of work at site(s) and observing performance of the power plant **for at least 30 days** in accordance with provision of this work. During handing over of the complete project work, the contractor will submit the followings in Six (06) sets for considering final payment.

a) All As-Built Drawings & Design of the power plant
b) Detailed Engineering Document with detailed specification, schematic drawing, Design and test results, manuals for all deliverable major items, Operation, Maintenance & Safety Instruction Manual and other information about the project
c) Bill of materials
d) Site wise documentation as per MNRE GoI Format
e) Performance Guarantee Certificate of PV modules from the original manufacturer
f) Inventory of spares at projects sites
g) Completion certificate as per prescribed format provided by WBPDCL
h) 30 days Generation Data.
i) Project Document as per MNRE Guideline
j) Site maintenance logbook.

4.20 COMPREHENSIVE MAINTENANCE

Comprehensive Maintenance during defect liability period

4.20.1. All the equipments to be installed for commissioning of each of the grid connected solar PV power plant and the power plant in whole shall be under Comprehensive Maintenance Contract within the scope of the tender for 5(five) years from the date of commissioning. The equipments or components, or any part thereof, so found defective during Comprehensive Maintenance Contract period will be forthwith repaired or replaced within the scope of guarantee obligation to the satisfaction of the Purchaser.

The maintenance of grid connected solar PV power plant include routine & periodic maintenance, overhauling, breakdown maintenance, and repairing or replacement of defective PV modules, invertors, and other components, providing of consumables. The Down-Time of PV system should not be more than 72 hours (03 days). Details of the maintenance scope are mentioned in the clause no. **GCC 3.8.4**

4.20.2. **Routine maintenance:**

In order to carry out routine maintenance of the power plant, the contractor will provide all labour, material, consumables etc. within the scope of maintenance service. Recommended tusks under the scope of routine maintenance will include but not limited to the followings:

Sl No.	Type of Routine Maintenance
01	Checking and tightening of all electrical connections
02	Checking and tightening of mechanical fittings
03	Checking and restoring of earthing system
04	Dusting and cleaning of Inverter and other electrical equipments
05	Routine maintenance as recommended by the Original Equipment Manufacturer (OEM)

4.20.3. **Rental and Other Periodic Charges**

The contractor shall pay the rental charge of the SIM / Telephone Bill web connectivity in order to transfer of data related to Web Based Remote Monitoring System. The contractor shall also pay the rental charges for server of the web based remote monitoring system for storing and access the data till the defect liability period is over. The Contractor shall also pay necessary charges periodically for refilling of the Fire Extinguisher till defect liability period is over.

4.20.4. The payment towards Operation & Maintenance shall be made on monthly basis on submission of bills in triplicate to WBPDCL along with a copy of the maintenance report during the claimed period.

4.21 WARRANTY OF EQUIPMENT

The contractor shall warrant that all equipments, hardware and accessories are new, unused, most recent or current models and incorporate all recent improvements in design and in accordance with the contract documents and free from defects in material and workmanship. The contractor shall also guarantee for defect free operation of the materials supplied and

workmanship towards erection for a period of **sixty** (**60) calendar months** commencing immediately upon date of TOC.

4.22 MANUFACTURER WARRANTY CERTIFICATE:

The manufacturer should warrant the supplied equipments, hardware and accessories free from the defects and/or failures specified below from the date sale to the original customer (i.e. EPC Contractor).

i. Defects and/or failures due to manufacturing
ii. Defects and/or failures due to quality of materials
iii. Non conformity to specifications due to faulty manufacturing and/or inspection processes.

If any equipment fails to conform to this warranty, the manufacturer will replace the equipments, at the Purchaser's sole option.

The contractor has to submit the Warrantee Certificate issued by the Equipments Manufacturer to WBPDCL against delivery of each lot. The Warrantee Certificate issued by the contractor must comprise order no. of WBPDCL, name of the project and name of WBPDCL.

The contractor should submit the warrantee certificate issued by the original Equipments manufacturer to WBPDCL after delivery of every lot. The warrantee shall include but not limited to the following:

a. Capacity and model of the Equipment,
b. Equipment serial no.
c. Warrantee period:
d. Name of WBPDCL (as principal purchaser)
e. Order reference of WBPDCL
f. Order reference & name of the of vendor

4.23 PERFORMANCE GUARANTEE OF PV MODULE:

The manufacturer should warrant the output of Solar Module(s) for at least 90% of its rated power after initial 10 years & 80% of its rated power after 25 years from the completion of trial run at site/date of final commissioning. The contractor shall collect the Warranty Certificate for performance of the modules from the manufacturer and submit the same to WBPDCL prior to delivery of the products to the respective sites.

If, Module(s) fail(s) to exhibit such power output in prescribed time

span, the Contractor will bound to either deliver additional PV Module(s) to compensate the shortfall power output with no change in area of site used or replace the PV Module(s) with no extra cost claimed at Purchaser 's sole option.

The contractor has to transfer Performance Guarantee Certificate of the module from the original manufacturer to the Purchaser for subsequent arrangement after completion of the guarantee period.

4.24 KICK OFF MEETING

Project Kick Off meeting to be held within 15 days of the placement of LOA and venue of the kick off meeting will be the Corporate Office of WBPDCL.

4.25 CLEAN-UP AND WASTE DISPOSAL

Contractor shall keep the power project site reasonably clean and otherwise free from accumulation of waste materials, rubbish and other debris resulting from performance of the EPC Contractor's obligations. Contractor shall be maintained project site at hygienic standards and shall be kept reasonably free from debris, litter and malodour on or before Final Performance Acceptance. The EPC Contractor shall remove from the power plant site area all petroleum, waste materials, rubbish and other debris, as well as all tools, construction equipment, machinery and surplus material which the Client does not hold title, and shall make the power plant area in a neat, clean and usable condition. The EPC Contractor shall remove, transport and dispose-off hazardous material transported into the power plant site or any subcontractor or created, used or handled as part of contractor's or any subcontractor's construction activities at the power plant site.

The EPC Contractor shall notify Purchaser immediately upon the discovery of presence of any hazardous material on, or the release of hazardous material on or from, the power plant site. All clean up and disposal activities of contractor (including, without limitation, the transportation and disposal of any hazardous materials taken from the power plant site) shall be conducted in accordance with all Applicable Laws and Applicable Permits. All these shall be applicable during the O&M period also in mutatis mutandis.

4.26 CO-ORDINATION WITH STATUTORY BODIES AND OUTSIDE AGENCIES.

The Bidder shall be fully responsible for carrying out all co- ordination and liaison work with Electrical Inspectors, Factory Inspector, and other statutory

bodies for implementation of the work including all the licence fees, statutory fees etc. Applications on behalf of the Owner, for submission to the Electrical Inspector and other statutory bodies along with necessary drawings complete in all respects shall be prepared by the Bidder. Approved drawings and certificates shall be submitted to the Owner/Consultant well ahead of schedule so that the actual commissioning of equipment does not get delayed for want of inspection and approval by the Inspector and other statutory bodies. The actual inspection work by the Electrical Inspector shall be arranged by the Bidder and necessary coordination and liaison work in this regard shall be the responsibility of the Bidder.

SECTION –V

TECHNICAL SPECIFICATION

A. GENERAL REQUIREMENTS:

5.1 NAME OF THE WORK:

Setting up 10 MW Grid connected Floating Solar Photovoltaic Power Plants on Raw Water Pond no.1, 2&4 in Sagardighi Thermal Power Project (SgTPP), Murshidabad, West Bengal.

5.2 SCOPE OF THE WORK:

Design & Engineering, Manufacture/Procurement, Supply, Installation, Testing and Commissioning of 10 MW Grid connected Floating Solar Photovoltaic Power Plants on Raw Water Pond no.1, 2 & 4 in Sagardighi Thermal Power Project (SgTPP), Murshidabad, West Bengal in turnkey basis including 05 (Five) years warrantee obligation with comprehensive Operation and Maintenance.

5.3 PROJECT SCHEDULE:

Zero date: Date of issue of LOA
Total time for competition: **365** days from zero date.

5.4 MODE OF EXECUTION

The entire work shall be executed on Lump sum turnkey basis. Any item(s) not included in the specification / schedule but required for completion of the work shall have to be carried out/supplied without any extra cost. Such works, not listed in the schedule of works but elaborately described to perform or to facilitate particular operation(s) required for completion of the project shall be deemed to have been included in the scope of this work and the bidder shall supply, install the same without any extra cost to WBPDCL.

The work shall be executed in conformity with the relevant standard of Bureau of Indian Specification (or equivalent International Standard), Indian Electricity Rules, 1956 (as amended up to date), Indian Electricity Act 2003(as amended up to date), BARC/DAE rules, Explosive Act 1948, Petroleum Act 1934, National Building Code and relevant Rules in vogue at the time of execution including operation & maintenance period.

The bidder shall comply with all applicable laws or ordinances, codes, approved standards, rules, and regulations and shall procure all necessary Panchayat / Municipal and Government permits & licenses etc at his own cost.

All sub systems /components such as cables, connectors, Junction boxes, surge protection devices, etc., shall conform to the relevant international and national standards for electrical safety besides that for Quality required for ensuring Expected service life and Weather resistance.

The bidder to provide full time round the clock watches and ward to protect the material from theft and pilferage.

5.5 SITE INSPECTION

The bidder is advised to visit and examine project site and its surroundings and obtain for himself, on his own responsibility, all information that may be necessary for entering into contract. The bidder will assess and satisfy himself as to the adequacy of the local conditions such as approach roads to the site, adequacy of existing culverts/bridges/roads for the expected traffic, water and power supply, nature of ground and sub soil condition, water table level, accommodations required during the contract, climatic conditions, local terrain, availability of labour and construction materials, details of taxes, duties and levies as applicable and any other information required. The cost of visiting the site shall be at the bidder's own expenses.

5.6 FACILITIES AT SITE

The Bidder will be provided with a 415V, 3 Phase, 50 HZ power supply at one point near the project location for construction and fabrication purpose but cabling to be done by the Bidder, Control, metering and distribution inside the solar power plant area shall be made by the bidder at his own cost. Cost of the construction power will be charged basis with the rate of WBSEDCL.

Water supply shall be arranged from the lake by the contractor for construction and maintenance purpose of floating solar PV power plant. The Bidder shall arrange for pumps and distribution piping to various locations within the solar power plant depends on the requirement.

