INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

KHARAGPUR, WEST BENGAL 721302

E-TENDER DOCUMENT

for

Design and Build 1100 kWp Solar Power Plant with value adding structures like parking bays, covered cycle ways etc. in IIT Kharagpur.

NIT No.: IIT/E/E&M/T/50/2019-20

Notice Invitation Tender Serial No. IIT/E/E&M/T/50/2019-20 ***dated-09.09.2019***

Tender Serial No. _____ *Issued to:*

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Contents

8. *Schedule of Quantities (BOQ).....uploaded separately in BOQ section on https://eprocure.gov.in/eprocure/app for online submission.*

1. NOTICE INVITING TENDER

1.1. INTRODUCTION

Indian Institute of Technology (IIT) Kharagpur, hereinafter called IITKGP, invites sealed tenders from the eligible contractors for **"Design and Build 1100 kWp Solar Power Plant with value adding structures like parking bays, covered cycle ways etc. in IIT Kharagpur..".** Particulars of the project are as following.

1.2. PARTICULARS

1.NIT Number	IIT/E/E&M/T/50/2019-20
2.Name of Work	**Design and Build 1100 kWp Solar Power Plant with value adding structures like parking bays, covered cycle ways etc. in IIT Kharagpur.**
3.Location of Work	Gandhi Park boundary, Nalanda cycle way, cycle parking and car parking
4.Estimated Cost(including GST)	₹6,98,54,400/- (Rupees Six Crore Ninety eight lakh Fifty four thousand Four hundred only)
5.Earnest Money Deposit	₹ ₹13,97,088 /- (Rupees Thirteen lakh Ninety seven thousand Eighty eight only) *[Not mandatory for bidders registered under MSE category]*
6. Performance Bank Guarantee	Rs. 34,92,720(Rupees Thirty four lakh Ninety two thousand Seven hundred Twenty only)**valid for 05 years**
7.Time Limit	**270 days** from Date of start
8.Tender Basis and Mode	Two stage (Technical Bid & Financial Bid)
9.Mode of Payment to IITKGP(EMD/Tender fee)	i) Original Demand Draft/Pay Order or copy of valid registration certificate under MSE category has to be submitted physically at the office of SE(E&M) on or before the due date/extended date of submission of bid. & Scanned copy of Demand Draft/Pay Order/Registration under MSE category has to be uploaded on *https://eprocure.gov.in/eprocure/app* ii) Demand Draft/Pay order to be drawn in favour of IIT KHARAGPUR payable at Kharagpur.
10. Date, Time & Venue of Pre-bid Meeting	17th September 2019at 3.30 pm, in the meeting room of ESTATE (E&M), Head Office, 1st Floor, Old Building, IIT Kharagpur, Kharagpur WB 721302
11. Closing Date & Time for Receipt of bids	15th October up to 15:30hrs
12. Date& Time for Opening Technical of Bid	16th October 2019at 16:30hrs ;
13. Date& Time for Power point presentation	17th October 2019 at 10.00 AM
14. Date& Time for Opening of Price Bid	To be informed later
15. Engineer-in-charge and contact details.	Mr. Sabyasachi Ghosh, Senior Executive Engineer Tel: 03222-282522__, Email: sghosh@hijli.iitkgp.ernet.in
16. Address for tender issue, submission and opening	Office of Senior Executive Engineer(Electrical),1st Floor, Old Building, IIT Kharagpur, Kharagpur WB 721302
17. Website for full and updated *publishing* information	*https://eprocure.gov.in/eprocure/app* http://www1.iitkgp.ac.in/topfiles/tenders.php
16. Website for tender submission & processing (This is e-Tender only submission	*https://eprocure.gov.in/eprocure/app*

1.3. ELIGIBILITY CRITERIA

3.1. The bidder must be registered in appropriate class of works with Government organization like CPWD/ PWD/ MES or PSUs or OEM or Authorized supplier and installer of OEM (Authority must be signed by OEM official not lower than General Manager or equivalent in corporate structure or those having experience in similar nature of works awarded by Government / Semi Government Organizations/ Government Funded Autonomous Organization.

1.3.2. The bidder must have done at least 1 (ONE) similar work of value of 80% of the estimated cost **or** 2 (TWO) similar works for projects each of value 60% of the estimated cost **or** 3 (THREE) similar work for projects each of value 40% of the estimated cost with Government/ Semi-government/ PSU/ Government Funded Autonomous Organization during last **7 (seven) years** preceding last date of the month of tender submission.

Note:

a. The estimated cost is **Rs. 6,98,54,400/- (Rupees Six Crore Ninety eight lakh Fifty four thousand Four hundred only)**

b. The value of executed works shall be brought to current costing level by enhancing the actual value of work at simple rate of 7% per annum; calculated from the date of completion to the last date of receipt of applications for tender.

c. **Similar works shall mean:** Installation and commissioning of Solar Power Plant

1.3.3. The bidder or the specialized agency the bidder intends to associate with must be registered with appropriate government authority as a bonafide business entity and must have GST registration certificate and Permanent Account Number of income tax.

1.3.4. Electrical work shall be executed by selected bidder through agency holding electrical license and electrical supervisor license valid on date of execution.

1.3.5. The validity of the registrations and licenses should be valid as on the date of tender submission.

1.3.6. Average annual turnover of the bidder as per ITCC or profit & loss statement shall not be less than 30% of the estimated cost, not having incurred loss in more than two years, during last 5 years ending 31 Mar 2019.

1.3.7. Bidder must hold solvency certificate from any scheduled banks for a minimum value of 40% of the estimated cost, issued not earlier than 6 (six) months from the last date of submission.

Sd/-
Chief Engineer

On behalf of the **Director, Indian Institute of Technology Kharagpur**

5/9/19

Copy to:

1) Superintending Engineer (E&M)
2) Superintending Engineer (Civil)
3) Chief System Manager
4) Mr. M. Kumar, Senior Executive Engineer (EW)
5) Mr. S. Ghosh, Senior Executive Engineer (EW)
6) Executive Engineer (Telephone)
7) Engineer/Assistant Engineer/ Junior Engineer (E&M)
8) Notice Board
9) Tender Notice uploaded to CPPP portal & Institute Website

Office file

GENERAL INSTRUCTIONS

1.4.1. The IITKGP intends to award the work of "**Design and Build 1100 kWp Solar Power Plant with value adding structures like parking bays, covered cycle ways etc. in IIT Kharagpur".** The work consists of comprehensive repair, renovation and modification of existing electrical systems.

1.4.2. Constraint: The job needs to be executed in Residential area without causing any disturbances to the Residence of campus quarters and hostel resident and also road networks.

1.4.3. The vendor shall work out execution sequence and methodology so as to complete the project within the envisaged time and the estimated cost, duly handling the constraint mentioned above.

1.4.4. Bidding documents are to be obtained electronically through websites: *https://eprocure.gov.in/eprocure/app*

1.4.5. This bid document shall be read in conjunction with GCC (General Conditions of Contract) available on http://www1.iitkgp.ac.in/topfiles/tenders.php.

