


6.5 MWp(DC) / 5 MW(AC) Grid Connected Ground mounted Solar Power Plant, at Nalanda University - Rajgir, BIHAR Price Schedule							
Sl. No	Name of Work	S//O	Unit	Qty	weightage in %	Rate/Unit	Total
(A)	Supply, installation, testing & commissioning:-						
1	Installation & commissioning of BHEL supplied items :						
1(a)	PV Modules with required nos of SS 304 nuts, bolts & washers as per Technical spec	I	Nos	20000	6.8692%	₹0.00	₹6.87
1(b)	Optimizer (4:1) with MC-4 connectors	I	Nos	5000	1.2822%	₹0.00	₹1.28
1(c)	Inverter & Accessories (50kVA- 200kVA)	I	Nos	50	0.9312%	₹0.02	₹0.93
1(d)	Erection of Module Mounting Structure with necessary SS 304 nuts , bolts & washers, as per drg No-24012100001, Rev 01 , tightening to required torque, drilling holes in case of any mismatch, all complete as per Technical spec.	I	Per Module	20000	14.6542%	₹0.00	₹14.65
2	ACDB supply & installation						
2(a)	Supply of ACDB/ACCB (50kVA-200kVA)	S	Nos	50	4.2360%	₹0.08	₹4.24
2(b)	ACDB/ACCB (50kVA-200kVA)	I	Nos	50	0.5136%	₹0.01	₹0.51
3	DC cabling						
3(a)	Supply of DC cable (4sqmm)	S	RMT	55000	7.5561%	₹0.00	₹7.56
3(b)	DC cable Laying through conduit pipe/ cable tray as per requirement - 8x4 Sq mm DC	I	RMT	6875	0.6297%	₹0.00	₹0.63
4	AC power Cabling (From Inverter to ACDB)						
4(a)	Supply of PVC sheathed XLPE copper conductor unarmoured 4core power cable of 1.1 KV grade of following size						
4 a (i)	16 Sqmm to 35 Sqmm	S	RMT	55	0.3705%	₹0.01	₹0.37
4a (ii)	Above 35 Sqmm to 95 Sqmm	S	RMT	55	0.7100%	₹0.01	₹0.71
4(b)	Laying and fixing of PVC sheathed XLPE copper conductor unarmoured 4core power cable of 1.1 KV grade of following size (including supply of accessories such as lugs, gland).						
4(b1)	16 Sqmm to 35 Sqmm	I	RMT	55	0.0083%	₹0.00	₹0.01
4(b2)	Above 35 Sqmm to 95 Sqmm	I	RMT	55	0.0176%	₹0.00	₹0.02
5	AC LT power Cabling (From ACDB to LT Panel)						
5(a)	Supply of PVC sheathed / XLPE, Armoured Aluminium conductor 4 core power cable of 1.1 KV grade of following size						
	Above 95 Sqmm to 185 Sqmm	S	RMT	3000	11.6089%	₹0.00	₹11.61
5(b)	Laying of PVC sheathed / XLPE, Armoured Aluminium conductor 4 core power cable of 1.1 KV grade of following size direct in ground including excavation of trench up to 1m, sand cushioning, protective covering and refilling the trench etc as required						
	Above 95 Sqmm to 185 Sqmm	I	RMT	3000	4.8084%	₹0.00	₹4.81
6	AC LT power bus duct (From LT Panel to Transformer)						
6(a)	Busduct - 3200A	S	RMT	12	2.2912%	₹0.19	₹2.29
6(b)	Busduct - 3200A	I	RMT	12	0.2720%	₹0.02	₹0.27
7	AC - HT (11kV) 3Core power cabling from Transformer to HT Panel						