B. SYSTEM DESCRIPTION:

5.7 LAYOUT:

a) **Capacity of the Plant**: 10000kW (AC).

b) **Capacity of the Pond:**

Approximate pond water surface area and expected estimated power plant capacity:-

Pond	Capacity(SqM)	Capacity(MW)
Raw Water Pond #1	60800	3.5
Raw Water Pond #2	59600	3.5
Raw Water Pond #4	65736	3

Capacity mentioned above is estimated only actual capacity may very after details engineering.

c) **Topography of the Site:**

2. Raw Water Pond #1:
   i) 24°21'50.8"N 88°06'53.7"E
   ii) 24°21'46.6"N 88°06'45.1"E
   iii) 24°21'40.6"N 88°06'48.3"E
   iv) 24°21'44.8"N 88°06'57.1"E

3. Raw Water Pond #2:
   i) 24°21'46.3"N 88°06'44.2"E
   ii) 24°21'42.1"N 88°06'35.7"E
   iii) 24°21'36.3"N 88°06'39.0"E
   iv) 24°21'40.4"N 88°06'47.7"E

4. Raw Water Pond #4:
   i) 24°21'38.7"N 88°06'45.7"E
   ii) 24°21'34.8"N 88°06'37.5"E
   iii) 24°21'32.7"N 88°06'38.4"E
   iv) 24°21'31.0"N 88°06'35.2"E
   v) 24°21'28.0"N 88°06'37.0"E
   vi) 24°21'33.0"N 88°06'49.0"E

d) Total depth of the Raw Water Reservoirs is 7.2 m with a free boat of 750mm. As this is a reservoir of power plant so generally fixed water level is maintained for whole year but water level may be reduced if scarcity of water from Ganges arises.

e) **FLOTATION UNIT FOR MOUNTING OF SOLAR MODULE**

The module mounting structure (flotation structure) shall be installed over an appropriately designed modular and pre-fabricated flotation device with appropriate buoyancy to support the weight of at least one solar panel and

one person per solar panel. The total 10MW (AC) plant to be installed in the centre of the pond in a continuous manner.

f) **MOORING AND ANCHORING SYSTEM**

Depending upon the water level variation and prevailing wind speed mooring and Anchoring system will be selected during designing. Water level variation may be considered up to ground level.

g) **WALKWAY INSIDE THE PLANT**

The design of the Floating device should incorporate appropriety sized walking platform for the regular maintenance and inspection. The row alleys platform should be for both column and row alleys.

h) **INVERTERS/POWER CONDITIONING UNIT (PCU)**

The DC power shall be converted to AC by PCU to supply AC loads. Sizing of Inverter of the Plant will be decided during designing & engineering.

i) **INVERTER CUM CONTROL ROOM**

Total 10MW AC plant to be installed on three raw water ponds as per the clause no.5.7 (b) above. So for each individual Ponds one Inverter cum Control Room to be constructed to place inverters of the said plant and outdoor type oil filled inverter transformers (400v/33kV) to be placed near to the Inverter room.

j) **GRID CONNECTIVITY**:

Power is to be evacuated through 33 kV indoor switchgear present in the floating solar plant control room which shall ultimately evacuate through the common floating solar power evacuation line.

k) **CONTROL BUILDING**:

Bidder shall install Inverter Cum Control room near each Pond along with Transformer Yard.

There is a Common control building present near the Phase-II Raw Water Pump House. This building has two parts, one part for **Equipment Room** for housing Switchgear, electrical equipments/panels and other part for **Control Room** for Control operation, office cum meeting or conference room and equipment room which is having AC environment for the operation & maintenance of entire floating Solar Plant system.

In the Equipment Room only spare space has been kept for accommodating the incoming power of the individual pond power plant. Successful Bidder shall supply both 33 kV HT extension panels and 415 V LT extension panel, installation connect with the main bus and other hooking up its equipments with the existing 33 kV and 415 V Switchgear. 33 kV cable shall run from new transformer yard near each Pond (Pond no. 1, 2, and 4) to existing Common control Room near Pond No. 3.

l) **THREE WINDING TRANSFORMER**

Three winding outdoor type oil filled step up transformer (0.4kV/0.4kV/33kV) for each pond shall be connected to the outputs of two inverters as input and the 33kV HV output sides will be connected to the 33kV bus of HT switchgear present in existing Common Floating Solar Control room through Protection system, VCB etc.

m) **STATION AUXILIARY TRANSFORMER(SAT)**

33kV/415V **Oil type** Station Transformer (100kVA) is already present **in the Transformer Yard Adjacent to the existing Main Control Room** for light and other auxiliary purpose. Auxiliary power for this three power plant to be drawn from the Station Service Board (SSB)/ 415 V LT Switchgear and arrangement/refurbishment (if any) to done by the Vendor only.

However Supply installation charging of another similar type 100kVA Station Auxiliary transformer adjacent to main control room is under bidder's scope.

n) **HT SWITCHGEAR**

Inside the existing control room building, 33kV switchgear already have two outgoing and two incoming feeder apart from Bus-coupler, Bus PT, Line PT etc. Existing feeder are connected with following system:

i. Outgoing Fdr#1: Power transmission/evacuation capacity through Fdr#1 is 20MW.

ii. Out going Fdr#2: One no. Station Transformer for lighting and other auxiliary consumption,

iii. Incoming Fdr#1, 2: Two nos. Step-up Inverter Transformers (0.4kV/0.4kV/33kV) of existing floating solar of Raw Water Pond #3.

Present 10MW Power Solar Power shall also be evacuated through the same outgoing Fdr#1. Spare space provision is available in the existing control room for connecting the Solar Power extension panel with the existing 33kV Switchgear present in the Control Room on both sides. So bidder has to design the system accordingly to add other required HT feeders similar to make, type and rating of existing BHEL make 33 kV switchgear. Details of feeder etc is mentioned under specification of 33 kV HT Switchgear **(**Clause No.5.13.6.1**)**

o) **LT SWITCHGEAR:**

One number indoor type 415V LT switchgear is present in the Common Control Room for supply of 415 V (3 phases, 1 neutral and single phase for lighting etc). Provision of Space has been kept for extension of existing LT Panel. Supply installation and connection of these extension with Incomer (for new 100 kVA SAT) and Bus-coupler in the existing LT Switch Gear along with new Outgoing feeders.

C. TECHNICAL SPECIFICATION (CIVIL)

5.8 TECHNICAL SPECIFICATION FOR CIVIL JOB

5.8.1 MODULE MOUNTING STRUCTURE

5.8.1.1 SCOPE

This section covers activities related to Design, Manufacturing, Testing, Supply, Insurance, Transportation and Delivery at project site, Storage, Erection, testing of module mounting structure and anchoring the system. The module mounting structure shall be installed over an appropriately designed modular and pre-fabricated flotation device with appropriate buoyancy to support the weight of at least one solar panel and one person per Mounting Structure. Total designing and engineering for floating and anchoring technology to be provided by the module mounting structure manufacturer

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5.8.1.2 STANDARD

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

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

SL NO	Standards	Description
1.	ASTM D1693	Test for Environmental Stress Cracking of HDPE
2.	ISO16770	Stress cracking resistance of HDPE
3.	IS 15410:2003	Test for drinking water compatibility, Material safe for drinking water
4.	RoHS directive 2002/ 95/EC	Test for Restriction of Hazardous Substances
5.	ASTM D5397	Standard Test Method for Evaluation of Stress Crack Resistance
6.	IS800:1984	Code of practice for general construction of steel
7.	IS875: Part 1 & 2	Code of practice for Buildings & structure
	IS875: Part-3	Code of practice for Buildings & structures-Wind Loads
8.	IS1893:2002	Criteria for earthquake resistant design of structures-General Provisions and buildings
9.	IS3043:1987	Grounding of mounting structures
10.	IS 4759	Hot dip Zinc coating on structural steel and other allied products.
11.	IS4736	Hot dip Zinc coating on mild steel tubes
12.	IS2062	Hot Rolled Medium and High Tensile structure steel.
13.	ASTM D790, ISO 178	Standard Test methods for Flexural properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
14.	ASTM D638, ISO 527	Standard test method for Tensile Properties of Plastics
15.	ASTM D695, ISO 604	Standard test method for compressive strength properties of plastics
16.	ISO16770	Full Notch Creep Test (FNCT)
17.	ASTM D2565, ISO 4892-2	Standard practice for Xenon-arc exposure of plastic intended for outdoor applications
18.	ASTM D4329, ISO 4892-3	Standard practice for fluorescent ultraviolet (UV) lamp apparatus exposure of plastics
19.	ASTM G7/G7M-11	Standard practice for atmospheric environmental exposure testing of non-metallic

5.8.1.3 TECHNICAL REQUIREMENTS

❖ **FLOTATION DEVICE:**

a) The module structure design shall be appropriate and innovative. It must follow the existing water profile.
b) The flotation unit shall be prefabricated and designed for simple on-site installation. There shall be minimum requirement of welding, masonry or use of complex machinery at the installation site. The floatation unit shall be modular in nature to facilitate the ease of assembly / disassembling and provision to be scaled up. Each module / combination of maximum two modules should support at least one solar panel. All modules should be standardized and independently created. Walk way should be provided to access the flotation device.
c) The flotation device should be manufactured from HDPE with UV stabilizer. The design of the floatation device should have satisfactory rigidity, flexural strength (ASTM D790, ISO 178), tensile strength (ASTM D638,ISO 527) and compressive strength (ASTM D695,ISO 604) while loaded with maximum load under extreme environmental conditions. The grade of thermoplastic used should be tested under extreme weather conditions if sunlight, UV, heat, air, and water (ASTM D2565, ASTM D4329, ASTMG7/G7M-11), good environmental stress crack resistance and a combination of hardness and impact strength (ASTM D5397, ASTM D1693). The thermoplastic used should be safe for use when in contact with water. (Above points to be confirmed by Manufacturer's data sheet and test certificates).
d) Stability of floating device should be maintained. No colour variation after UV exposure equivalent to 10 years under 150 kilo-Langley / Year irradiation. Third party testing or witness is required by purchaser.
e) The flotation device shall have minimum strength at ambient temperature of the site location or minimum range of (+) 50 to (-) 10 Deg C, while it shall be designed to have safety factor of minimum 1.15 on extreme conditions.
f) The flotation device should be passed the Full notch creep test (ISO16770).
g) On the date of bid opening, the floater vendor should have proven experience and the agency should have supplied floater to any project in MW range, which is working successfully at least for a period of one (01) year under Govt./Quasi Govt./Reputed Private Organization (Listed companies).
h) The bidder has to ensure that the supplier of floater should not be more than one.
i) PV fixation system shall be of proven design and subjected to Mechanical test to withstand unit failure conditions under static and fatigue conditions for wind speeds to withstand the maximum wind speed of the area.
j) The materials used shall be halogen, silicon free conforming to RoHS directive 2002/95/EC. (Same to be confirmed by Manufacturer's data sheet and test certificates)

k) The floatation device should be chemically resistant to acid, lye, petrol and mineral oil and partially resistant to benzene.

l) The floatation device should pass the different HDPE material test from Central Institute of Plastics Engineering & Technology (CIPET) or reputed labs from India with may be inspected by the purchaser.

m) The floatation device used should be safe for use when in contact with drinking water and meet requirements stipulated in standard IS 15410:2003.

n) The min. thickness of thermoplastic used for floatation device should be 3 mm.

o) The floatation device, when installed in the raw water reservoir, should not restrict the process of gas exchange across the air water interface. More specifically, the water plane area (WPA) does not allow the transmission of sunlight into the water and the transfer oxygen across the air-water interface. In order to facilitate this, the design of the floatation device should be such that appropriate voids, greater than at least 30% of all area covered by the floatation device.

p) The floatation device should be designed such that it arrests evaporation and facilitates in evaporation loss mitigation. Vendor should provide appropriate cover by flotation device and solar panel and total coverage of water body should not more than 70% of the Raw Water Pond and water body. Appropriate vapour escape vents should be provided for each floatation device and solar panel assembly for the purpose of maintaining BOD of the water body.

q) The design of the flotation device should incorporate appropriately sized walking platform for regular maintenance and inspection. The row alleys platform should be for both column and row alleys.

r) The design of the floating device should incorporate appropriately sized walking platform for regular maintenance and inspection. The walking platform should have a continuous uninterrupted surface with the minimum width of at least 400 mm excluding cable laying arrangement. Walkable floater pathway shall be provided after consecutive two strings of modules. The complete floating system shall have at least 400 mm walking corridor all along the periphery comprising of module floaters and / or walkway floater to prevent water splash.