1.4.6. The bidder shall visit and inspect the site and obtain all information on his own responsibility and at own cost, which may be necessary for the purpose of quoting and submitting the tender. No excuse or ignorance as to site conditions and local information shall be accepted after awarding of the contract. Access to the site will be granted by the Engineer-in-charge on all working days within working hours.

1.4.7. IITKGP shall not provide any space at site for labour hutments.

1.4.8. All clarifications about the tender shall be sought by bidder on or before **17th September 2019 3.30PM** through e-mail to the Engineer-in-charge on **sghosh@hijli.iitkgp.ernet.in**

1.4.9. Completion certificate issued by Competent Authority will only be considered as credential. If the Completion certificate issued by Competent Authority does not reflect the type of work, then Final bill / Schedule of Quantity of the qualifying works also to be attached along with the Completion certificates. Certificate from private individuals / organizations for whom such works have been executed shall not be accepted.

1.4.10. The bidding document (consisting of specifications, the schedule of quantities of various types of items to be executed, the set of terms and conditions of the contract and other documents / drawings, if any), Addendum/Corrigenda, Clarifications to Pre-bid queries can be downloaded from the websites: i)https://eprocure.gov.in/eprocure/*app*

1.4.11. ; *iii)https://eprocure.gov.in/eprocure/app*. Corrigenda, if any shall be published only on these websites *at any time before the closing time of tender.* The institute shall not be responsible for any delay / difficulties / inaccessibility of downloading facility for any reason whatsoever. *The tenderers who have downloaded the tender documents from website must visit the website and ensure that such addendum(s)/corrigendum(s) (if any) is also downloaded by them. This shall be the responsibility of the prospective registered bidders to check the web site for any such corrigendum/addendum before closing time of tender and ensure that bid submitted by them are in accordance with all the corrigendum's/addendums.*

1.4.12. All costs, charges & expenses that may be incurred in connection with the preparation of his tender shall be borne by him and the Institute accepts no liability whatsoever therefore.

1.4.13. **Rates quoted by the bidders shall be inclusive of GST (Goods and Services Tax - Central, State and Interstate) and all applicable taxes. Income Tax and all other statutory deductions like labourcess etc. will be deducted from the bill as per prevailing rules.**

1.4.14. Exemption to IITKGP against any tax/ duty/ fee/ surcharge/ charge/ cost, if any, found applicable or sought later from IITKGP after award shall be passed on to IITKGP by the contractor without dispute.

1.4.15. IITKGP reserves the right to reject any or all of the bids without assigning any reason.

1.4.16. **Bid Validity:** Bid shall remain valid for 120 days from the date of submission.

1.4.17. **Firm Price: Bidder's quoted Rates/Prices for executing the activities under the Contract shall remain firm till completion of the entire work & shall not attract any escalation under any circumstances whatsoever.**

1.4.18. If any information furnished by the bidder is found as false / fabricated, then his bid will be rejected and treated as cancelled. Even if the such manipulation is detected at any stage after signing of the contract, it would lead to termination of the contract besides forfeiture of Earnest Money Deposit and liabilities towards prosecution. In such cases the bidder will be debarred from participation in future tendering process in IITKGP for next 05 (Five) years.

1.4.19. **Earnest Money Deposit (EMD)** of requisite amount and that in prescribed mode or proof of payment thereof shall be enclosed with the Technical Bid explained in following section.

1.4.20. **Refund / Conversion of Earnest Money Deposit:** The Earnest Money received shall be refunded to the unsuccessful bidders without any interest after the opening of financial bids. The Earnest Money Deposit of successful bidder shall be retained and converted into part of Security Deposit.

1.4.21. **Forfeiture of Earnest Money Deposit:** Earnest Money Deposit will be forfeited in any of the following cases:

(i) The bidder withdraws / modifies his tender during the period of Bid Validity.

(ii) The bidder, in case of tie between lowest bids, refuse to submit revised offer.

(iii) The bidder does not accept the correction of arithmetical errors of his tender.

(iv) The bidder fails to deposit Performance Guarantee and information as per format given in GCC within the stipulated time period before award of the work.

1.5. SUBMISSION OF TENDER

1.5.1. ***Help for Contractors, FAQ, Information about DSC and Bidders Manual Kit containing the detailed guidelines for e-Procurement system are also available on Central Public Procurement Portal.[*** **https://eprocure.gov.in/eprocure/app]**

1.5.2. ***It is mandatory for all the bidders to have a valid Class-II/Class-III Digital Signature Certificate (in the name of person having power of attorney to sign the Bid) from any of the licensed Certifying Agency (Bidders can see the list of licensed CA's from the link www.cca.gov.in) to participate in e-Procurement of IIT KHARAGPUR.***

1.5.3. ***It is mandatory for the bidders to get their firm /company registered with e-procurement portal https:// eprocure.gov.in/eprocure/app to have user ID & password.***

1.5.4. ***Tender documents will be available online on website https://eprocure.gov.in/eprocure/app which can be downloaded free of cost.***

1.5.5. ***Bidders may download and refer the "Instructions for Online Bid Submission" from (https://eprocure.gov.in/eprocure/app;jsessionid=A8B54EEC72D86DF9AA9D9B2DDACDAB8D.eprocgep4?page=Bidders ManualKit&service=page).***

1.5.6. ***The tender documents shall be submitted online in the prescribed format given on the websites and technical bids received online shall be opened as per NIT or Corrigendum thereof. No other mode of submission is acceptable. Detailed credentials as per the requirement of eligibility criteria and all tender papers except Bill of Quantities are to be submitted in "Technical Bid".***

1.5.7. ***Bill of Quantities with rates duly filled in are to be submitted in the format provided online in the name of "Financial Bid". Hence, physical submission of the documents is limited to submission of original Earnest Money Deposit in the form of Pay Order/ Demand Draft / Bank Guarantee/MSE registration certificate as per provision given in sub-clause 1.2.5 of NIT & 2.2.15 of Information to Bidders.***

1.5.8. ***Representative of the bidder, who chooses to attend, may attend the online opening of the technical bids on the scheduled date and time of Bid opening. However, such representatives shall be allowed to attend the opening of the Technical Bids, only, if such person presents the letter of authority issued in his name by the bidder on his letter head.***

1.5.9. ***Bidders cannot submit the tender after the due date and time of e-bid submission. Time being displayed on Central Public Procurement Portal https://eprocure.gov.in/eprocure/app ("Server System Clock Time") shall be final and binding on the bidder. e-Bids are required to be submitted by bidders, only as per the Indian Standard Time (IST) and not the time as per their location/country.***

1.5.10. ***The bidders are advised to submit their e-bids well before the e-bid due date. IIT KHARAGPUR shall not be responsible for any delay in submission of e-bids for any reason including server and technical problems.***

1.5.11. ***The Technical and Financial Bid shall be digitally signed by the Authorized Signatory of the bidder & submitted "on-line" only. The authorized signatory of the bidder must be in possession of Power of Attorney before submitting the digitally signed bid. Scanned copies of various documents can be prepared in .pdf file format.***

1.5.12. ***Any tender received without original Earnest Money in the form as specified in clause 1.2.8 of tender documents shall not be considered and shall be summarily rejected.***