6.5 MWp(DC) / 5 MW(AC) Grid Connected Ground mounted Solar Power Plant, at Nalanda University - Rajgir, BIHAR Price Schedule							
Sl. No	Name of Work	S//O	Unit	Qty	weightage in %	Rate/Unit	Total
7(a)	Supply of PVC insulated and PVC sheathed / XLPE, 3core Armoured Aluminium conductor power cable of 11 kV grade of following size						
	Above 35 Sqmm to 95 Sqmm	S	RMT	900	2.8850%	₹0.00	₹2.89
7(b)	Laying of PVC insulated and PVC sheathed / XLPE, Armoured power cable of 11 KV grade of following size direct in ground including excavation, sand cushioning, protective covering and refilling the trench etc as required						
	Above 35 Sqmm to 95 Sqmm	I	RMT	900	1.4425%	₹0.00	₹1.44
8	Supply & Installation of Conduits along with all accessories for cable laying						
	Supplying and fixing of following sizes of medium class HDPE/uPVC conduit along with accessories in surface/recess including jointing with all bends, adhesives etc., cutting the wall and making good the same in case of recessed conduit as required.						
8(a)	50 mm	S&I	RMT	3000	0.8243%	₹0.00	₹0.82
9	Supply & Installation of GI cable tray, including jointing, welding, bending & applying cold galvanised paint at welding locations , all complete as per drgs & tech. spec.						
9(a)	up to 35sqmm	S&I	RMT	700	0.4488%	₹0.00	₹0.45
9(b)	above 35sqmm upto 95sqmm	S&I	RMT	700	0.4808%	₹0.00	₹0.48
9(c)	above 95sqmm	S&I	RMT	600	0.6512%	₹0.00	₹0.65
10	Supply and installation of Earthing Strips						
10(a)	25x5 mm GI Strip	S&I	RMT	1500	1.1128%	₹0.00	₹1.11
10(b)	Earthing Wire (Green 2.5 Sqmm)	S&I	RMT	2000	0.3206%	₹0.00	₹0.32
11	Construction of Earth Pits with 300 thk alternate layers of charcoal & salt, including exaction, back filling, 75 dia 3 m long tapered GI pipe with holes at regular intervals at right angles to each other, and testing megger value as per design, including all material, cost of consummables etc. as per drawings & technical specs, all complete.						
11(a)	For chemical Earthing / Conductor Earthing (Pipe) (as per Approved Documents)	S&I	Nos.	70	1.7015%	₹0.02	₹1.70
12	Integration of Power						
12(a)	Supply of LT Panel having rating of (415 volt, 3200 Amp, 2000kVA)	S	No	3	8.2430%	₹2.75	₹8.24
12(b)	Installation & commissioning of LT panel having rating of (415 volt, 3200 Amp, 2000kVA) including termination of incoming & outgoing cables/busduct etc, including all material consummables etc.	I	No.	3	0.2061%	₹0.07	₹0.21
13	Supply & Installation of :-						
13(a)	Rating board / Name Plate	S&I	No.	14	0.0192%	₹0.00	₹0.02
13(b)	Display board	S&I	No.	2	0.0046%	₹0.00	₹0.00
13(c)	Danger Board	S&I	No.	60	0.0481%	₹0.00	₹0.05

Price Schedule


Sl. No	Name of Work	S/I/O	Unit	Qty	weightage in %	Rate/Unit	Total
--------	--------------	-------	------	-----	----------------	-----------	-------

Offered Price						₹100.00
Total Price of Bidder						₹100.00
GST Rate as Follows :-						
5% on 70% of the total Value						₹3.50
18% on 30% of the total Value						₹5.40
Total Price Including GST						₹108.90

	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
	GROUP : REG(Renewable Energy Group)	Rev no	00

Index

Sl. No	Description	Chapter	Page No
1	General Intent of Specifications	Chapter-I	2
2	Delivery Period	Chapter-II	3
3	Obligations of Contractor	Chapter-III	4-5
4	Responsibilities of Contractor in respect of Labour, Supervisory Staff, etc.	Chapter-IV	6-7
5	Drawings and documents	Chapter-V	8-9
6	Inspection and Quality	Chapter-VI	10-12
7	HSE & OHSAS	Chapter-VII	13-19
8	Payment	Chapter-VIII	20-22
9	Performance Monitoring	Chapter-IX	23
10	Performance Guarantee	Chapter-X	24