s) In order to increase longevity and prevent unexpected loss of buoyancy, the floating unit shall have a minimum material thickness of 3mm, with moisture retention of less than 5%. (Detailed buoyancy calculation to be submitted along with the drawings at the time of drawing approval).

t) Float system should be designed to withstand the maximum wind speed (200km/hr) and shall be able to withstand the weight of one O&M personal carrying tools, equipments etc with minimum weight of 80Kg.

u) Flexible mooring system shall be designed to keep the platform position to adopt waves, wind and water level variation.

v) The array structure should be so designed that it will occupy minimum space without sacrificing the output from SPV panels.

w) In case, Switch Monitoring Board (SMB) mounted on floaters, bidder to take into consideration the load of SMB during design of floaters and suitable supporting arrangement for mounting the SMB of floaters.

x) The floatation modules once assembled together should form an integrated structure and relative alignment of the flotation modules subsequent to complete installation (installing module mounting structure and solar PV modules) shall not misalign the solar panels and adversely affect their power generation capability.

y) In order to address the proper handling of panel mounting system during the severe weather conditions, floating vendor should have proper expansion capability for panel mounting system.

z) The floatation device should be re-processable and recyclable at the end of its useful life.

aa) Each floatation module should have its appropriate drainage facility such that there is no water logging on the floating module.

bb) Big wind tunnel test for the structures in all wind directions (real scale, real angle) for at least 2x4 configurations to be done.

cc) The clearance between lowest part of the module structure and the water level shall normally not be more than 250mm.

dd) The module alignment and tilt angle, in case of floating SPV power plant, shall be between 1 degree to 18 degrees. It shall be mounted facing south and tilted to an angle within the range og 1 degree to 18 degrees for optimum performance and appropriate wind resistance that must be mentioned in engineering drawing for approval of WBPDCL with documentary proof.

ee) Mountability of solar panel by the floatation device should be maximum 2 panels per unit.

ff) The flotation device should balance the thermal expansion so that PV panel not stretched by thermal expansion.

gg) Min. guaranteed life of the floatation device/ unit floater should be 25 years.

hh) The design of complete system, including CFD modeling, comprising of Floating unit, MMS and anchoring and mooring system, shall be verified by suitable third party NABL accredited agency/ reputed institutions like IITs and submitted for employer's approval.

ii) The flotation device should be manufactured locally (in India) only, to ensure safe work practice, genuine process is followed & transparent quality checks by WBPDCL at manufacturing premises any time.

❖ **MODULE MOUNTING STRUCTURE:**

a) The array structure shall be so design that it will occupy minimum space without sacrificing the output from SPV panels.
b) The structure shall be designed to allow easy replacement of any module by authorized personnel and shall be in line with the site requirements.
c) The array structure for metallic structure (if used) shall be made of anodized aluminium (aluminium alloys) / SS 304 or SS better grade, of suitable thickness size. (Same to be confirmed by suitable test report and material composition report) having sufficient strength and suitable size to mount/ support all the PV panel/ accessories/ equipment required for the plant. (To be supported by structural analysis report). All design shall be submitted during drawing approval with suitable test reports.
d) The complete support structure, design shall normally be designed to withstand wind speed up to 200km/hr (to be confirmed by suitable third party test report).
e) The complete plant is to be designed with proper anchorage system so as to withstand the wind pressure at maximum 200km/hr.
f) In general bolts, nuts, shims and other hardwires should be Zinc plated. Fasteners visible outside shall be of stainless steel SS 304. The generally applicable engineering principle will be the fasteners shall be equal to or of greater corrosion resistance than the most corrosion resistance metals being fastened.
g) Dedicated floating approach walkways to be provided from the end of the water body to each block of the plant with suitable railing on both sides. The block size of the floating system depends on the array layout optimization. The same shall be finalized during detailed engineering.

❖ **ANCHORING AND MOORING SYSTEM:**

The water level variation and prevailing wind speed are the primary safety consideration, to be taken into account, while designing the plant such that the plant has no impact on the reservoir. The mooring system thus needs to be designed that it not only restricts the lateral movement of the proposed plant but also accommodates the water level variability. In addition the mooring system should also have minimal impact on the overall ecosystem of the reservoir.

a) The minimum life of the Anchoring system shall be 25 years.
b) The materials used in the anchoring system shall not contaminate the water of or affect the aquatic life.
c) The design of mooring system shall permit minimal lateral movement of the plant in case of maximum wind loads (As per IS 875-3). Anchoring design report for the project showing that the system could support the maximum wind load on site shall be submitted to employer.

d) Placement of Plant: The placement of the plant in the water body shall be decided during detail engineering after conducting bathymetric survey, topographical survey, hydro graphic and hydrological studies and geo-technical assessment of the site.

e) Prevailing wind load: The mooring system should be designed for worst case scenario; for a wind load of 200km/hr. The design of the mooring should prevent the lateral movement of the plant in case of maximum wind loads.

f) Water variability: The mooring system should accommodate fluctuations in water level. Further the orientation of the plant needs to be maintained; hence fluctuations in water level should not result in lateral movement of the plant.

g) The mooring system should minimize its impact on the reservoir and thus as far as possible pilings or movement of mooring system of the reservoir bed should be avoided.

h) Suitable wind breakers should be provided.

5.8.1.4 PERFORMANCE WARRANTY

The manufacturer should warrant the Module Mounting Structure and Anchoring system to be free from the defects and/or failures specified below for a period not less than **fifteen (15)** years from the date of sale to the original customer (i.e. EPC Contractor).

i. Defects and/or failures due to manufacturing
ii. Defects and/or failures due to quality of materials
iii. Non conformity to specifications due to faulty manufacturing and/or inspection processes.

If the Solar Module Mounting Structure and Anchoring system fails to conform to this warranty, the manufacturer will repair or replace the Solar Module Mounting Structure and Anchoring system, at the Purchaser's sole option. The contractor shall be responsible to contact with the supplier if any of the above mentioned cases occurred.

5.8.1.5 APPROVAL

- Successful Bidder must take prior approval from WBPDCL before placement of their internal Order for Floaters. WBPDCL's acceptance of such makes shall be based on its prior performance and relevant credentials (as stated in NIT-Sec :V, clause no: 5.8.1.3)

- Design, drawings, specifications of all components with material selected & installation details shall also be included with Detailed Design Report.

- Joint inspections and testing will be done by WBPDCL 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 Mounting Structure" s workshop.

- Approval of the Engineer in charge should be taken before execution of the work at site.

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

5.8.2 INVERTER CUM CONTROL BUILDING:

New Inverter cum Control Room building is required to be constructed for housing the electrical equipment/ panel, Inverters, Local Lighting panel, Local UPS cum-UPS DB, Fire Fighting System etc other daily requirements for the operation & maintenance of Solar Photovoltaic Power Plant. The building shall be constructed with conventional RCC framed structure with brick partition walls for equipments and operations room. Equipment room shall be designed as per the OEM recommendations to ensure desired life of equipment. Bidder shall furnish the drawing of the proposed buildings to the Employer for approval, prior to construction. The construction of the same shall be as under-

5.8.2.1 EQUIPMENT ROOM LAYOUT:

Flexibility shall be kept for handling of equipment without obstruction both during erection and maintenance. Adequate handling facilities, space, door/ rolling shutter of adequate width and height shall be provided for the purpose. The followings specification shall be followed for designing the Equipments cum Control Building:

a) Minimum clearance between two switchgear panels, facing each other shall be maintained as 2200 mm. These distances shall be maintained for all other panels located inside the room.

b) 33 kV Switchgear Front side and rear side shall be with minimum 3 mtrs and 2 mtrs gap from Wall/Panel. Each 33 kV Indoor switchgear shall be kept with a minimum one additional space to install one breaker on either side other than the specified requirement. Switchgear cum control room shall be provided with a Monorail arrangement with Hoist.

c) Clearance from any obstruction like column, wall, and vertical raceway on back side of switchgears shall be maintained as 1200mm (minimum) for single front panel / 1500mm (minimum) for double front panel and shall also comply with manufacture's standard. Minimum Space between the sides of two switchgears or between any two panels or between switchgear and the wall shall be 1200 mm. Where access is not envisaged, clearance shall be 200 mm.

d) All electrical room shall be provided with 2 doors in addition to the shutters provided for handling transformer, switchgear, panels etc.

e) Switchgear room/MCC/Control room shall be pressurized above the atmospheric pressure to prevent ingress of dust.

f) Switchgear/MCC room shall have a minimum clear height of 4 m above floor level. All electrical equipment shall be located above the highest flood level. Cable trench shall be provided in the Inverter cum control room. Cable trench shall be designed as per NIT Sec V, Cl. No. 5.9.15.

g) Control room shall be separated from switchgear /MCC room.

h) Inverters shall be placed inside RCC covered (RCC roof) room with a clear height of 4 mtrs. in a separate room adjacent to the switchgear room. Inverter shall have open air ventilation / forced ventilation (as per the OEM's requirements) where air circulation shall be done through large windows with MS grill arrangement. Rest of the cover area (other than equipment foundation/ cable trenches) should be paved with RCC using nominal reinforcement.

i) Clearance from inverter to wall / grill /column shall be minimum1500 mm.

j) Existing Control room floor level shall be lifted and matching with the elevated floor level so that 33 kV breaker truck shall be removed smoothly.

5.8.3 PV ARRAY O&M MAINTENANCE ARRANGEMENT

Equipments which are required for day to day cleaning of the solar panels and for O&M of the solar plant shall be in the scope of the bidders and accordingly the bidder has to provide all the necessary equipments, accessories, tool & tackles, boat, piping arrangement which as may be required for the same. Bidder shall have to provide a paddle boat for O&M operation with carrying capacity of four persons.

5.8.4 APPROCH ROAD FOR SOLAR POWER PLANT

Suitable approach road from Control Building to Solar Plant to carry safe and easy transportation of equipment and material at the project site shall be made. The road should provide easy and fast approach to each location of the plant. Roads are to be constructed with sufficient width (minimum 3.75m) followed by 0.5m well compacted shoulders on each side. The road must be well compacted as per the relevant IS standards and MORTH updated till date. All peripheral roads and pathways from central road to Inverter room road shall be WBM road. Also, all cable crossings and other crossings shall be provided with GI/ Hume pipes.

Bidder shall have to construct suitable approach step / ramp from embankment to inverter cum control room along with road connectivity with 3mtrs wide concrete road.

5.8.5 WATCHMEN / SECURITY CABIN

Contractor shall provide adequate numbers of prefabricated Watchman's portable cabin at each corner of Ponds (1, 2&4) and strategic locations surrounding of the plant. The Minimum size of watchmen's (Security Cabin) cabin is 1.2 metre x 1.8 metre size and height of 2.4m with appropriate roof at the top. Location of the watch Cabin (Security Cabin) will be as directed by the Purchaser. The Prefabricated Security Cabin of size 3 metre x 3 metre at the main entrance gate shall be designed and constructed by the Successful Bidder keeping in view the safety and security of the power plant.

5.8.6 TRANSFORMER YARD

Transformer Yard shall be constructed adjacent to each Inverter Cum control Room near each pond for installation of Inverter Transformer.

5.8.7 Additional requirement:

- The peripheral road around the reservoir and access to inverter cum control room will be of minimum 5m in width and 1M shoulder on each side. The road will of rigid pavement. (Concrete road with reinforcement).
- The cable crossing across the embankment will be of reinforced concrete box culvert with sufficient spacing as per the electrical requirements.
- The cable will be on cable tray when laid over the reservoir embankment slope.
- Cable from toe of embankment to inverter room will be on pedestal/ rack.