1.5.13. ***IIT KHARAGPUR reserves the right to cancel the tenders before submission/opening of tenders, postpone the tender submission/opening date and to accept/reject any or all tenders without assigning any reasons thereof. IIT KHARAGPUR's assessment of suitability as per eligibility criteria shall be final and binding.***

1.5.14. ***Tenderers may note that they are liable to be disqualified at any time during tendering process in case any of the information furnished by them is not found to be true. EMD of such tenderer shall be forfeited. The decision of IIT KHARAGPUR in this regard shall be final and binding.***

1.5.15. **The sealed *EMDs* shall be received at the Office of Senior Executive Engineer(Electrical),1st Floor, Old Building, IIT Kharagpur, Kharagpur WB** 721302**, up to 15:30hrs,** 15th October 2019 **or Corrigenda otherwise**. Tenders received after the due date and time shall not be considered. *The EMDs* shall be submitted in a sealed envelope super scribed **"Design and Build 1100 kWp Solar Power Plant with value adding structures like parking bays, covered cycle ways etc. in IIT Kharagpur"** with NIT No. IIT/E/E&M/T/50/2019-20 *as NIT No.*, clearly super scribed as **"EMD "**

1.6. EVALUATION OF BIDS AND AWARD OF WORK

1.6.1. The Bid of bidder will be opened on the specified date and time. Bids shall, first, be checked for payment of **Earnest Money Deposit**. Only those bids found to have duly paid/ submitted Tender Fee and Earnest Money Deposit shall be considered for evaluation.

1.6.2. Evaluation of **Technical Bid:**

a) In the first stage the bids received will then be assessed on the eligibility criteria mentioned at para1.3of Notice Inviting Tender. **Bids found not meeting the eligibility criteria shall be considered non-responsive and shall be rejected summarily.**

b) In the second stage of technical evaluation the bidders qualified in stage one shall be called for **Presentation. The bidders will be evaluated on the basis of the Table below:**

Sl. No.	Evaluation criteria	Marks
1	Annual Turnover	10
2	Experience showing work done of similar nature	15
3	General Arrangement Framework of structures proposed: (Aesthetics, Sleekness, Innovation)	30
4	Electrical SLD clearly indicating evacuation system with metering	15
5	Type of PV modules used	15
6	O&M strategy including a schematic for water conservation by reuse of the water .	15
	TOTAL	100

The financial bids of the bidders scoring 65 and above will be opened.

1.6.3. IITKGP retains the right to revert back to individual bidders with further clarifications / queries on the Technical Bid. The bidder has to respond to the queries within the specified time mentioned in the covering letter.

1.6.4. On the date & time specified for opening of Financial Bid or the Revised Financial Bids as the case may be will be opened on specified date and time.

1.6.5. **EVALUATION OF Financial Bids:** The Financial Bid should contain the complete bid document with duly filled in Schedule of Financial Quote. Financial Bids opened as above will be checked for arithmetical errors.

1.6.6. **Letter of Acceptance:** The successful bidder shall be issued Letter of Acceptance (LOA) of the bid, and be required to furnish Performance Guarantee as per General Conditions of Contract, Program Schedule with specific Milestones to be achieved as to complete the work within the stipulated time limit, details of his Technical Staff to be deployed as per ANNEXURE-I, and complaint handling arrangement for the Defect Liability Period.

1.6.7. **Letter of Award (Work Order)** shall be issued to the successful bidder only after receipt of the Performance Guarantee, along with Program Schedule, details of Technical Staffs to be deployed for the work and Complaint redressal Mechanism **as per following para.**

2.4.8 (a) Contractor shall submit Complaint redressal arrangement with name & contact number of the contractor's authorized representative for the purpose.

1.6.8. **Agreement (Contract)** consisting of complete tender document including conditions, bill of quantities, technical proposal and specialized services, drawings, if any, and acceptance thereof together with any correspondence leading thereto, shall be drawn and signed with the awardee **within10 days** of the Letter of Award.

1.6.9. **Date of start** of work shall be reckoned from **the 10th day** of the issue of the Work Order.

1.6.10. **Defect Liability Period (DLP):** In partial modification to clause no.16 of General Conditions of Contract (GCC), the Defect Liability Period shall be **60 months** after successful completion of the work certified by engineer-in-charge.

1.7. COMPLAINT REDRESSAL MECHANISM

1.7.1. All maintenance complaints shall be got addressed by the contractor to the satisfaction of Engineer-in-charge within 3 days from the date of issuance of the "Job Card" from IIT Kharagpur.

1.7.2. Complaints requiring completion time more than 3 days shall be responded specifically by the contractor with the scheme, in consultation with Engineer-in-charge, and timeline for compliance, to the Engineer-in-charge within 3 days from the date of issuance of the "Job

1.7.3. Any complaint left unattended by the contractor beyond 3 days without specific reasons on record shall attract levy of penalty of Rs 50/- per complaint per day from 4th day to 7th day and Rs 100/- per complaint per day thereafter recoverable from dues to the contractor.

1.7.4. **Payment terms:**

Sl. No.	Location	Approx. capacity(kWp)	Structural Work Completion	PV Installations	Power Evacuation (Completion)
1	Gandhi park boundary	350	35%	40%	20%
2	Cycle parking	250	30%	45%	20%
3	Car parking	500	30%	45%	20%

1.7.5 **Standard Deductions from bills:**

Sl No	Deductions	%age to be deducted
1.	Security deposit	5%
2.	Income tax	2%
3.	Labour Cess	1%

2. UNDERTAKING BY THE BIDDER

U N D E R T A K I N G

I / We have read and examined the Tender document including terms & conditions, specifications, bill of quantities, drawings and designs, general rules & directions, General Conditions of Contract, Special Conditions of Contract and all relevant other documents, publications and rules referred to in the Conditions of Contract and all other contents in the tender documents for the work.

I / We, hereby tender for execution of the work specified for the Indian Institute of Technology Kharagpur within the time specified and in accordance in all respects with the specifications, designs, drawings and instructions in writing.

We agree to keep the tender open for 120 days from the last date of its submission and not to make any modifications in its terms and conditions. A sum of Rs. _____ has been deposited in cash / demand draft of a scheduled bank / Pay order as earnest money. If I / we, fail to furnish the prescribed performance guarantee within prescribed period, I / we agree that the said Director, Indian Institute of Technology Kharagpur or his authorized officer shall without prejudice to any other right or remedy, be at liberty to forfeit the said earnest money absolutely. Further, if I / we fail to commence work as specified, I / we agree that the Director, Indian Institute of Technology Kharagpur shall without prejudice to any other right or remedy available in law, be at liberty to forfeit the said earnest money and the performance guarantee absolutely, otherwise the said earnest money shall be retained by him towards security deposit to execute all the works referred to in the tender documents upon the terms and conditions contained or referred to therein.

Further, I / We agree that in case of forfeiture of earnest money or both Earnest Money & Performance Guarantee as aforesaid, I / We shall be debarred for participation in the re-tendering process of the work.

I / We hereby declare that I / We shall treat the tender documents, drawings and other records connected with the work as secret / confidential documents and shall not communicate information derived there-from to any person other than a person to whom I / We am / are authorized to communicate the same or use the information in any manner prejudicial to the safety of the State.