	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

Chapter-I:
General Intent of Specifications

1. INTENT OF THE SPECIFICATION

- 1.1.** Various activities required for Supply and Installation of Solar Ground Mounted systems have been identified by BHEL. All the activities required for providing services related to BHEL supplied items, dismantling of existing system (If Required) and Installation of COMPLETE Solar Ground Mounted systems at site have been identified and listed. Supply of DC cable, AC Cable, LT panel, CCTV, Lightening Arrestor (LA), other minor items, fittings etc. as per list have also been identified as separate line items. Apart from the items generally required for completion of a basic system – other items for supply, installation have also been identified which are required on cases to case basis against various specific requirements of our customer/end user.
- 1.2.** BHEL will place the order with the lowest bidder for full scope of work. Works order is to be awarded to bidder who meet pre-qualification requirement, and techno-commercially qualified and quotes “lowest landed cost to BHEL” for complete specification and scope defined in tender enquiry


3/10/21

	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
	GROUP : REG(Renewable Energy Group)	Rev no	00

Chapter - II:
Delivery Period

1. DELIVERY PERIOD

As per NIT.

	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

Chapter - III:

Obligations of Contractor

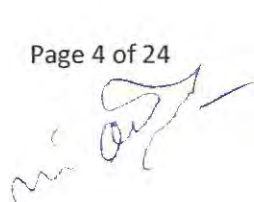
1. CONSUMABLES & OTHER ITEMS


The contractor shall provide within finally accepted price / rates, all Minor accessories, fitting items, Concrete etc for ensuring proper finish and completeness of the work. Other erection consumables such as Nuts and Bolts, ferrules tapes, CTC / other cleaning agents are to be provided by the contractor. Steel, packers, shims, wooden planks, scaffolding materials hardware items etc required for temporary works such as scaffoldings are to be arranged by the contractor. Wooden sleepers, for temporary work, required for completion of work except those which are specifically supplied by manufacturing unit are also to be arranged by the contractor.

2. TOOLS AND PLANTS / MONITORING AND MEASURING EQUIPMENT (MMEs)

T&Ps and MMEs to be provided by Contractor

- 2.1. All T&Ps and MMEs except those that are in BHEL scope are to be provided by the Contractor. Contractor has to make his own arrangement at his cost for completing the formalities, for bringing their materials, plants and equipment's at site for the execution of work under this contract.
- 2.2. Timely deployment of adequate T&Ps is the responsibility of the contractor. The contractor shall be prepared to augment the T&P at short notice to match the planned program and to achieve the milestones.
- 2.3. In the event of contractor failing to arrange the required tools, plants, machinery, equipment, material or non-availability of the same owing to breakdown, BHEL will make alternative arrangement at the risk and cost of the contractor. Decision of BHEL shall be final and binding on the contractor.
- 2.4. The T&P to be arranged by the contractor shall be in proper working condition and their operation shall not lead to unsafe condition. Their movements, should be such that no damage / breakage occurs to foundations, other equipment, material, property and men. All arrangements for the movement of the T&P etc shall be the contractor's responsibility.




	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
	GROUP : REG(Renewable Energy Group)	Rev no	00


2.5. Contractor shall ensure deployment of reliable and calibrated MMEs (Inspection measuring and Monitoring equipment). The MMEs shall have test / calibration certificates from authorized / Government approved / accredited agencies traceable to National / International standards. Each MME shall have a label indicating calibration status i.e. date of calibration, calibration agency and due date for calibration. A list of such instruments deployed by contractor at site with its calibration status is to be submitted to BHEL Engineer for control.

2.6. The contractor shall engage trained and experienced operators for the operation of T&Ps.

3. EPF/ESIC

For the persons deputed at site – Bidder should ensure EPF/ESIC registration and payment towards PF of employee as per applicable rules prevailing in the state/UT of work. Workmen compensation policy has to be taken by the Bidder and should be submitted to BHEL before start of work. Indemnity bond to this effect shall be submitted by vendor for release of payment.

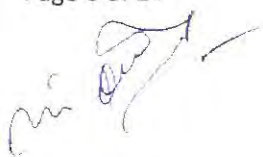
3/10/21


	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

Chapter – IV:
Responsibilities of Contractor in respect of Labour,
Supervisory Staff, etc.