- All road crossing for DC cable will be on reinforced concrete box culvert with sufficient spacing from electrical and serviceability considerations. However for HT cable, road boaring shall be used with GI pipes with a minimum thickness of 5mm & depth of 1 mtrs from the top of Road.
- If, any of the existing structure is damaged or required to be dismantled for convenience of the erection, the same has to mend good as per the original.
- Existing drainage system must have to be maintained. If, any cable crossing is required to cross over the existing toe drain of the reservoir, the same has to be properly blocked with RCC wall and drainage to be restored to the original.

D. TECHNICAL SPECIFICATION FOR ELECTRICAL

5.9 SPECIFICATIONS FOR SUPPLY MATERIAL

5.9.1 PV MODULE:

5.9.1.1 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.

a. Solar Mono/ Poly crystalline modules having capacity minimum 325 Wp shall be used for the project for 10 MW Solar PV Power Plant each at Sagardighi Thermal Power Plant, Murshidabad. However the make, capacity, technical specification and the model no. of each module connected with an individual inverter should be the same.

b. Total capacity of the Solar PV modules shall be designed to ensure **10 MW AC with minimum 10% overloading on DC capacity** and the net minimum guaranteed generation mentioned in the **clause no. 3.33 of GCC** of this tender document.

The scope of supply shall also include spare modules (at least 100 Nos) required for any normal or breakdown maintenance and special tools & plants required for erection & maintenance for each project. Corresponding parts of all the equipments & 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.

5.9.1.2 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: 61701/IS: 61701	Salt Mist Corrosion Testing of the module.
5	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 under off grid programme.

The test certificates issued from IEC accredited laboratories shall also be acceptable.

The manufacturers should get their samples tested as per the new format/ procedure which are effective from 1st April 2013 onwards as per MNRE, Govt. of India Guideline.

5.9.1.3 IDENTIFICATION AND TRACEABILITY

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

i. Name of the manufacturer of PV Module
ii. Name of the Manufacturer of Solar cells
iii. Month and year of the manufacture (separately for solar cells and module)
iv. Country of origin (separately for solar cells and module)
v. I-V curve for the module
vi. Peak Wattage, I_m, V_m and Fill Factor for the module
vii. Unique Serial No and Model No of the module

viii. Date and year of obtaining IEC PV module qualification certificate

ix. Name of the test lab issuing IEC certificate

x. Other relevant information on traceability of solar cells and module as per ISO 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 MNRE norms which is effective from 1st April 2013.

5.9.1.4 AUTHORIZED TESTING LABORATORIES/ CENTERS

PV modules must qualify (test reports/ certificate from IEC/NABL accredited laboratory should be enclosed) as per the relevant IEC 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).

5.9.1.5 PERFORMANCE WARRANTY

A. Material Warranty: The manufacturer should warrant the Solar Module(s) to be free from the defects and/or failures specified below for a period not less than five (05) years from the date of sale to the original customer (i.e. EPC Contractor).

i. Defects and/or failures due to manufacturing

ii. Defects and/or failures due to quality of materials

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

If the solar Module(s) fails to conform to this warranty, the manufacturer will repair or replace the solar module(s), at the Purchaser's sole option. The contractor shall be responsible to contact with the contractor if any of the above mentioned cases occurred.

B. Performance Warranty: The manufacturer should warrant the output of Solar Module(s) for at least 90% of its rated power upto initial 10 years & 80% of its rated power upto 25 years from the completion of trial run at site/date of final commissioning. The contractor shall collect the Warranty Certificate for performance of the modules from the manufacturer and submit the same to WBPDCL prior to delivery of the products to the respective sites.

If, Module(s) fail(s) to exhibit such power output in prescribed time span, the Contractor will bound to either deliver additional PV Module(s) to replace the missing power output with no change in area of site used or replace the PV Module(s) with no extra cost claimed at Purchaser 's sole option.

Manufacturer of proposed PV modules must have the ISO 9001:2008 or ISO 14001 Certification for their manufacturing unit for their said manufacturing item.

Note: Only indigenously manufactured PV modules should be used in Grid Connected Floating 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 and approval of the Purchaser**.**

5.9.1.6 PERFORMANCE RATIO OF THE PLANT

Performance Ratio of the plant calculated for any time period of measurement shall be minimum 75 %.

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 Purchaser / Purchaser's engineer.

The final tests to prove the guaranteed performance parameters shall be conducted at site by the Contractor in presence of the Purchaser. 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 IS/IEC 61724: 1998 (Photovoltaic system performance monitoring - Guidelines for measurement, data exchange and analysis).

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

Where;

$\mathbf{Y_A}$ = 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)

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

$\mathbf{Y_R}$ = 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)

Or, $Y_R = I_{R\ Site} / I_{R\ STC}$

E_{ac}	=	AC energy injected into the grid during a clearly specified amount of time (kWh)
P_{Nom}	=	Installed nominal peak power of modules (Flash test rating at STC) (kWp)
$I_{R\ Site}$	=	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)
$I_{R\ STC}$	=	Irradiance at STC (kW/ sq. m)
$T_{cell\ avg}$	=	Average cell/ module temperature (^{0}C)
T_{cell}	=	STC cell/ module temperature (^{0}C)
α	=	temperature coefficient of power (negative in sign) corresponds to the installed module (%/^{0}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 ±1 °C.
- Shielded ventilated thermocouple with a measurement accuracy of ±1°C.
- An anemometer mounted on a 10m mast to measure wind speed (without additional shadowing on modules).

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

5.9.1.7 TECHNICAL REQUIREMENTS

- Modules should be **Mono /** Poly crystalline type having capacity of **minimum 325 Wp**. Higher capacity Solar PV modules will be preferred.
- The module frame shall be made of aluminium or corrosion resistant material, which shall be electrically compatible with the structural material used for mounting the modules. Grounding / Earthing provision shall be provided.
- Solar module shall be laminated using lamination technology using established polymer (EVA: Ethylene-vinyl acetate).
- The back sheet used in the crystalline silicon based modules shall be of 3 layered structures. Outer layer of fluoropolymer, middle layer of Polyester (PET) based and Inner layer of fluoropolymer or UV resistant polymer. Back sheet with additional layer of Aluminium also will be considered. The thickness of back sheet should be of minimum 300 microns with water vapour transmission rate less than 3g/m2/day. The Back sheet shall have voltage tolerance of more than 1000 V.
- 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 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**. The solar cell shall have surface anti-reflective coating to help to absorb more sunlight in all weather conditions. 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.
- The peak-power point voltage and the peak-power point current of any supplied module and/or any module string (series connected modules) shall not vary by more than 2 % (two percent) from the respective arithmetic means for all modules and/or for all module strings, as the case may be.
- 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 25 years.
- The modules should be 100% PID (Potential Induced Degradation) tolerant 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 65 and shall have sufficient bypass diodes to avoid shadowing effects.
- Modules shall perform satisfactorily in relative humidity up to 95% and temperature between -10^{0}C and 85^{0}C (module temperature).
- The PAN file of the solar module should be validated by Third party.

- 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.
- 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 and should be highly reliable, light weight and must have a service life of more than 25 years.

5.9.1.8 SPECIFICATION OF THE PV MODULES

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

SI. No.	Item	Description
1	Type	Crystalline Silicon – **Mono / Poly**
2	Efficiency of module	Minimum 15 % at STC
3	Cell efficiency	Minimum 17 % at STC
4	Fill Factor	Minimum 73 %
5	No. of cells per module	atleast 72
6	Module Frame	Non-corrosive and electrolytically compatible with the structural material, preferably anodized Aluminium.
7	Termination box	Thermo-plastic, IP 65, UV resistant
8	Blocking diodes	Schottky type
9	Bypass Diode	Yes, as required
10	Power Rating	The nominal power of a single PV module shall be minimum 325 Wp
11	Power tolerance	upto +5 %
12	Temperature co-efficient of power	Less than - 0.50% / °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.

5.9.1.9 APPROVAL

- The Detailed Design Report Submitted by the contractor to WBPDCL must contain but not limited to the following details of the solar modules:
  - Detailed specification
  - Necessary Drawings
  - Type Test Report and Necessary Certificates etc.
- Inspection of Electro Luminescence (EL) & Potential Induced Degradation (PID) tests during manufacturing of solar PV modules may be carried out by WBPDCL.
- Joint inspections and testing will be done by WBPDCL 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 WBPDCL) as acceptance tests of Solar PV Modules:
  - Visual Inspection
  - Thermal cycling test
  - Damp heat test
  - 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/m^2) 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
  - Potential induced degradation test
  - Mechanical load test
  - Solar cells: Cell tester.
  - EVA: Gel content test and pressure cooker test.
  - Glass: Fragmentation test

- Frame: Frame anodizing test
- Junction box: IP 65 test.
- Ribbon: Elongation test and camber test.
- RTV Silicone sealant: Adhesiveness test.
- Electroluminescence test to detect micro cracks.
- Ammonia test for anti-corrosion
- Any other test as desired by WBPDCL

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
  - 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 WBPDCL.
- WBPDCL 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 WBPDCL in respect of taking further course of action.

5.9.1.10 ACCEPTANCE CRITERIA:

- Each module is to be tested for electro luminescence test (on site) to detect micro cracks and pass the test as per IEC norms and also record of data on the test for each module will be done by WBPDCL for future studies. Contractor has to co operate at site.
- 25 no modules to be carried out NISE, Delhi or any NABL or MNRE accredited test centers.
- For the above (i.e.25 no modules) special packing if required may be done to shift the panels from manufactory site to testing lab as directed by WBPDCL.

- Sufficient competent man power to be deployed at test centre for sufficient days to unpack and repack the modules after the test.
- Contractor has to coordinate with WBPDCL for all the testing activity.
- 1no. module from each batch of production will be tested for PID (1000V) & LID test also need to be carried out test and results should be submitted to WBPDCL.

5.9.2 GRID CONNECTED INVERTERS

5.9.2.1 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/Power Conditioning Unit (PCU) as detailed hereunder.

a. Adequate number of outdoor Solar Central Inverter of minimum capacity 500 kW having high quality, high efficiency and reliable operation. Total inverter capacity of the plant should not be less than 10000 kW(AC).

b. The scope of supply shall also include necessary spares, if any, required for normal or any breakdown maintenance for at least 05 (five) years and special tools & plants required for erection & maintenance. Corresponding parts of all the equipments & 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.

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.

5.9.2.2 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/IS: 61683	Photovoltaic systems – Power Conditioners – Procedure for measuring efficiency
2	IEC 62093	Balance-of-system components for photovoltaic systems – Design qualification

		natural environments
3	IEC 60068	Environmental Testing
4	IEC 62116 / IEEE 1547/UL 1741/ equivalent IS standard	Islanding Prevention Measurement
5	IEC 61727 Relevant CEA/ CERC regulation and grid code (amended up to date)	Interfacing with utility grid
6	IEC 61000 series	EMC, harmonics, etc.
7	IEC 62109 (1&2), EN 50178 or equivalent	Electrical safety
8	IEC 62093 or equivalent	Reliability test standard

Solar Inverters should have certificate and approval from VDE, IEC 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.