Seal & Signature of Contractor

Postal Address

Dated

Witness

Address

Occupation

ANNEXURE-I

TECHNICAL STAFF OF CONTRACTOR

Name of the Work: Design and Build 1100 kWp Solar Power Plant with value adding structures like parking bays, covered cycle ways etc. in IIT Kharagpur

DISCIPLINE	NAME	QUALIFICATION	EXPERIENCE	CONTACT NUMBER
Overall Project In-charge				
Engineer - Structure and Civil Works				
Engineer – Electrical & Mechanical Works				
In-charge - Safety, Health & Environment				
In-charge for Maintenance (DLP) period				

Seal & Signature of Contractor

1. Checklist for Documents to be uploaded on *https://eprocure.gov.in/eprocure/app*

Sl. No.	Documents	Reference
1.	Tender Documents (upload after signed and stamped all pages)	2.3
2.	EMD scan copy) Original EMD physically has to be at the office of SE (E&M) on or before the due date/extended date of submission of bid.	1.2.8
3.	Company registered by Govt. Organisation like CPWD/PWD/MES/Autonomous bodies or Other PSUs	1.3.3
4.	GST Registration Certificate	1.3.3
5.	Permanent Account Number	1.3.3
6.	Average Annual Turnover (as per ITCC profit & loss statement shall not be less than 30% of Estimated cost)	1.3.5
7.	Completion Certificate during last 07yrs.	1.3.2
8	Updated Electrical Contractor Licence	
9	Updated Electrical supervisor license	
10	Updated Bank Solvency Certificate	
11	ANNEXURE-I	

N.B.: All uploaded documents should be Self-Attested with stamp.

Signature of contractor

TENDER SPECIFICATIONS

IIT Kharagpur intends to integrate a 1100 kW grid connected solar power plant to the system. The Institute has a main 33kV/11kV Receiving Substation. There are 17 nos 11kV/415V distribution substations. The 11kV lines are connected in a ring main. The institute also has an installed capacity of 1200Kwp of distributed rooftop mounted grid connected solar power station.

OVERVIEW

1. The 1100 kWp Solar PV power plant shall be installed in such a manner that the solar power installation creates value adding structures like parking bays for cars and cycles, covered cycle tracks etc.

2. The plant output shall be connected to Low Voltage (LV) distribution grid supply.

3. Contractor shall be responsible for operation and maintenance as well as monitoring of the plant for the first 5 years and shall handover the plant to the Electrical Works, IIT KGP at the end of the 5th year..

TECHNICAL SPECIFICATI1ON

The general scope under this contract includes to design, manufacture, testing, inspection, packing and forwarding, transportation upto project site, loading & unloading, storage in safe custody, erection, carrying out preliminary tests at site, commissioning, performance testing, operation and maintenance for 5 years & handling over to all the equipment of SPV Power plant on the respective sites / as per instruction from time to time. The illustrative Schedule of requirements is in accordance with the specifications contained in this document.

Scope of Work

1. Design, Installation and commissioning of solar power plant in Five locations(Car parking, cycle parking , Park boundary,) along with PV syst design.
2. Detailed design of PV Array, Inverter and Balance of Systems (BoS).
3. Due diligence in detailed civil, electrical, mechanical and data acquisition system design and engineering of the plant.
4. Due diligence in installation, testing, commissioning, operation, maintenance and monitoring of the plant.
5. Construction of access for maintenances.
6. Operation and maintenance of the plant

System Description and Specifications

General System

1. The solar radiation and environment monitoring system to be installed on the cycle parking and Car parking area, Cycle way, Park boundary with the PV power plant.
2. The operating life of the plant shall be minimum 25 years.
3. The plant shall feed AC power to the Low Tension (LT) distribution grid power supply.
4. The plant shall monitor solar generated energy using plant AC energy meter independent of load energy monitoring. Two remote monitoring facility should be made available.
5. The plant shall consist of PV array, fixed PV array support structure, String/Array combiner boxes, DC cabling, DC distribution box, Inverter, AC cabling, AC distribution box, plant AC energy meter, load energy meter and data acquisition system
6. The individual string/array combiner boxes and DC cabling shall be installed on top of the structure with sufficient ground clearance.
7. The inverter shall be installed in the control room/open space provided in the building / nearest electrical panel room.
8. The DC and AC distribution boxes, DC and AC cabling, energy meters and data acquisition system shall be installed in the control room/open space provided in the building.

PV Array

The total solar PV array capacity should not be less than 1100kWp should comprise of solar crystalline modules of any latest technology with minimum capacity of 330 Wp and above wattage. Module capacity less than minimum 330 watts should not be supplied. Efficiency of PV module should not be less than 19 %.The PV modules used must qualify to the latest edition of IEC PV module qualification test or equivalent BIS standards Crystalline Silicon Solar Cell Modules IEC 61215/IS14286. In addition, the modules must conform to IEC 61730 Part-1 - requirements for construction & Part 2 - requirements for testing, for safety qualification or equivalent IS.Certificate for module qualification from IEC or equivalent to be submitted as part of the bid offer.Self undertaking from manufacturer/supplier that the modules being supplied are as per above.

1. The peak power rating of the Solar PV array under Standard Temperature Conditions (STC) shall be equal to the peak power rating of the plant.
2. The PV array shall consist of framed multi-crystalline.
3. Individual PV modules rating should be of minimum 330 watt peak at STC.
4. The rated maximum power rating of PV modules should have positive tolerance in range of 0 to +3%. And negative temperature co-efficient of power for PV modules should be less than or equal to 0.45% per deg. C. 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 more than 3 (three) percent from the respective arithmetic means for all modules and/or for all module strings, as the case may be.
5. A suitable number of Solar PV modules shall be connected in a series string. A suitable number of series strings shall be connected in parallel to formulate a series parallel array.
6. The PV strings and array shall be designed to match the inverter input specifications.
7. Maximum DC output voltage of the array shall not exceed 1000V.

8. The module shall be provided with junction box with provision of min. 3 Nos. of by-pass diodes and external MC4 type or equivalent plug-in connectors. The junction box should have hinged, weatherproof lid with captive screws and cable gland entry points.

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

10. The module frame shall be made of corrosion resistant material electrically compatible with structural material used for mounting the modules.

11. Each PV module manufactured in India must have RF identification tag (RFID) compatible with MNRE requirements. (Traceability requirement)

12. DC negative conductor shall be bonded to the ground via Ground Fault Detector Interrupter (GFDI). The grounding point shall be as close as possible to the PV Array.

13. The module shall be provided with a junction box with either provision of external screw terminal connection or sealed type and with arrangement for provision of by-pass diode. The box shall have hinged, weather proof lid with captive screws and cable gland entry points or may be of sealed type and IP65 rated.

14. Necessary I-V curves at 25^0C, 45^0C, 60^0C and at NOC are required to be furnished. Offers to provide PV module warranty of 25 years with not more than 20% degradation in performance/output over 25 years.

15. The PV module must have 10 years free replacement guarantee against material defect or craftsmanship or any damages by hail storm.

16. Name of the manufacturer of PV module; name and manufacturer of the solar cell; month and year of manufacture; I-V curve, wattage, Im, Vm, FF for the module; unique serial no & model no; date & year of obtaining IEC PV module qualification certificate.