1. RESPONSIBILITIES OF CONTRACTOR IN RESPECT OF LABOUR, SUPERVISORY STAFF, ETC.

- 1.1. Refer relevant clauses of General Conditions of Contract (GCC) also in this regard
- 1.2. The contractor shall deploy all the necessary skilled/semiskilled/ unskilled labour including highly skilled workmen etc. These workmen should have previous experience on similar job. They shall hold valid certificates wherever necessary. BHEL reserves the right to insist on removal of any employee of the contractor at any time if he is found to be unsuitable and the contractor shall forthwith remove him.
- 1.3. Contractor shall also comply with the requirements of local authorities/ project authorities calling for police verification of antecedents of the workmen, staff etc.
- 1.4. It is the responsibility of the contractor to engage his workmen in shifts and or on overtime basis for achieving the targets set by BHEL. This target may be set to suit BHEL's commitments to its customer or to advance date of completion of events or due to other reasons. The decision of BHEL in regard to setting the erection and commissioning targets will be final and binding on the contractor.
- 1.5. The Contractor shall obtain Independent license under the Contract labour (Regulation and Abolition) Act 1970 from the concerned authorities based on Form-V issued by the Principal Employer/Customer. In order to issue Form-V by Customer, Contractor shall fulfill all Statutory requirements like Insurance Policy, PF Code/PF Account number etc as per the requirement of BHEL/Customer.
- 1.6. Contractor shall deduct the necessary amount towards Provident Fund and contribute equal amount as per Government of India laws. This amount will be deposited regularly to the provident Fund Commissioner. BHEL/Customer may insist for submission of the account code duly certified by PF Commissioner
- 1.7. Contractor may also be required to comply with provisions of ESI Act in vogue if applicable and submit evidence to BHEL.




	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

1.8. BHEL / customer may insist for witnessing the regular payment to the labour which is to be done compulsorily through e-payment mode. They may also like to verify the relevant records for compliance with statutory requirements. Contractor shall enable such facilities to BHEL/ Customer.

1.9. Contractor shall deploy only qualified and experienced engineers/ supervisors. They shall have professional approach in executing the work.

1.10. The contractor's supervisory staff shall execute the work in the most professional manner in the stipulated time. Accuracy of work and aesthetic finish are essential part of this contract. They shall be responsible to ensure that the assembly and workmanship conform to dimensions and tolerances given in the drawings/instructions given by BHEL engineer from time to time.

1.11. The supervisory staff employed by the contractor shall ensure proper outturn of work and discipline on the part of the labour put on the job by the contractor. Also in general they should see that the works are carried out in a safe and proper manner and in coordination with other labour and staff employed directly by BHEL or other contractors of BHEL or BHEL's client.


1.12. It is the responsibility of the contractor to arrange gate pass for all his employees, T&P etc for entering the project premises. Necessary coordination with customer officials is the responsibility of the contractor. Contractor to follow all the procedures laid down by the customer for making gate passes. Where permitted, by customer / BHEL, to work beyond normal working hours, the contractor shall arrange necessary work permits for working beyond normal working hours.

1.13. The actual deployment will of Labour and Engineer/supervision staff shall be so as to satisfy the erection and commissioning targets set by BHEL. If at any time, it is found that the contractor is not in a position to deploy the required engineers/supervisors/workmen due to any reason, BHEL shall have the option to make alternate arrangements at the contractor's risk and cost. The expenditure incurred along with BHEL overheads thereon shall be recovered from the contractor

1.14. Contractor shall not deploy women labour at night.

[Handwritten signature]

[Handwritten signature]


	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

Chapter – V:

Drawings and documents

1. DRAWINGS

- 1.1. On award of work, for complete works, bidders shall arrange site visit and confirm feasibility as per drawings and rating provided by BHEL to the bidder.
- 1.2. The detailed drawings, specifications available with BHEL engineers will be made available to the contractor during execution of work at site. The contractor will also ensure availability of all drawings / documents at work place
- 1.3. Necessary drawings to carry out the erection work will be furnished to the contractor by BHEL on loan, which shall be returned to BHEL Engineer at site after completion of work. Contractor shall ensure safe storage and quick retrieval of these documents.
- 1.4. The contractor shall maintain a record of all drawings and documents available with him in a register as per format given by BHEL Engineer. Contractor shall ensure use of pertinent drawings / data / documents and removal of obsolete ones from work place and returning to BHEL.
- 1.5. The data furnished in various annexure enclosed with this tender specification are only approximate and for guidance. However, the change in the design and in the quantity may occur as is usual in any such project work. The contractors quoted rates shall be inclusive of the above factor
- 1.6. Should any error or ambiguity be discovered in the specification or information the contractor shall forthwith bring the same to the notice of BHEL before commencement of work. BHEL's interpretation in such cases shall be final and binding on the contractor.
- 1.7. Deviation from design dimensions should not exceed permissible limit. The contractor shall not correct or alter any dimension / details, without specific approval of BHEL.


	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

2. DOCUMENTS

Below mentioned timeframe is an essential condition of contract

The Contractor shall furnish the following documents on Award/Intent and obtain approval

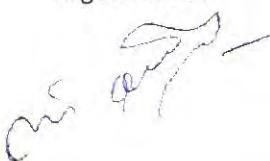
- 2.1. Confirmation of site mobilization date and list of persons to be deputed to site. (to be submitted with 03 days of award of work. (Site to be mobilized within 07days of award of work and civil foundation work to be lined up first).
- 2.2. PERT CHART – listing activities with start & finish date as per contract.
(to be submitted within 05 days of award of work)
- 2.3. General arrangement (Location of ACDB, DCDB, Inverter, etc.)
(within 05 days from order) – CONSIDERING 03 DAYS FOR SITE VISIT.
- 2.4. Drawing and its stability report for Mounting structure for ACDB, DCDB and Inverter.
- 2.5. As built drawings
- 2.6. O&M manual


	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

Chapter – VI: **Inspection and Quality**

1. Inspection, Quality Assurance, Quality Control

- 1.1. Preparation of quality assurance log sheets and protocols with customer/ consultants/statutory authority, welding logs, NDE records, testing & calibration records and other quality control and quality assurance documentation as per BHEL engineer's instructions, is within the scope of work/specification. These records shall be submitted to BHEL/customer for approval from time to time.
- 1.2. The protocols between contractor and customer/ BHEL shall be made prior to installation for correctness of foundations, materials, procedures, at each stage of installation, generally as per the requirement of customer/ BHEL. This is necessary to ensure elimination of errors or keeping them within tolerable limits and to avoid accumulation and multiplication of errors.
- 1.3. The protocols between contractor and customer/ BHEL shall be made prior to installation for correctness of foundations, materials, procedures, at each stage of installation, generally as per the requirement of customer/ BHEL. This is necessary to ensure elimination of errors or keeping them within tolerable limits and to avoid accumulation and multiplication of errors.
- 1.4. Contractor shall provide all the Measuring Monitoring Equipment's (MMEs) required for completion of the work satisfactorily. These MMEs shall be of brand, quality and accuracy specified by BHEL Engineer and should have necessary calibration and other certificates as per the requirement of BHEL Engineer. Decision of BHEL Engineer regarding acceptance or otherwise of the measuring instruments/gauges/tools for the work under this specification, is final and binding on the contractor. BHEL may give an indicative list of MMEs required for this work and to be made available by the contractor. The list will be reviewed by BHEL and the contractor shall meet any augmentation needed wherever required.
- 1.5. Any re-laying or re-termination of cables/re-erection of instruments/ recalibration of instruments etc. required due to contractor's mistake or design requirement and found at any stage inspection, shall be carried out by the contractor at no extra cost.




 Rudrapur	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
	GROUP : REG(Renewable Energy Group)	Rev no	00

1.6. Total Quality is the watchword of the work and Contractor shall strive to achieve the Quality Standards, procedures laid down by BHEL. He shall follow all the instructions as per BHEL drawings and Quality Standards.