5.9.2.3 TECHNICAL REQUIREMENTS

- The inverter should be 3-Φ static solid state type power conditioning unit.
- Inverter/PCU shall be centralized grid tied in nature, shall consist of MPPT controller. Inverter shall be selected based on array design. Associated control and protection devices shall be an integrated part of the PCU.
- Degree of protection of the outdoor Inverters shall confirm at least IP-56.
- The inverters shall be built in with data logging system for remote monitoring of the plant performance through external PC. (PC shall be provided as a part of the Solar PV Plant).
- 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 shall have suitable fuses & surge arrestors and contactors to allow safe start up and shut down of the system.
- PCU shall be capable to synchronize independently & automatically with grid power line frequency to attain synchronization and export power generated by solar plant to grid.
- Inverters shall have the features like Low Voltage Ride through (LVRT), High Voltage Ride through (HVRT) etc. for grid support and connection.
- Inverters should run in synchronized manner, effect of one inverter should not be reflected to the others. The PCU shall be capable of operating in parallel with the grid utility service and shall be capable of interrupting fault line currents, line to ground fault currents and short circuit currents.
- The PCU shall be able to withstand an unbalanced load conforming to related IEC standard (+/- 5% 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 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.
- The inverters shall operate satisfactorily within the operating ambient temperature range of -15°C to +60°C. The contractor shall assure that the inverter should not de-rate upto 50°C ambient temperature.

- To take care of PID (Potential Induced Degradation), the inverters should have active negative grounding kit.
- Following protections shall be provided with the inverter.
    - Over voltage both at input & output
    - Over current both at input & output
    - Over/under grid frequency
    - Heat sink over temperature
    - Short circuit
    - Protection against lightning
    - 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
    - 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.
    - 15 minute, Daily, monthly & Annual energy generated by the solar system(kWh)
    - Solar system temperature
    - Ambient temperature
    - Grid Voltage, frequency and power factor
    - AC and DC side voltage and current
    - Power factor on AC side
    - DC injection into the grid
    - 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 etc.
    - Total Current Harmonics distortion in the AC side
    - Total Voltage Harmonic distortion in AC side
    - Efficiency of the inverter

- Solar system efficiency
- Display of I-V curve of the solar system
- Fault details with time when occur.
- Any other parameter considered necessary by supplier of the solar PV system based on prudent practice.

5.9.2.4 SPECIFICATION

SI. 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	Number of MPPT channel shall be minimum one. One spare MPPT channel shall be provided.
2	Output (AC)	
	Nominal AC Power output	500 kW (minimum)
	Number of Grid Phase	3
	Adjustable AC voltage range	+/- 10%
	Frequency range	+/- 5%
	AC wave form	Sine wave
	THD	Less than 3%
	Switching	H.F. transformer/transformer less
3	General Electrical data	
	Maximum Efficiency	97.5 % (minimum)
	VAR Control	Optional
	No load loss	< 1% of rated power
	Maximum loss in sleep mode	< 0.05% 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)
	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

SI. No.	Operating Parameter	Desired specification
		ii. On site dumping data from the memory iii. Plant based remote monitoring system
10	Storage of Data	At least for 1 year. Separate data logger may be provided to meet the criteria.
11	Monitoring	Matched with the monitoring and data logging system (SCADA)
12	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 %
	Noise Emission	Less than 80 dB (A) @ 1 meter
	Cooling	Forced cooling

5.9.2.5 Communication interface

The project envisages a communication interface which shall be able to support:

- Real time data logging
- Event logging
- Supervisory control
- Operational modes
- Set point editing

5.9.2.6 COMMUNICATION SYSTEM

Communication System shall be an integral part of inverter. All current values, previous values up to 40 days and the average values of major parameters shall be available on the digital bus.

5.9.2.7 DATA LOGGER SYSTEM

Data logger system (Hard ware) and the software for study of effect of various environmental & grid parameters on energy generated by the solar system and various analyses would be required to be provided.

The communication interface shall be suitable to be connected to local computer and also remotely via the Web using either a standard modem or a GSM / WIFI modem.

All the soft and hard data shall be connected from different Inverter cum control of this package to the SCADA of existing Control room near Raw Water Pond-3 through FO cable. Entire supply of cable and accessories, laying, termination / hookup, configuration, commissioning & display of entire soft data at the existing OWS at the existing BHEL server shall be under bidder scope.

5.9.2.8 APPROVAL

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

- Detailed technical description of the complete unit
- Necessary Drawings
- Type Test Report etc.

Joint inspections and testing will be done by WBPDCL 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 WBPDCL) 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 WBPDCL

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 WBPDCL.

5.9.2.9 Acceptance:

a) Factory tested for routine & type as per IEC norms in the presences of WBPDCL staff along with warranty & guarantees certificates.

b) The supplied inverters should have weighted average efficiency under Indian conditions be minimum 93% and minimum input power under Indian conditions should be above 85%.

5.9.3 PV ARRAY

Desired specification of the PV Array shall include but not limited to the following:

Sl No	Item	Description
1.0	PV Module interconnection connector	MC-4 / Tyco
2.0	PV Module interconnection cable and array cable	PV 1-F standard /NEC standard "USE-2 or RHW-2" type (double insulated)
3.0	PV array String Voltage	Compatible with the MPPT Channel of the inverter

5.9.4 STRING MONITORING BOX (SMB)

5.9.4.1 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 array junction box as detailed hereunder.

a. Adequate number of String Monitoring Boxes shall be provided for termination of array string with inverter.

b. The number and specification of PV String Monitoring Box will be as per plant configuration.

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

5.9.4.2 STANDARDS

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

Sl. No.	Standards	Description
1	IS 13703: Part 1	Low voltage fuses for voltage not exceeding 1000V AC or 1500V DC: General Requirements
2	IEC 60269: Part 4 /IS 13703: Part 4	Low-voltage fuses: Supplementary requirements for fuse-links for the protection of semiconductor devices
3	IEC 60269-4: Part 6	Low-voltage fuses: Supplementary requirements for fuse-links for the protection of solar photovoltaic energy systems
4	VDE 0636	Low-voltage fuses

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.

5.9.4.3 TECHNICAL REQUIREMENTS

- The junction Boxes shall have suitable arrangement for the followings (typical):
  - Combine groups of modules into independent charging sub-arrays that will be wired into the controller.
  - Provide arrangement for disconnection for each of the groups.
  - Provide a test point for each sub-group for quick fault location finding.
  - To provide group array isolation.
- The string monitoring box shall be dust, vermin, and waterproof and made of Polycarbonate Plastic.
- The string monitoring box shall be of IP 65 or better.
- The terminal will be connected to bus-bar arrangement of proper size. The junction boxes shall have suitable cable entry points fitted with cable glands of appropriate sizes for both incoming and outgoing cables.
- Suitable markings shall be provided on the bus-bars for easy identification and Cables shall be fitted at the cable termination points as per appropriate polarity.

- Each String shall be terminated through Fuses of required current rating
- The string monitoring box shall be provided with suitable Surge Protection Device (SPD).

5.9.4.4 APPROVAL

The Detailed Design Report Submitted by the contractor to WBPDCL must contain but not limited to the following details of the String Monitoring Boxes:

- Detailed specification
- Necessary drawings etc.

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

- Guarantees
- Instructions for installation and operation, manuals
- Necessary test certificates

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

5.9.5 THREE WINDING TRANSFORMER

5.9.5.1 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.

a. One number of 3-Φ, three winding, oil filled, ONAF/ONAN type cooled transformers per pond with suitable capacity (not less than 10% higher margin as per NIT) 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.

b. Two LV winding of the three winding transformer will be connected to the outputs of two inverters and the HV sides will be connected to the 33 KV line through VCB, Isolator etc. Three winding transformer will be Oil Type and placed outside of each local Inverter cum control room.

c. Supply, laying, termination, testing, charging of 33/36 kV grade cable from respective Transformer Yard to existing 33 kV switchgear at Control room near Raw Water Pond no.3. The said 33 kV cable shall be terminated at new extension panel supplied under this package (Refer Single Line Diagram).

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.

5.9.5.2 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: 335	Transformer oil
5	IS: 3637	Gas and oil operated relay
6	IS: 5120	Fittings and accessories for power transformers
7	IS: 6088	Dimensions for porcelain transformer bushings
8	IS: 3347	Loading guide for oil-immersed transformers
9	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 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.

5.9.5.3 TECHNICAL REQUIREMENTS

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

Sl. No.	Standards	Description
1	Type	Three Winding

Sl. No.	Standards	Description
2	No. of phases	Three
3	Installation	Outdoor on rails
4	Rated continuous MVA at maximum ambient temperature of 40^0C	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/ONAF
7	Winding material	Copper
8	Connection	
	HV	Delta
	LV	Star-Star
9	Vector group	YNy11y11or as per system requirement
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	170kV (Peak)
	LV	NA
14	Insulation level (Power freq. withstand)	
	HV	70 kV (rms)
	LV	3 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
17	Hot spot temperature over a maximum yearly weighted average ambient temperature of 32 °C	105°C
18	Short circuit current for 1 sec. on HV side	25 kA
19	Short circuit withstand time	2 sec
20	Insulation	
	HV winding	Class B (Winding insulation shall be able to withstand 33 kV continuously)
	LV winding	Class B (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

Sl. No.	Standards	Description
		operation.
22	Noise level	< 90 dB As per NEMA TR-1 standard
23	Cooling medium	Mineral oil (as per IS 335)
24	Earthing	LV neutrals solidly earthed through neutral CT, HV side should also be earthed.
25	Minimum efficiency	98%

5.9.5.4 DESIGN CRITERIA

- 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: 50^0 C
  - Maximum daily average ambient air temperature: 40^0 C
  - Maximum yearly weighted average ambient air temperature: 32^0 C
  - Minimum ambient air temperature: - 5^0 C
- The transformer shall be capable of withstanding the short circuit stresses 25 KA due to a terminal fault on one winding with full voltage maintained on the other winding for minimum period of two (2) seconds. This capability shall be demonstrated by type test report.
- Neutral Grounding Resistor (NGR) (if applicable):
  - The resistor element shall be made of non-aging stainless steel having high electrical resistivity and low temperature co-efficient of resistant. Group of resistor elements shall be mounted together between end plates to form a bank. Banks are then to be connected in series-parallel combination to provide the current and ohmic value required. Adjacent banks shall be insulated from each other and the metal frame.

- Each neutral grounding resistor shall have structural work enclosed on all sides and also on top by sheet steel. Suitable ventilating louvers shall be provided on sides to ensure proper ventilation. The louvers shall be provided with fine wire mesh to make it vermin proof. Protection class shall be IP55 or better.
- Each cubicle shall be complete with two (2) nos. ground pads, tapped holes and bolts suitable for connection of 75 x 10 mm galvanised steel flats.

- Transformer neutral shall be grounded through NGR. The Neutral Grounding Resistor (NGR) shall be used for non-effective grounding of HV System of the plant. NGR shall be connected between the equipment neutral point and earth.
- Neutral Grounding Resistor shall be used to limit the magnitude of earth fault current so that damage of Electrical equipment is reduced, safety of personnel is increased and sensitive / selective earth fault protection can be provided.
- 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.
- Necessary protection arrangement should be provided in the transformer.
- 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.
- Oil pit with sump pump arrangement to be provided if oil capacity of the transformer is more than 2000 l. Capacity of oil pit shall be minimum 1.25 times of total oil capacity of transformer.
- **Insulating oil**
  - The transformer shall be filled with mineral insulating oil suitably inhibited to prevent sludging.
  - First filling of oil along with 10% excess shall be furnished for each transformer. Oil shall be supplied in non-returnable containers suitable for outdoor storage.