Inverter

The Inverter shall be of 50 KVA [lower capacity of inverter (below 50 kVA) may be considered in case it is required for specific site condition] should convey DC power produced by SPV modules into AC power and adjust the voltage & frequency levels to shout the local grid conditions. The 50 KVA Inverter with grid interactive shall feed power to the A.C. load of IIT Building at Kharagpur.

Common Technical Specification

Control Type : Voltage source, microprocessor assisted, output regulation.
Output voltage : 3 phase, 415 V ac (+12.5%, -20% V ac)
Frequency : 50 Hz (+3 Hz, -3 Hz)
Continuous rating : 50 KVA with net metering/off Import/Exportmeters
Normal Power : 50 KVA
Total Harmonic Distortion : less than 3%
Operating temperature Range : 0 to 55 deg C
Housing cabinet : Inverter to be housed in suitable switch cabinet, Within IP 55 degree of ingress protection.

Inverter efficiency : 98% and above at full load.

Other important Features/Protections of Inverter:

- Mains (Grid) over-under voltage and frequency protection..
- Over load capacity (for 10 sec) should be 200% of continuous rating.
- The PCU shall be self commuted and shall utilize a circuit topology and components suitable for meeting the specifications listed above at high conversion efficiency and with high reliability.
- The PCU shall be provided with MPPT (Maximum Power Point Tracing) features, so that maximum possible power can be obtained from the PV module.
- The PCU shall be self commuted and shall utilize a circuit topology/ DSP technology to meet the specifications listed above at high conversion efficiency and with high reliability. The Inverter shall by Hybrid One and shall give the preference to feed the Loads from Solar Energy being produced and shall draw the additional power from mains to meet the load requirements in the case load is more than solar energy being produced. Conversely it should feed the solar power to the Grid if the load is less than the solar energy generated.
- Full proof protection against grid islanding which ensures that the PV power and the grid power gets disconnected immediately in the event of grid failure.
- The Inverter shall be capable of operating in parallel with the grid utility service and shall be capable of interrupting line-to-line fault currents and line-to-ground fault currents.

  The Inverter shall be able to withstand an unbalanced output load to the extent of 50%.
- The PCU shall go to the shut down/standby mode with its contacts open under the following conditions before attempting and automatic restart after an appropriate time delay in insufficient solar power output.

  (a) Utility-Grid Over or Under Voltage The Inverter shall restart after an over or under voltage shutdown when the utility grid voltage has returned to within limits for a minimum of two minutes.

  (b) Utility-Grid Over or Under Frequency

  The Inverter shall restart after an over or under frequency shutdown when the utility grid voltage has returned to the within limits for minimum of two minutes. The permissible level of under/over voltage and under/over grid frequency is to be specified by the tenderer.

- The Inverter shall not produce Electromagnetic interference (EMI) which may cause malfunctioning of electronic and electrical instruments including communication equipment, which are located within the facility in which the Inverter is housed.
- Communication Modbus protocol with LAN/WAN options along with remote access facility and SCADA package with latest monitoring systems.

1. The inverter with MPPT shall be used with the power plant.

2. The sine wave output of the inverter shall be suitable for connecting to 415V, 3 phase AC LT voltage grid

3. The inverter shall be transformer less, grid islanding protection disconnection of grid & PV power in case of failure of Grid supply suitable DC/AC fuses/circuit breakers and voltage surge protection. Fuses used in the DC circuit shall be DC rated.

4. The inverter shall have internal protection against any sustained faults and/or lightening in DC and mains AC grid circuits.

5. The peak inverter efficiency inclusive of built-in isolation transformer shall exceed 94%. (Typical commercial inverter efficiency normally more than 97%, and transformer efficiency is normally more than 97%.)

6. The kVA ratings of inverter should be chosen as per the PV system wattage.

7. The nominal AC voltage tracking range shall be +10%, -20%.
8. The nominal AC frequency tracking range shall be +/-3Hz.
9. The output power factor should be of suitable range to supply or sink reactive power.
10. Inverter shall provide display of PV array DC voltage, current and power, AC output voltage and current (All 3 phases and lines), AC power (Active, Reactive and Apparent), Power Factor and AC energy (All 3 phases and cumulative) and frequency. Remote monitoring of inverter parameters should be possible.

11. The inverter shall include adequate internal cooling arrangements (exhaust fan and ducting) for operation in a non-AC environment.

12. Max. Permissible DC input voltage shall be min. 700V.

13. THD should be less than 4%.

Factory Testing:

a. The PCU shall be tested to demonstrate operation of its control system and the ability to be automatically synchronized and connected in parallel with a utility service, prior to its shipment.

b. Operation of all controls, protective and instrumentation circuits shall be demonstrated by direct test if feasible or by simulation operation conditions for all parameters that cannot be directly tested.

c. Special attention shall be given to demonstration of utility service interface protection circuits and functions, including calibration and functional trip tests of faults and isolation protection equipment.

d. Operation of startup, disconnect and shutdown controls shall also be tested and demonstrate. Stable operation of the PCU and response to control signals shall also be tested and demonstrated.

e. Factory testing shall not only be limited to measurement of phase currents, efficiencies, harmonic content and power factor, but shall also include all other necessary tests/simulation required and requested by the Purchasers Engineers. Tests may be performed at 25, 30, 75 and 100 percent of the rated nominal power.

f. A Factory Test Report (FTR) shall be supplied with the unit after all tests. The FTR shall include detailed description of all parameters tested qualified and warranted.

Earthing:

1. PV array, DC equipment, Inverter, AC equipment and distribution wiring shall be earthed separately as required.
2. Equipment grounding (Earthing) shall connect all non-current carrying metal receptacles, electrical boxes, appliance frames, chassis and PV panel mounting structures in one long run. The grounding wire should not be switched, fused or interrupted.
3. The complete earthing system shall be electrically connected to provide return to earth from all equipment independent of mechanical connection.
4. The equipment grounding wire shall be connected to PV power plant.
5. A separate grounding electrode shall be installed using earth pit per power plant. Test point shall be provided for each pit.
6. An earth bus and a test point shall be provided inside each control room.
7. Earthing system design should be as per the standard practices.
8. Minimum two earthing for one inverter, Four for structure, four for lighting arrester, two for AC panel for each plant.

Balance of Systems (BoS)

1. String/Array combiner boxes shall incorporate DC string circuit breakers, DC array disconnect switch, lightening and over voltage protectors, any other protection equipment, screw type terminal strips and strain-relief cable glands.