2. Stage Inspection By FES/QA Engineers

Apart from day-to-day inspection by BHEL Engineers stationed at Site and Customer's Engineers, stage inspection of equipments under erection and commissioning at various stages shall also be conducted by teams of Engineers from Field Engineering Services of BHEL's Manufacturing Units, Quality Assurance teams from Field Quality Assurance, Unit/Factory Quality Assurance and Commissioning Engineers from Technical Services etc. Contractor shall arrange all labour, tools and tackles etc along with proper access for such stage inspections free of cost


3. Statutory Inspection of Work

The work to be executed under these specifications has to be offered for inspection, at appropriate stages of work completion, to various statutory authorities for compliance with applicable regulations. The work related statutory inspections, though not limited to, are as under: 1) Inspectorate of Steam Boilers and Smoke Nuisance 2) Electrical Inspector 3) Factory Inspector, Labour Commissioner, PF Commissioner and other authority connected to this project work The scope includes getting the approvals from the statutory authorities, which includes arranging for inspection visits of statutory authority periodically as per BHEL Engineer's instructions, arranging materials for ground inspection, taking rub outs for the pressure parts to be offered for inspection, submitting co-related inspection reports, documents, radiographs etc and following up the matter with them. Contractor shall also make all arrangements for offering the Products / Systems for inspection at location, as applicable, to the concerned authority.

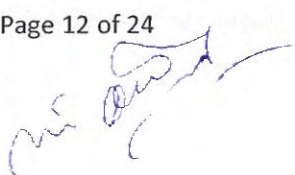
4. Field Quality Assurance


4.1. Contractor shall carry out all activities conforming to the approved Field Quality Plan (FQP) as revised from time to time. Total quality shall be the watchword of the work and contractor shall strive to achieve the quality standards, procedures laid down by BHEL. He shall follow all the instructions as per BHEL drawings and quality standards. Contractor shall provide the services of quality assurance engineer as per the relevant clauses




	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

- 4.2. Contractor has to fulfil quality requirement as per this chapter. In case of any gap in fulfilling these requirements by the contractor, financial penalty shall be imposed on the contractor with the rate mentioned in the "MEMO for penalty imposition against non-compliance in Quality area" enclosed as Annexure-IV.




	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

Chapter VII

HSE & OHSAS – SAFETY ARRANGEMENT & PRECAUTIONS

1. OCCUPATIONAL HEALTH, SAFETY & ENVIRONMENT MANAGEMENT/ QUALITY ASSURANCE PROGRAMME :

BHEL, Rudrapur has HSE certification (ISO14001& OHSAS18001) and accordingly, Contractor has to organize/ plan/ perform all their activities to meet with the applicable requirements of these standards.

BHEL, Rudrapur is certified for ISO 9001. Quality of work to customer's satisfaction and fulfillment of system requirements are the essence of ISO 9001 certification.

HSE (Health, safety & Environment):

Requirements of BHEL HSE compliance in brief is given below:-

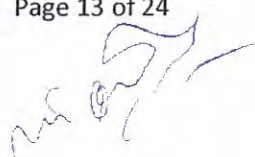
- 1.1.** Contractor will nominate only qualified and experienced employees. The site in-charge nominated by contractor will be responsible for all HSE related issues of contractor's work area. In case contractor feels that the site in-charge needs training regarding the HSE guidelines – he may request in writing to BHEL in this regard. All details shall be explained in detail to the person identified by contractor at BHEL Rudrapur unit.

The Site In-charge will have authority to stop any activity, in case he observes that the activity is not being carried out in safe manner. He will conduct surprise inspection as well as periodic inspection/drill (at least once in a month). He will conduct periodic meetings with different working groups and explain HSE issues and use of PPEs to them. Contractor will develop suitable work procedures based upon HSE guidelines and OCPs and implement it. Such work procedures will consist of Area of work, T&P Details, Work Procedure, PPE requirements etc.

No extra charges shall be payable to contractor towards compliance of the safety requirements as per BHEL HSE guidelines.


- 1.2.** Requirement of all personnel protective equipments (PPEs), in adequate numbers shall be assessed by the site in-charge and will be made available at site for their regular use by all concerned. This will be ensured by site in-charge.

List of such PPEs shall be recorded in the site register and issue records to individuals with signature will be maintained.