- Oil preservation shall be by means of bellows/ diaphragm sealed conservator tank with silica gel breather to avoid direct connection between atmosphere and transformer oil. It shall be complete with level gauges, pipes, drain valve, buchholz relay with shut-off valves at both sides etc. The level gauges shall be so placed that same can be readable standing from ground. Necessary device shall be kept to provide annunciation in the event of rupturing of bellow.

- **Marshalling box:**
  - A sheet steel, weatherproof, IPW55, marshalling box shall be provided for the transformer. The box shall contain all auxiliary devices except those which must be located directly on the transformer.
  - All terminal blocks for cable connection shall be located in this box.
  - The marshalling box shall be provided with cubicle lamp with door switch, space heater with thermostat and removable cable gland plate.

5.9.5.5 APPROVAL

The Detailed Design Report Submitted by the contractor to WBPDCL 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 drawings of transformers and fittings/accessories
  - Assembly drawings and weight of main components.
  - Transport drawings, showing main dimensions and weight of each package.
  - Foundation details
  - Tap-changing equipment
  - Name-plate diagrams
- Necessary test certificates and type test reports.

A joint inspection and testing will be done by WBPDCL 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 WBPDCL.

5.9.6 33kV INDOOR SWITCHGEAR & POWER EVACUATION

5.9.6.1 SCOPE

Proposed plant site is at SgTPP and evacuation voltage level is 33kV. 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 36KV, 3 phase, 50 Hz air insulated Metal clad indoor VCB type switchgear & Power Evacuation System unit with horizontal draw out horizontal isolation circuit breaker as per IS 13118 (1991)/IEC-60056 and other standards for satisfactory operation of 10 MW Solar PV Power Plant in SgTPP, Sagardighi, Murshidabad, West Bengal though **the bas bar capacity of the existing 33kV switchgear is capable of handling 20MW power**.

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 design of the switchgear shall be based on safety to personnel and equipment during operation and maintenance, reliability of service, ease of maintenance, mechanical protection of equipment, interchangeability of equipment and ready addition of future loads.

Power shall be evacuated through existing 33 kV Switchgear installed at common Control Room for Floating Solar near Raw Water Pond No.3. The technical details of the said switchgear are mentioned in this specification.

The details of the equipments present in the existing switch gear are described in the clause no.

Bidders shall supply the following equipments for extension of the existing switchgear for the evacuation of 10MW power. Bidder shall supply at least **seven** number 33 kV VCB panels of similar type, rating and make of present existing 33 kV

switchgear complete with all accessories. All new 33 kV panels shall be installed and successfully connected and charged with existing power Bus, control bus on both the side of Bus-section, maintaining load balance. Necessary space provision is kept for this panel extension. The following equipments shall be supplied for the extension of the existing 33kV switchgear:

a. 33kV incoming feeder:

Three(3) no 33kV outgoing feeder from Inverter Transformer of pond no.1, 2 & 4 Floating Solar plant shall be supplied as incomer of 33kV Switchgear

Supply, laying, termination and charging etc of cable 33kV grade shall be done from the outgoing feeder from Inverter Transformer to the incoming feeder 33kV Switchgear. Distance from Inverter Control Room to 33 kV Switchgear shall be different for different feeder. However bidder shall evaluate the distance during detail engineering. Details of the cable laying root and specification given in the clause no.5.9.15.5 and 5.9.15.6.

b. 33kV Outgoing Feeder:

One (1) out going feeder and Line PT shall also be supplied and connected on Bus Section 2 having a power evacuation capacity of 20 MW complete with all accessories similar to the present out going feeder of 20 MW capacities.

Supply, laying, termination and charging etc of cable 33/36 kV grade shall be done from this new outgoing feeder (20MW capacity) to new 33kV bay at SgTPP Switch Yard(under construction). Distance from Main Floating Solar Control Room to New 33 kV Switchyard is around 1000 mtrs. However bidder shall evaluate this distance during detail engineering.

c. Outgoing feeder for 100kVA Station Auxiliary Transformer(SAT):

One(1) Outgoing feeder for new Station Auxiliary Oil Type Transformer (100 kW capacity) shall also be supplied and connected on Bus Section 2 complete with all accessories similar to the existing out going Station Auxiliary Transformer feeder installed at Bus section 1 of existing Common 33 kV switchgear.

Supply, laying, termination and charging etc. of cable 33/36 kV grade shall be done from this new outgoing Station Aux. Transformer Feeder to new Station Aux. Transformer are under bidder scope.

Table for new 33 kV panel extensions:

Sl No.	Description	Quantity

1	Incoming feeder from each Floating Solar Inverter Transformer (from Pond no. 1, 2 & 4) Evacuation capacity of each feeder is in line with MW capacity mentioned in the specification with 10% higher margin	3 Nos.
2.	Outgoing feeder with 20 MW capacity with Line PT	1 No.
3.	Outgoing feeder for 100 KVA SAT	1 No.
4	One Spare feeder for 3.5 MW Incoming capacity	1 No.
5.	Outgoing Transformer feeder for 2.5 MVA capacity for Storage Battery	1 No.

Details of the Electrical Layout is shown in the attached tender drawing No.SG-FLSP-DWG-E-01 for ready reference of the bidder.

5.9.6.2 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: 5	Colors for ready mixed paints & enamels
2	IEC-62271-100,200; IEC-600298 / 600694; IS-3427	AC metal enclosed switchgear & control gear for rated voltages above 1 kV & up to & including 52 kV.
3	IS: 13947/ IEC 60529	Degree of protection provided by enclosures for switchgear.
4	IS: 1901	Specification for visual indication lamps
5	IEC-60056 / IS 13118 /IEC	High Voltage Alternating current Circuit Breakers
6	IS: 2705 - (Part I - IV)/ IEC 60185	Current Transformers
7	IS: 3156 - (Part I - IV)/ IEC 60186	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-3231 & 3842 / IEC 60255	Electrical relays for Power Systems
12	IEC: 62271-102/ IEC 60129	Alternating current disconnectors and earthing switches

Sl. No.	Standards	Description
13	IEC-99-4	Metal oxide surge arresters without gates for A.C. systems

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.

5.9.6.3 SPECIFIC TECHNICAL REQUIREMENTS/PARAMETERS:

All indoor switchgear panels shall have minimum technical parameters for design consideration as mentioned hereunder:

BUS BARS/CUBICLE

SI. No.	Description	Requirement
1	Nominal/Highest System Voltage	33 kV/36 kV
2	Type of Installation	Indoor
3	Max. Ambient Temp. and Temp. Rise	As per IS/IEC
4	Min. Clearances in air (Phase to Phase and Phase to Earth)	As per IS/IEC
5	Degree of protection	IP 52
6	Continuous current rating	As per system design which is capable of handling 20MW power
7	Short Time Current Rating for 1 sec	25 kA
8	Rated Power Frequency withstand voltage	70 kV (rms)
9	Rated Lightning Impulse Withstand Voltage	170 kV (peak)
10	Cable Entry	From bottom

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	Indoor
5	Duty Cycle	O- 0.3 sec-CO-3 min-CO

SI. No.	Description	Requirement
6	Operating cycles	Min. 10000
7	Control Voltage	110/220 V DC (10% to -15%)
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 55
13	Operating mechanism	Spring Charged

CURRENT TRANSFORMER

SI. No.	Description	Requirement
1	Type	Cast Resin Type
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 B or better
6	Rated Power Frequency withstand voltage (Primary/secondary)	70 kV (rms)/3 kV (rms)
7	Rated Lightning Impulse Withstand Voltage	170 kV (peak)
8	Protection Class	5P20
9	Diff./REF Protection Class	PS
10	Metering Class	Class 0.2 and ISF <=5

POTENTIAL TRANSFORMER

SI. No.	Description	Requirement
1	Type	Cast Resin Type
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 B or better
6	Rated Power Frequency withstand voltage (Primary/secondary)	70 kV (rms)/3 kV (rms)
7	Rated Lightning Impulse Withstand Voltage	170 kV (peak)
8	Accuracy Class	0.2 for metering and of 0.5 for other purposes.

ISOLATOR/DISCONNECTING SWITCH

SI. No.	Description	Requirement
1	Type	Cast Resin Type
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 system design which is capable of handling 20MW power
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)

SURGE ARRESTOR

SI. No.	Description	Requirement
1	Type	Metal Oxide Gapless
2	Rated Voltage	30 kV
3	Nominal Discharge Current	As per IS
4	Installation	Indoor
5	Rated Power Frequency withstand voltage	70 kV (rms)
6	Rated Lightning Impulse Withstand Voltage	170 kV (peak)

EXISTING 33 KV SWITCHGEAR FOR COMMON POWER EVACUATION:

SI. No.	Description	Requirement
1	Type	Vaccum, VM-36
2	No. of Poles	3
3	Make	BHEL, Bhopal
4	Nominal/Highest System Voltage	33 kV/36 kV
5	Nominal current	1250A
6	Type of Installation	Indoor
7	Duty Cycle	O- 0.3 sec-CO-3 min-CO
8	Control Voltage	220 V DC

SI. No.	Description	Requirement
9	Short Time Current Rating for 3 sec	25 kA
10	Short Circuit Making Current	62.5 kA

5.9.6.4 GENERAL REQUIREMENTS

The 33 kV Indoor Switchgear shall be designed considering the minimum general requirements as mentioned hereunder:

A. STRUCTURAL & MECHANICAL CONSTRUCTION

i. The Switchgear shall be factory assembled, totally enclosed, metal clad, dead front cubicle. It shall be of sheet Steel (preferably galvanized to avoid rusting) construction and shall be dust, moisture and vermin proof complying with degree of protection of not less than IP-4x as per IS-3427 (1997). The panels shall be of Metal Clad compartmentalized design with all the High Voltage compartments viz. Circuit Breaker, Bus Bar, Current Transformers and Voltage Transformers separated by metallic partitions. The switchgear panels shall be rigid without using any external bracing. The switchboard panels should comply with relevant ISS/IEC and revision thereof and shall be designed for easy operation maintenance and further extension. Bus bar, metering, circuit breaker chamber, cables and cable box chamber should have proper access for maintenance, proper interlocks should be provided. All instruments shall be non draw-out type and safeguard in every respect from damages. The switchgear shall be complete with all necessary wiring fuses, auxiliary contacts, terminal boards etc.

ii. The overall design of the switchboard shall be such that front access only is required. The panels shall be constructed from prime quality folded and bolted steel sheet of 2 mm thick or Al-Zn sheet steel. Only doors and end covers shall be painted with paint shade as specified.

The observation window on the CB compartment door shall be provided. Observation window shall be of same material and construction as the type tested design/construction.

The design of the panels shall be such that no permanent or harmful distortion occurs either when being lifted by eyebolts or when moved into position by rollers or transpallets.

The switchgear and control gear should have the minimum degree of protection (in accordance with IEC 60529)

- IP 4X for the enclosure for rated current up to 1250A

- IP 3X for the enclosure for rated current up to 2500A

- IP 2X for the partition between compartments

The switchgear must be readily extendable in either direction.

iii. For Seismic Applications: The switchboard may be subject to seismic disturbance, hence the switchgear supplier shall provide proof by type test or calculation according to IEEE 693 standards, documentation to support the offered equipment.

iv. Each cubicle shall be equipped with anti-condensation heater controlled by thermostat.

v. Assembly of all current carrying parts shall be such that they shall be easily accessible for inspection and maintenance.

vi. Switchgear cubicles shall be satisfied the requirement of IEC:62271-200, IEC:60298, IEC:60694.

vii. Switch gear shall be supplied with basic operating tools.

viii. The switchgear and control gear shall be suitable for continuous operation under the basic service conditions indicated below.