2. All DC and AC cables shall be terminated using suitable crimped cable lugs/sockets and screw type terminal strips. No soldered cable termination shall be accepted.
3. Only terminal cable joints shall be accepted. No cable joint to join two cable ends shall be accepted.
4. Suitable Ground Fault Detector Interrupter (GFDI) shall be incorporated either with the inverter or with the array combiner box.
5. String/Array combiner boxes shall be secured onto walls or metal structures erected separately on the terrace.
6. Conduits/concealed cable trays shall be provided for all DC cabling on the Roof top. Conduits/concealed cable trays shall be adequately secured onto the roof top/wall.
7. The DC and AC cable type shall be PVC/XLPE insulated, suitably armoured, 1100V grade multi-stranded copper conductor. Appropriate colour coding shall be used.
8. The DC ad AC cables of adequate electrical voltage and current ratings shall be also rated for 'in conduit wet and outdoor use'.
9. The total DC cable losses shall be maximum of 2% of the plant rated DC capacity over the specified ambient temperature range.
10. The DC and AC cable size shall be selected to maintain losses within specified limits over the entire lengths of the cables.
11. DC cables from array combiner box on the terrace to DC distribution box in the control room shall be laid inside cable duct where available or secured with conduits/concealed cable trays where duct is not available.
12. The DCand AC distribution boxes shall be wall mounted inside control room/open space.
13. DC distribution box shall incorporate DC disconnect switch, lightening surge protectors, any other protection equipment, screw type terminal strips and strain-relief cable glands.
14. AC distribution box shall incorporate AC circuit breaker, surge voltage protectors, any other protection equipment, plant energy meter, screw type terminal strips and strain-relief cable glands.
15. DC and AC cabling between inverter and distribution boxes shall be secured with conduits/concealed cable trays.
16. The total AC cable losses shall be maximum of 1% of the plant AC output over the specified ambient temperature range.

17. All cable conduits shall be GI/HDPE type.
18. All cable trays shall be powder coated steel or GI or equivalent.

Civil

1. PV array shall be installed in the space free from any obstruction and / or shadow.
2. PV array shall be installed utilizing maximum space to minimize effects of shadows due to adjacent PV panel rows.
3. Adequate spacing shall be provided between two panel frames and rows of panels to facilitate personnel protection, ease of installation, replacement, cleaning of panels and electrical maintenance.
4. PV panel frames shall be fixed with suitable GI structure for cycle parking /Car parking/ cycle way , which in turn shall be secured the structure in a seamless manner with no impact on waterproofing of the existing structure. Additional waterproofing shall be provided if required.
5. Ample clearance shall be provided in the layout of the inverter and DC/AC distribution boxes for adequate cooling and ease of maintenance.
6. The supplier shall specify installation details of the PV modules and the support structure with appropriate diagrams and drawings. Such details shall include, but not limited to, the following;

    a) Determination of true south at the site;
    b) Array tilt angle to the horizontal, with permitted tolerance;
    c) Details with drawings for fixing the modules;
    d) Details with drawings of fixing the junction/terminal boxes;
    e) Interconnection details inside the junction/terminal boxes;
    f) Structure installation details and drawings;
    g) Electrical grounding (earthing);
    h) Inter-panel/Inter-row distances with allowed tolerances; and
    i) Safety precautions to be taken.

    The array structure shall support SPV modules at a given orientation and absorb and transfer the mechanical loads to the support structure properly. All nuts and bolts shall be of very good quality stainless steel.
7. For cycle parking, park boundary and Car parking/ all the construction work should be made by the contractor. Foundation of the structure shall be RCC column type/ Medium gauge GI pipe/ Rail pole, PV modules shall be fixed in such a way that the space should be used as parking area. Minimum ground clearance for cycle shed should be maintained. A typical drawing of the elevated structure may be attached for reference.
8. **Minimum 1000 Ltr capacity three no water tank should be provided with pipe line for panel cleaning at locations specified by the institute. The Institute will supply water in these tanks**

Mechanical

1. The min. clearance between lower edge of PV panel and ground shall be 2.5m. (for cycle and Car parking and cycle way)
2.. The PV array structure design shall be appropriate with a factor of safety of min. 1.5.
3. Each PV panel structure shall incorporated one bird repellant spike at a level higher than the panel upper edge. The location of the spike should be selected for minimum shadow effect.
4. Array support structure shall be fabricated using corrosion resistant GI or anodized aluminum or equivalent metal sections.
5. Array support structure welded joints and fasteners shall be adequately treated to resist corrosion.
6. The support structure shall be free from corrosion when installed.

7. PV modules shall be secured to support structure using screw fasteners and/or metal clamps. Screw fasters shall use existing mounting holes provided by module manufacturer. No additional holes shall be drilled on module frames. Module fasteners/clamps shall be adequately treated to resist corrosion.
8. The support structure shall withstand wind loading of upto 150 km/hr.
9. Adequate spacing shall be provided between any two modules secured on PV panel for improved wind resistance.
10. The structure shall be designed to withstand operating environmental conditions for a period of minimum 25 years.
11. **The support structure design shall be made in such a way that sufficient allowance is available for car parking and cycle parking in the respective parking area. The structural design (submitted in triplicate) will require approval from IIT KGP before installation of structure and PV modules.**
12. It is required to design the grid structure (on which PV module will be installed) in such a way that all load is transferred to the columns of the structure. Such grid design should be presented to IIT KGP, which are certified by structural engineers.
13. **Design calculation in Stad Pro should be attached to justify that the structures are capable of withstanding wind velocity of 150 km ph. The same may be approved by the institute**

Electrical:

1. LT distribution grid specifications 415V +/- 5%, 50Hz and frequency variation as per IE rules.
2. The output of the inverter shall be transformer isolated and shall be fed into 415V, 3 phase AC LT grid supplied via LT Air circuit Breaker
3. The inverter output shall be connected to LT line prior to the LT/DG changeover switch. The mandatory islanding protection provided by inverter shall isolate the Solar PV power plant. Refer 'LT Distribution Grid Supply Schematic Diagram'
4. The time of day (TOD) 3 phase, digital AC load energy meter with Net metering facility shall be installed in the Main Distribution Box to monitor energy drawn by building load.
5. The time of day (TOD) 3 phase, digital AC energy meter with Net metering facility shall be installed in the AC distribution box to monitor energy generated by Solar PV power plant.
6. The load energy meter operation shall be completely independent of the plant AC energy meter.
7. The energy meters shall be provided with communication interface and necessary data cables.

Data Acquisition System

1. Data Acquisition System shall be provided for solar PV plant.
2. Computerized DC String/Array monitoring and AC output monitoring shall be provided as part of the inverter and/or string/array combiner box or separately.
3. String and array DC Voltage, Current and Power, Inverter AC output voltage and current (All 3 phases and lines), AC power (Active, Reactive and Apparent), Power Factor and AC energy (All 3 phases and cumulative) and frequency shall be monitored.
4. The time interval between two sets of data shall not be more than 3 minutes. (A min. of 20 samples of data shall be recorded per hour)
5. Data Acquisition System shall have real time clock, internal reliable battery backup and data storage capacity to record data round the clock for a period of min. 1 year.
6. Computerized AC energy monitoring shall be in addition to the digital AC energy meter.
7. The data shall be recorded in a common work sheet chronologically date wise. The data file shall be MS Excel compatible. The data shall be represented in both tabular and graphical form.
8. All instantaneous data shall be shown on the computer screen.

9. Software shall be provided for USB download and analysis of DC and AC parametric data for individual plant.
10. Provision for internet monitoring and download of data shall be also incorporated.
11. Software for centralized internet monitoring system shall be also provided for download and analysis of cumulative data of all the plants (including Existing plant) and the data of the solar radiation and environment monitoring system.
12. A data logging system (Hardware and Software) for plant control and monitoring shall be provided with the following features:

1 No. suitable Computers : i5 (7^{th} Gen) processor with 500 GB HDD, 8 GB RAM, 2 Parallel & 2 Serial Port, Wi-Fi Lan Card, DVD RW Drive, 27" LCD, USB Scroll Mouse, along with 1 KVA ups.