Ambient temperature °C	- 5 to + 50
Relative humidity	up to 95%
Altitude of installation	up to 1000m, IEC120.

B. BUS BARS AND CONNECTORS

Bus bars and all other electrical connections between various components shall be made of Electrolytic copper of adequate cross-section. The bus bar section shall be of ample capacity to carry the rated current for 20MW power with 10% higher margin, continuously without excessive heating and for adequately meeting the thermal and dynamic stresses in the case of short circuit in the system up to full fault MVA. Minimum 4 bolts shall be connected with sufficient contact surface for each bus to bus connection.

All bus bars shall be rigidly and firmly mounted. Spacious bus bar chamber shall be provided with use of tubular busbar design and free from any high voltage stresses by avoiding all sharp edges and bringing them to uniform potential. Bus bar shall be sleeved for full voltage. Sleeve shall be heat shrinkable BTPM type of Raychem make. **No PVC sleeve in bus bar for 36KV is acceptable.**

Bus bar shall be located in a separate metal clad chamber and shall be air insulated. It shall be adequately supported on insulators or integral epoxy spouts to withstand dynamic stress due to the short circuit current as specified.

Bus bar shall be extensible on either side to make it in switch board configuration in future.

C. CIRCUIT BREAKER

a) The Circuit Breaker shall be drawing out type suitable for installation in the switchgear cubicle. The breakers shall comply with IS-13118 / IEC-60056 conforms to latest amendment thereof.

b) The Circuit Breaker shall be spring operated, DC Motor charged, manually released spring closing mechanism with three pole simultaneous operation. The indicating device shall show the OPEN and CLOSE position of breaker visible from front of the cubicle. The spring charging time of the motor shall not exceed 15 sec. The “TRIP” and “CLOSE” coils shall be of reliable design and low consumption preferably less than 300W. It shall be possible to manually charge the circuit breaker operating spring in case of auxiliary supply failure.

c) The breakers shall be capable of Making & Breaking the short time current in accordance with the requirement of ISS 13118 / IEC 60056 conform to latest amendment thereof and shall have 3 phase rupturing capacity of 31.5KA at 33KV. The continuous current rating of breaker shall not be less than 1250A for all items.

d) The circuit breaker shall be isolated by horizontal racking and positively fixing the unit into any one of the following positions:,

- **Service position**; main and auxiliary circuits connected
- **Test position**; main circuits disconnected auxiliary circuits connected. Circuit breaker in its isolated position shall be completely contained in the

apparatus compartment with shutters on main circuit closed and compartment front door closed.

- **Withdrawn position**; main circuits and auxiliary circuits disconnected. Circuit breaker is removed out of the cubicle.

e) Locking of circuit breaker in the test position shall be possible by means of key lock on the earth switch manoeuvre.

f) A position indicator switch or viewing window must be provided for visual indication of the circuit breaker position.

g) Comprehensive interlocking system to prevent any dangerous or inadvertent operation shall be provided. Isolation of circuit breaker from bus bar or insertion into bus bar shall only be possible when the breaker is in the "OPEN" position.

h) Each circuit breaker shall be provided with following accessories.

i) ON-OFF indicator for indicating circuit breaker position.
ii) Trip push button
iii) Shunt trip coil operating between 70% - 110% of rated control voltage.
iv) Close coil, operating between 85% - 110% of rated control voltage.
v) Spring charge motor, operating between 90% - 110% of rated control voltage.
vi) Two trip coils and one closing coils shall be provided in all the breakers.
vii) Metering with higher class of accuracy (Class 0.2 and ISF <=5 for metering.)

i) The switchgear shall be provided with facilities for full operation from a remote point. In case of Local Operation of circuit breakers, Control switch of Circuit Breaker shall be located at such a height so that a man can operate standing on ground/floor. It shall be possible to trip the circuit breaker locally by mechanical means.

j) The circuit breaker truck shall ensure earth in both connected and disconnected positions.

k) An electro-mechanical device shall be provided to ensure the auxiliary circuits have been securely connected between the fixed and moving portions of the switchgear, before allowing closing operation of the circuit breaker. The voltage rating of the device shall be the same as the voltage used for the closing circuit.

l) Tripping and/or release coils shall be continuous rated to ensure longer life but rating should not exceed 300 W each. The electrical tripping device shall be of a type which acts directly on the circuit breaker mechanism and shall give positive operation for a supply voltage of 70% of nominal at DC control voltage.

m) Circuit breakers will be provided with at least one spare normally-open and one spare normally-closed contact, each wired out to terminals for the connection of external wiring.

n) Each circuit breaker shall be interlocked to prevent:

- the breaker being inserted into service position unless it is open
- the breaker being withdrawn from the service position unless it is open
- the breaker being closed unless it is fully in the service or test position
- remote operation whilst in the service position and/test position

o) Circuit breakers shall be mechanical latching and electrical and mechanical tripping. The operating mechanism shall be trip-free and shall include an anti-pumping device.

p) Shutters: Circuit breaker compartment should have non magnetic non ferrous automatic safety shutters, which shall be opened and closed by the mechanical drive of the circuit breaker. The bus bar and circuit spout covers shall be operated independently of each other. Padlock facilities can be provided on the metal shutters.

q) INTERLOCKING Isolation and connection of the circuit breaker shall be carried out inside the compartment with the door closed. The following mechanical interlocks shall be provided for service safety:

- Interlocking which prevents racking-in and racking-out of the circuit breaker when closed
- interlocking which prevents manual or electrical closing of the circuit breaker in the intermediate positions between connected or isolated.

D. CURRENT TRANSFORMER :

The CT shall be mounted in a manner to make it very easy for fitting / replacement at site. It shall be designed with built in adjustable cable holding clamps, makes it very easy for removal/sturdy fitting of power cables and to prevent any swing due

to forces encountered during short circuit. P1 of primary side of the in-built CT shall be at bus side of all the panels.

E. POTENTIAL TRANSFORMER

Three numbers Single phase draw out type PT of ratio 33000/√3; 110/√3 Volts with HT/LT fuses mounted on an independent trolley housed at the bottom in the same feeder/transformer panel or separately vertical housed . This Line PT shall not get disconnected along with the Circuit Breaker in case the breaker is drawn out from 'SERVICE' position. Arrangement shall be made in such a way so that PT primary fuse can be replaced without switching OFF the breaker.

F. AUXILIARY/CONTROL WIRING

All the secondary wiring in the panel shall have high quality PVC insulation 1100 volts grade and the same shall be of standard Copper Conductor of size not less than 2.5 sq. mm. for control circuit and 4 sq. mm. for CT circuits. Colours of the secondary / auxiliary wiring should confirm to ISS 375/1963 conform to latest amendments thereof. All wiring shall be neatly run and group of wiring shall be securely fixed with clips so that wiring can be checked without necessity of removing the clamps. Ferrules with number shall be provided on both end of the wiring.

G. PAINTING The Panels shall be pre-treated using 7-Tank process and then Epoxy Powder Coated with Paint shade of RAL 7032.

H. EARTHING

a. An earth bus of size minimum 40 mm x 6 mm or equivalent copper shall be provided and shall be extended throughout the length of the switch board with a provision to extend further on both sides of the end switchboard for future extension of switchboards.
b. It shall be possible to connect each circuit of the switchgear to earth, through earthing switches suitable for fault make current.
c. Earthing switch shall be mechanically interlocked with the associated breaker as per interlock requirement.
d. Earthing circuit shall be suitable for testing at 31.5KA for 1.0 sec.
e. Breaker compartment shall have scrapping earth bar and spring load finger shall be provided in withdrawal truck.
f. Provision of Busbar earthing at both side of Bus-Coupler is to be provided.

I. TYPE TESTS

The bidder shall submit following Type test reports (not more than five year old from the date of bid opening) along with the bid to prove the capability and suitability of his offered switchgear.

i. Short Time Current Test for 31.5KA for 3 second.
ii. Short Circuit Test duties on Circuit Breaker.
iii. Impulse withstands Test.
iv. Power Frequency withstands Test.

If bidder fails to provide test report they have to do the type test without any price implication before delivery of equipment.

5.9.6.5 OTHER SOME GENERAL REQUIREMENTS:

- The switchgear shall be indoor, free standing, sheet metal clad, draw out type and shall be fully compartmentalized.
- The Switchgear enclosures shall be totally enclosed design, dust tight and vermin proof.
- 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).
- Switchgear design shall comprise of fully compartmentalized execution having separate vertical sections for each circuit.
- Structure, buses and control wiring shall be designed and arranged in such a manner so that future extension of the switchboard would readily be feasible.
- All corresponding components of the circuit-breakers and switchgear of same rating shall be fully interchangeable.
- The power shall be fed from new 33 kV Transformer Yards placed adjacent to respective Inverter cum Control room through 33 kV XLPE Cable. This cable shall be connected at new extension 33 kV panel at Main Control Room near Raw Water Pond 3. Cable shall be laid **through buried / concrete trench / cable trestle subject to approval during detail engineering.** For buried cable minimum depth of one (1) meter with cable marker, distance between two cable markers shall not be more than 30m.
- The disconnecting switches shall be provided with local electrical/manual control. 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. Details layout shown in the tender drawings.

- 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.
- The lightning arrester & voltage transformer (LAVT) cubicles for 33 kV shall comprise of lightning arresters and capacitors (for surge protection) and voltage transformers. The LAVT & VT cubicles shall be dust tight, vermin-proof.
- 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 switchgear to support all power and control cables entering the switchgear.
- Cables for each equipment must be tagged with permanent metal tag of impregnated cable number as per drawings at MCC/switchgear 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 relay for the switchgear units shall have all the features as specified under Cl. no. 5.13.11 of, Sec-V of the Technical Specification.
- The switchgear units shall have the remotely controlled.
- 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 switchgear shall be monitored and control from OWS of existing SCADA/DCS:

  1) Circuit breaker - On/Off status & Control, Test, service, spring charged, Trip Circuit unhealthy, Lock out operated etc.

  2) Transformer - Winding temperature & Oil temperature, Bucchhlz etc Alarm status

  Through hardwire. IPR shall be placed at switchgear end.

  3) Energy meters through RS 485 network.

  4) Numerical Relays through RS 485 network.

  5) Voltmeters- from transducer as analogue signal.

  6) Ammeters- from transducer as analogue signal.

- The switchgear shall be capable of addition another two outgoing and two incoming feeder and separate line PT provision for future extension. Necessary space provision should be envisaged during control room design.

5.9.6.6 APPROVAL

The Detailed Design Report submitted by the contractor to WBPDCL must contain but not limited to the following details of the Ring Main Unit/Switchgear:

- Detailed specification of all the items.
- Necessary Drawings
- All necessary test certificates and approvals 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.

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 WBPDCL.

5.9.7 33kV OUTDOOR SWITCHYARD:

5.9.7.1 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 following outdoor equipment at switchyard for Power Evacuation from three inverter control room building to existing floating Solar Control room building(**Refer NIT SLD**).

The following equipments to be envisaged for power evacuation of the solar plant.

i. **Isolator-** Isolator with earth switch for power evacuation from Inverter Transformer to 33 kV Existing Switchgear.