13. Remote Supervisory Control and data acquisition through SCADA software at the purchasers location (two) with latest software/hardware configuration and service connectivity for online/real time data monitoring/control complete to be supplied and operation and maintenance/control to be ensured by the supplier. Data acquisition system should be made only using the LAN of IIT Kharagpur not with external agencies website or cloud and would require to be integrated to the existing portal.

14. Disconnection and Islanding.

Disconnection of the PV generator in the event of loss of the main grid supply is to be achieved by in built protection within the power conditioner, this may be achieved through rate of change of current, phase angle, unbalanced voltage or reactive load variants.

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 : Neutral voltage displacement Over current Earth fault and reverse power in case of the above, cases, tripping time should be less than (15 seconds Response time in case of grid failure due to switch off or failure based shut down should be well within seconds. In case of use of two PCUs capacity suitable equipment for synchronizing the AC output of both the PCUs to the ACDB/Grid should be provided.

Automatic reconnection after the grid failure is restored.

15. PCU shall have the facility to reconnect the PCU automatically to the grid following restoration of grid subsequent to grid failure condition. And also the facility to connect the system with load at grid failure condition for essential power supply.

16. **42" Led display to be provided at Main building with continuous display of each plant including existing plants through IIT LAN**

Solar Radiation and Environment Monitoring System

1. Computerized solar radiation and environment monitoring system shall be installed on the buildings along with the solar PV power plant.
2. The system shall consist of various sensors, signal conditioning, data acquisition, LCD display and remote monitoring.
3. Global and diffuse beam solar radiation in the plane of array (POA) shall be monitored on continuous basis.
4. Ambient temperature and relative humidity near PV array, control room temperature, wind speed and wind direction at the level of array plane shall be monitored on continuous basis.
5. Solar PV module back surface temperature shall be also monitored on continuous basis.

6. Simultaneous monitoring of DC and AC electrical voltage, current, power, energy and other data of the plant for co-relation with solar and environment data shall be provided.
7. The time interval between two sets of data shall not be more than 3 minutes. (A min of 20 samples of data shall be recorded per hour)
8. Solar radiation and environment monitoring system shall have real time clock, internal reliable battery backup and data storage capacity to record data round the clock for a period of min. 1 year.

9. The data shall be recorded in a common work sheet chronologically date wise. The data file should be MS Excel compatible. The data shall be represented in both tabular and graphical form.

10. All instantaneous data shall be shown on the computer screen.
11. Historical data shall be available for USB download and analysis.
12. Provision for Internet monitoring and download of data shall be incorporated.

Operating Environment

1. Temperature: 5 to 55 C.
2. Relative Humidity: 100% @ 40 C
3. Precipitation: 2.46 mm per day (Annual average)
4. Clearness Index: 0.62 (Annual average)
5. Wind Speed: up to 150 km/hr.
6. Corrosion: high
7. Dust: moderate to high
8. Bird Interference: high
9. Bird Droppings: frequent and large
10. Trees: large and in abundance.

Testing, Certification and Approval Schedule

All components, sub-assemblies and system test parameters shall be verified on site to ensure they meet the specifications.

Plant Power Performance Ratio Testing

The overall power performance ratio of the system shall exceed 75%. (Sum total of the system power losses shall not exceed 25%). This allows for elevated module temperature during afternoon hours. For global solar radiation in the Plane of Array (POA) of 1000 W/m2, 100kWp PV power plant AC output shall be minimum of 75 kW at any time during the day. Correction shall be applied based on available solar radiation. For example, for 800 W/m2 radiation, 100kWp PV power plant shall produce min. of 60 kW AC output (70X0.8).

Plant Energy Performance Ratio Testing

The overall energy performance ratio of the system shall exceed 80%. (Sum total of the system energy losses shall not exceed 20%). For global solar insulation in the Plane of Array (POA) of 5 kWh/m2 (5 Peak Sun Hours) for the day. 100 kWp PV power plant AC energy output shall be minimum of 400 kWh (80kW x 5 hrs.) for the day.

Operation and Maintenance (O&M)

1. Cleaning of solar modules with soft water, wet and dry mops : Weekly
2. DC String / Array and AC Inverter monitoring : Continuous and computerized.
3. AC Energy monitoring : Continuous and computerized.
4. Visual Inspection of the plant : Monthly
5. Functional Checks of Protection Components and Switchgear : Quarterly.
6. Spring Clean PV Array and Installation Area : Quarterly.
7. Inverter, transformer, data acquisition, energy meters and power evacuation checks : Half Yearly.
8. Support structure and terrace water-proofing checks : Yearly.
9. O & M log sheet shall be provided and maintained.
10. The repair/replacement work shall be completed within 48 hours from the time of reporting the fault.
11. A half yearly performance report of the plant inclusive of energy generation data shall be provided as per approved format.
12. All recorded data for the first 5 years shall be preserved in both manual and computer format and submitted at hand over.
13. Thrift use of water is mandatory and a scheme for reuse of the water must be considered

INSPECTION AND MAINTENANCE SCHEDULE

Component	Activity	Description	Interval	By
PV Module	Cleaning	Clean any bird droppings/ dark spots on module	Immediately	Technician
	Cleaning	Clean PV modules with plain water or mild dishwashing detergent. Do not use brushes, any types of solvents, abrasives, or harsh detergents.	Once in a week	Technician
	Inspection	Use infrared camera to inspect for hot spots; bypass diode failure	Annual	Technician
PV Array	Inspection	Check the PV modules and rack for any damage. Note down location and serial number of damaged modules.	Half yearly	Technician
	Inspection	Determine if any new objects, such as vegetation growth, are causing shading of the array and move them if possible.	Half yearly	Technician
Junction Boxes	Inspection	Inspect electrical boxes for corrosion or intrusion of water or insects. Seal boxes if required. Check operation of all protection devices.	Half yearly	Technician
Wiring	Inspection	Observe instantaneous operational indicators on the faceplate of the inverter to ensure that the amount of power being generated is typical of the conditions.	Monthly	Electrician
Inverter	Service	Clean or replace any air filters.	As needed	Technician
Earthing	Inspection	Measurement of Earth resistance value	Half yearly	Technician
Plant	Monitoring	Daily Operation and Performance Monitoring	Daily	Site in charge
Log Book	Documentation	Document all O&M activities in a workbook available to all service personnel	Continuous	Site in charge

Warranties and Guarantees

1. Solar Modules: any damage due to Workmanship/product replacement/ hail storm – 10 years.
2. Solar Modules: 90% power output for 10 years and 80% power output for 25 years.
3. Inverter: Workmanship/product replacement – 5 years, service-25 years
4. Power Evacuation and Metering Equipment: Workmanship/product replacement – 10 years, service-25 years
5. BoS : Parts and Workmanship – 10 years, service – 25 years.
6. Power Plant Installation: Workmanship-10 years, service-25 years
7. PV Array Installation: Structural – 25 years
8. Power plant power performance ratio-min 70%
9. Power plant energy performance ratio-min. 75%

Standards and Compliance

1. IEC 60364-7-712 : Electrical Installations of Buildings : Requirements for Solar PV power supply systems.
2. IEC 61727 or similar : Utility Interface Standard for PV power plants > 10 kW.
3. IEC 62103, 62109 and 62040 (UL 1741) : Safety of Static Inverters – Mechanical and Electrical safety aspects.
4. IEC 62116 : Testing procedure of Islanding Prevention Methods for Utility-Interactive PV Inverters.
5. PV Modules : IEC 61730- Safety qualification testing, IEC 61701 – Operation in corrosive atmosphere
6. IEC 61215 : Crystalline Silicon PV Modules qualification
7. String/array junction boxes : IP65, Protection Class II, IEC 60439-1, 3.
8. Surge Protection Devices : Type 2, DC 1000V rated.
9. PV module/string/string combiner box interconnects : MC4 compatible. DC 1000V rated.
10. The central inverter shall be rated for IP54.
11. The DC/AC distribution boxes shall be rated IP54.
12. The data acquisition systems shall be rated for IP54.
13. All DC and AC cables, conduits, cable trays, hardware : relevant IS.
14. Earthing System : relevant IS.
15. PV array support structure : relevant IS.

Technical Bid Deliverables

For PV plant of 1100 kWp, following details are to be provided as part of technical bid :

1. Systems Diagram
2. Electrical Line Diagram
3. Structure design drawings and material specifications
4. Structure design calculations.
5. PV panels and structure installation drawings, indicate row spacing
6. Specifications as per SPV power plant specification sheet attached.
7. Deviations to technical specifications and cost of withdrawing deviations
8. PV module and inverter data sheets
9. PV array and inverter design calculations
10. DC and AC electrical BoS design calculations
11. DC and wiring diagrams
12. DC and AC cable sizes

13. Earthing system diagram
14. Plant power performance ration calculations and guarantee.
15. Plant energy performance ration calculations and guarantee
16. Plant performance simulation using PV syst.
17. Estimated yearly degradation of PV module power output.
18. Estimated plant energy generation in the first year till 25th year
19. Total foot print area required for the plant.

Tentative Locations and envisaged capacity(Capacity may be increased)

Sl No.	Location	Capacity (kWp)
1.	Gandhi park boundary	350
2.	NCRC Front cycle shed	200
3.	Car parking	500
4.	NCRC back cycle shed	50
	Total	1100

Schedule of quantities (BOQ) uploaded on the BOQ section on *https://eprocure.gov.in/eprocure/app* for online submission of the tender.

Special Condition for Electrical work

1. The work shall be carried out as per national code or C. P. W. D specifications for works with correction slips issued up-to date unless otherwise specified in the schedule of quantities for the works.
2. The following Indian Standard Specifications and Codes of Practice will apply to the equipment and the work covered by the scope of this contract. In addition the relevant clauses of the Indian Electricity Act 1910 and Indian Electricity Rules 1956 as amended upto date shall also apply. Wherever appropriate Indian Standards are not available, relevant British and/or IEC Standards shall be applicable.

BIS certified equipment shall be used as a part of the Contract in line with Government regulations. Necessary test certificates in support of the certification shall be submitted prior to supply of the equipment.

It is to be noted that updated and current Standards shall be applicable irrespective of those listed below.

Low voltage Switchgear and Controlgear specifications	IS 13947 : 1993
Part I – General	
Part 2 – Circuit Breakers	
Part 3 – Switch Fuse Units	
Part 4 – Contactors and Motor Starters	
Part 5 – Control Circuit Devices	
Electrical Relays for power system protection	IS 3231 : 1986
Low voltage Switchgear and Control gear assemblies	IS 8623 : 1993
Marking of Switchgear busbars	IS 11353 : 1985
Degree of Protection of Enclosures for low voltage switchgear	IS 2147 : 1962
Code of Practice for selection, installation and maintenance of Switchgear	IS 10118 : 1982

4. No under-ground work or above the false ceiling shall be covered until the same has got approved by the Engineer-in-charge. The contractor will supply the drawings of specific works for approval, if required
5. All the old wiring has to be dismantled with proper care. The reusable old materials if any are to be handed over to departmental store with proper documentation and the other non reusable (nil reselling value) will be disposed by the contractor. The contractor shall clear the site thoroughly of all scaffolding materials & rubbish etc. left out of his work & dress the site around the building to the satisfactions & his decision in writing shall be final & binding on all concerned
6. Special care to be taken to avoid any theft of electrical fittings and fixtures while executing the work.
7. The location of Panel / DB / Switch board / Light point / Fan point will be as per existing location or as per the instruction of Engineer-in-charge.
8. **All the wiring will be done with feruling and cable / Wire termination by required size or lugs of required materials and It should be noted that license wire man shall only be allowed for the wiring work.**

Electrical safety at work site

The contractor will identify one of the supervisors for taking care of implementation of Safety systems.

The Contractor should follow the following General Guidelines governing the safety rules as laid down under:

Usage of eye protection equipment shall be ensured when workmen are engaged for grinding, chipping, welding and gas-cutting. For other jobs as and when site safety co-coordinator insists eye protection has to be provided.

1. All safety appliances like Safety shoes, Safety gloves, Safety helmet, Safety belt, Safety goggles etc. shall be arranged before starting the job.
2. All excavated pits shall be barricaded & barricading to be maintained till the backfilling is done. Safe approach to be ensured into every excavation.
3. All the dangerous moving parts of the portable / fixed machinery being used shall be adequately guarded.
4. Ladders being used at site shall be adequately secured at bottom and top. Ladders shall not be used as work platforms.

5. Material shall not be thrown from the height. If required, the area shall be barricaded and one person shall be posted outside the barricading for preventing the tre-passers from entering the area.

6. Other than electricians no one is allowed to carry out electrical connections, repairs on electrical equipment or other jobs related thereto.
7. All electrical connections shall be made using 3 or 5 core cables, having a earth wire.

8. Inserting of bare wires for tapping the power from electrical sockets is completely prohibited.

9. A tools and tackles inspection register must be maintained and updated regularly.

10. Debris, scrap and other materials to be cleared from time to time from the workplace and at the time of closing of work every day.

11. All the unsafe conditions, unsafe acts identified by contractors, reported by site supervisors and / or safety personnel to be corrected on priority basis.

12. No children shall be allowed to enter the workplace.

13. All the lifting tools and tackles shall be stored properly when not in use.

14. Clamps shall be used on Return cables to ensure proper earthling for welding works.

15. All the pressure gauges used in gas cutting apparatus shall be in good working condition.

16. Proper eye washing facilities shall be made in areas where chemicals are handled.

17. Connectors and hose clamps are used for making welding hose connections.

18. All underground cables for supplying construction power shall be routed using conduit pipes.

19. Spill trays shall be used to contain the oil spills while transferring / storing them.

20. Tapping of power by cutting electric cables in between must be avoided. Proper junction boxes must be used.

21. **Non-compliance to above shall invite a penalty recovery as per 3.22.8.**