The rating of the Isolator switch shall match with the corresponding breaker ratings. It shall be of centre rotating type with AC motor operated mechanism and manually operated earth switch. Each Isolator shall be installed near each Inverter transformer after LA.

ii. **Lighting arrester- (as per SLD)**

Gapless type of lighting arrester (Zno) with counter shall be used for 33kV system. LA should be heavy duty station class type. LA shall be placed over Four Pole structure. Bidder shall provide necessary earthing in line with specification to meet IS requirement.

iii. **4 Pole structure:**

i) Inverter Transformer Yard : each transformer yard.

ii) 20 MW Evacuation point at Switchyard : 2 nos.

iv. **33/36 kV Grade cable:**

b) Complete supply, laying, termination charging etc. of 33/36 kV grade Cable from new 33 kV Extension panel at existing 33 kV Indoor Switchgear at Floating Solar Control Room to Isolators on Four Pole structure before all the Inverter Transformers.

c) Complete supply, laying, termination charging etc. of 20 MW, 33/36 kV grade Cable from new 33 kV Extension panel at existing 33 kV Indoor Switchgear at Floating Solar Control Room to new 33 kV Outdoor switchyard Bay.

d) Complete supply, laying, termination charging etc from extension panel of 33kV existing Indoor switchgear at Floating Solar Control Room to one number new Station Auxiliary Transformer.

e) Bidder shall submit cable sizing calculation during detail engineering for approval.

V. Inverter cum Control Room and CR Panel:

Control Relay Panel with 220 V DC System for Control, indication and protection and testing, metering shall be considered for each 33 kV VCB and its associated Isolator.

VI. OUTDOOR 36 kV VCB

33 kV Outdoor VCB shall be installed for evacuation of Power from each Pond Plant Inverter transformer to Main Control Room near Raw Water Pond 3 and necessary control and protection panel shall be provided in the Inverter cum control room. Details specification of 36 kV VCB is as furnish in clause no.5.9.30.

5.9.7.2 OTHER REQUIREMENTS:

i. All switchyard structure should be lattice mild steel structure hot dip galvanized.

ii. All the buses should be adequately sized for fault and continuous current requirement.

iii. For 33kv bus, suitably supported single “Moose” conductor will be used in each phase.

iv. The bus bar fittings, connectors etc will be of suitable aluminium alloy having desired mechanical strength and electrical properties.

v. The contractor shall be fully responsible for carrying out all co ordination and liaison work with electrical inspectors and other statutory bodies for implementation of the work, as and when required.

vi. The relay for the switchgear units shall have all the features as specified under **Cl. no. 5.13.11** of, Sec-V of the Technical Specification.

vii. The scopes which are mentioned above are only for indicative purpose only. The contractor to supply all equipments which are also required for successful completion of the work.

5.9.7.3 Approval

Before starting manufacturing any equipment, the contractor shall have to take approval of relevant drawings and data from the purchaser.

5.9.8 STATION AUXILIARY TRANSFORMER

5.9.8.1 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 33 / 0.415 kV oil type outdoor one number 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.

5.9.8.2 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

Sl. No.	Standards	Description
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.

5.9.8.3 TECHNICAL REQUIREMENTS

- Capacity of the Station Auxiliary Transformer (SAT) shall be 100 kVA. It shall be similar to the existing SAT. Bidder shall provide Baffle walls to meet the Statutory and TAC requirement.
- HT side of the transformer shall be connected to the 33 kV Bus through an indoor VCB and LT side shall be terminated to the Station Service Board (SSB)/ 415 V LT Switchgear.
- SAT shall be installed at the space provided in the Transformer Yard adjacent to the existing Common Floating Solar Control Room near Raw Water Pond #3.
- 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 (-10% to +10% @1.25% 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 existing 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.
- 415V side of the transformer shall be terminated through cable with the new extended section of the LT Switchgear.

5.9.8.4 APPROVAL

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

- Detailed specification
- Fittings and Accessories
- Necessary Drawings shall contain but not limited to the following:
  - Outline dimension drawings of transformers and fittings/accessories
  - Assembly drawings and weight of main components.
  - Transport drawings, showing main dimensions and weight of each package.
  - Foundation details
  - Tap-changing equipment
  - Name-plate diagrams
  - Schematic control and wiring diagrams for all aux. equipment etc.
- Tools and spare parts etc.
- Type Test Reports and certificates etc.

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 WBPDCL.

5.9.9 LT SWITCHGEAR

5.9.9.1 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 indoor type following 415V LT Switchgear complete with all accessories and spares.

- Extension of existing LT switchgear at Main Floating Solar control room is under Bidder's scope. This switchgear extension shall have one Incomer and One Bus-coupler along with out-going feeders for new Floating Solar Plant under this package.
- Solar Plant of each Raw Water Pond under this package shall have two dedicated power feeders (MCCB) of equal capacity in this LT Switchgear from both of the Bus-section.
- One Sub-ACDB shall be installed with two incomer (MCCB's) and one Bus-coupler MCCB at each of the Inverter cum Control room for local illumination and auxiliary loads for each Solar Plant. These ACDB's shall receive power from the extended LT Board as mentioned elsewhere through 1.1 kV grade 3Ph, 4W cable.
- Supply, laying, termination of these cables for charging of these new ACDB is under this package.

The Scope shall include supply of 415 V (3 phase, 1 neutral and single phase for lighting etc.) transmission line (all Al conductor) for the entire area from the LT switchgear at both site with necessary breaker, switch fuse unit as and when required, Boards as above along with gland plates for all power and control cables, base frames, special tools i.e. operating handles, trolley necessary for removing the circuit breakers for maintenance etc. Isolators should be provided in the line to connect or isolate the connection from both the station auxiliary transformer.

The scope shall include all associated devices, components, relays, contactors, switches etc. required for satisfactory operation of the switch boards as per the proposed logic control scheme. The scope of supply shall also include necessary

spares required for operation & maintenance of switchgear equipments 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 existing Floating Solar LT switchgear near Floating Solar Control Room has already designed in such way that it should capable to accommodate auxiliary load of these solar power plants. Necessary equivalent space provision also kept physically for present extension of bus on both side of the switchgear.

Table for new 415 kV panel extensions and Sub-ACDB:

Sl	Description	Quantity
1.	Incoming feeder (ACB) from each 100 KVA Aux. Service Transformer Capacity of each feeder is in line with KVA capacity mentioned in the specification with 10% higher margin;	1 Nos.
2.	One Bus-coupler breaker (ACB)	1 No.
3.	Outgoing feeders for each Sub ACDB from both Bus sections LT switchgear at Main control Room.	According to number of Sub-ACDB
4.	Sub-ACDB for each Inverter-cum Control room.	1 No.
5.	Spare feeder	2 nos. of each type and rating for each DB.

- **One ACDB inside New Battery Charger Room at 10 MW Ground Solar Plant:**

Table with description

Sl	Description	Quantity
1.	Incoming feeder (100 A MCCB) from WBPDCL existing source from 500 mtrs distance. Supply, laying, termination of cable and charging of this panel is under bidders' scope	1 Nos.

2.	Outgoing feeder 32 A MCCB	4 nos.
3.	Outgoing feeder 16 A MCCB	6 nos.

5.9.9.2 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: 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 Aluminium and Aluminium 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.

5.9.9.3 TECHNICAL REQUIREMENTS

- Main Incoming A.C. circuits on Station service Board shall be controlled through microprocessor based numerical relay with draw out type Air 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 switchgears shall be suitable for indoor installation in the control room.
- LT switchgears shall be placed in each site 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 shall be sectionalized in two parts through sectionalizing breakers of equivalent capacity and protection of incomers 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, 50 kA, 3 pole draw-out type MCCBs with adjustable current setting shall be provided.
- The Air Circuit Breakers, Boards etc. shall have at least the following ratings:

o No. of phases	:	Three
o Rated voltage	:	1.1 kV
o Service voltage	:	415 V ± 10%
o Frequency	:	50 Hz. ± 5%
o Rated short time current rating	:	50 kA for 1 sec. for bus & switchgear
o Normal control voltage	:	220V DC
o Degree of Protection	:	IP 42 or higher

- The following equipments at LT switchgear shall be monitored from existing SCADA /DCS supplied by BHEL.

  1) Circuit breaker - On/Off status & Control, test, service, spring charged, TCS healthy, 86 operated, DC fail etc.

  2) Auxiliary Transformer - Winding temperature Alarm status

  3) Energy meters

  4) Voltmeters-from transducer

  5) Ammeters-from transducer

6) Numerical Relays should also be integrated with SCADA.

- The 415V switchboards shall be metal-enclosed draw out 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.
- Tube light / CFL 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.
- The relay for the switchgear units shall have all the features as specified under Cl. no. 5.13.11 of, Sec-V of the Technical Specification.
- All relays shown in the drawing and others required for operation of the system as per the specification shall be included in the scope of supply. The relays shall be of electromagnetic/ static/numerical type/ microprocessor based conforming to the requirements of IS: 8686 or IEC: 255.
- 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.
- The VA burden of instrument coils/elements shall be as low as possible, consistent with the best modern design.
- 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 switchgears as well as each 33 kV switchgears.
- 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 switchgears should be as per relevant IS.

5.9.9.4 APPROVAL

The Detailed Design Report submitted by the contractor to WBPDCL 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.

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 WBPDCL.

5.9.10 DC BATTERY, BATTERY CHARGING EQUIPMENT & DCDB

5.9.10.1 SCOPE

For 220 V DC Load requirements along with DC emergency lighting, bidder shall submit battery sizing calculation for approval. Bidder to consider DC Battery Backup for 10 Hours for new Inverter rooms.

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 220 V D.C Dual Float Cum Battery Charger with Battery Bank Plante

type of suitable designed capacity complete D.C. Distribution Board and other auxiliary equipments.

a) No of Battery and Charger for 220 V DC:
Bidder should consider 2 nos. (2X100%) Dual Float cum Boost Chargers with two sets of Battery Banks and DCDB for all three nos new floating solar plant. Bidder shall distribute entire 220V DC load for all the plants from one central DCDB with dual sources (2X100%)

b) 1 No of Battery and Battery Bank for 110 V DC:

WBPDCL is having only one no battery and one charger for 10MW Ground mounted Solar PV Plant at SgTPP. To enhance redundancy another battery and its charger with DCDB have envisaged under this package. Detail scope of 110V DC system is enumerated below:

(i) 1 No Float cum Boost Charger with 200 AH capacity of Battery Bank (Plante type similar to existing battery of 10 MW Ground Solar) to be installed near the 10MW Ground Solar PV Plant Control Room.

(ii) 1 no. DCDB with one incoming MCCB (200 A) from FCBC and 12 nos. outgoing DC MCB/SFU. Outgoing DC MCB/SFU shall have 8 nos 16 A and 4 nos: 32A capacity.

(iii) For this 110 V DC Battery Set and FCBC, Bidder shall construct one small building with two separate rooms for Battery and its Charger adjacent to the existing 10 MW Ground Solar Plant Main Control Room.

(iv) DCDB shall be installed inside Battery Charger Room. Size of the Battery room shall be not less than 3500 mm x 4000 mm with 100% redundant exhaust fan. Size of Battery Charger cum ACDB- DCDB Room shall be not less than 2500 mm x 4000 mm. Necessary cable slit, Acid proof tiles on the wall inside Battery room, Acid Proof Door, illumination with corrosion proof fixtures, tap-cell, cable connectivity with DCDB, small lighting panel etc. shall be bidders' scope.

(v) 2 nos. of 32 A Power supply for FCBC shall be fed from new ACDB (refer LT Switchgear specification).

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 5 (five) 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.

5.9.10.2 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.

5.9.10.3 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 220 V 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