	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

- 1.3. Contractor will provide appropriate First Aid facilities for prompt treatment of injuries and illness at work place. Arranging training to contractor workmen/ employees for giving first aid.
- 1.4. All the following details shall be displayed properly for emergency reference. Information regarding the same shall also be provided to all workmen during HSE briefing.
 - a) Arranging ambulance in case of any emergency situation.
 - b) Identification of nearest hospital for health check-up of workmen/employees.
 - c) Identification of nearest fire station and display contact telephone nos./ person's name around work places for cases of emergencies.
- 1.5. Contractor will make arrangement for proper drinking water at work place.
- 1.6. Contractor will ensure that safety requirements at all power tapping points are fulfilled.
- 1.7. Red & White caution tape of proper width (1.5 to 2 inch) to be used for cordoning unsafe area such as open trench, excavation area etc.
- 1.8. Providing contractors company logo on cloths /uniform/ proper identity cards with photographs, for correct identification of people working at project site.
- 1.9. All scaffolding/ platforms should be made from materials of appropriate quality/grade so that these are safe for use. It should be certified/declared safe for use by an experienced contractor person, before any scaffolding/platform is used. Please refer IS:3696 part 1&2 and 4014 part 1 & 2 for further details.
- 1.10. Ensure that the regulatory requirement of excessive weight limits (to carry/ lift/ move weights beyond prescribed limits) for male and female workers are complied with.
- 1.11. Safety slogan, Safety/ Caution boards, wherever required to be displayed in consultation with BHEL.
- 1.12. Take suitable measures for waste management and environment related laws/legislation as a part of normal construction activities. Ensure proper cleanliness of work place, housekeeping and waste management (including proper waste disposal) on daily basis.

 Rudrapur	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
	GROUP : REG(Renewable Energy Group)	Rev no	00

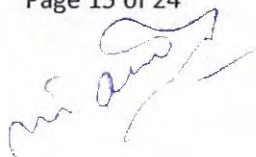
1.13. The Contractor is required to provide proper safety net systems (IS-11057) where ever the hazard of fall from height is present. The safety nets shall be fire resistant, duly tested and shall be of ISI Mark and the nets shall be located as per site requirements to arrest or to reduce the consequences of a possible fall of persons working at different heights.


1.14. Different risk areas shall be identified by the site in-charge and accordingly, all applicable OCPs (Operational control procedures) will be followed. Based on identified safety risks at site – the contractor may submit request to BHEL in writing for required assistance in making of suitable OCPs in case the same is not available with them. The OCPs are also available in BHEL website in downloadable format. Complete responsibility for identification of risk areas and displaying the OCPs prominently at site, explaining the procedure to each workman in the area, lies with the contractor.

2. **SUBMISSION OF SAFETY PLAN:**

The contractor shall take all necessary safety precautions and arrange for appropriate appliances to prevent loss of human lives, injuries, to personnel engaged and damage to property. Before commencing the work, the contractor shall submit a "Safety Plan" to the above authorized BHEL official and obtain approval on the same. The safety plan shall indicate in detail the measures that would be taken by the contractor to ensure safety of men, equipment, materials and environment during execution of the work. Area wise Electrical safety inspection is to be carried out and the report is to be submitted. This will also include an organization structure, role and responsibilities of the concerned key personnel, the safety practices that will be followed, PPEs deployed, plan for handling critical activities and emergencies.

3. During the course of construction, alternation or repairs, scrap with protruding nail, sharp edge etc and all other debris shall be kept clean from working areas, passage, ways and stairs in and around site.
4. Rigging equipment for materials handling shall be inspected prior to use in each shift and as necessary during its use to ensure that it is safe. Defective rigging equipment will be removed from service.





	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

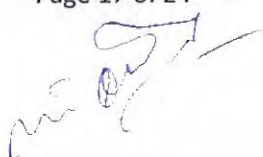
5. All workmen of the contractor working on construction area shall wear safety shoes, hand gloves, safety helmets and safety belt as applicable.
6. The contractor shall insure his workmen against all accidents and the policy shall be presented to BHEL Engineer on demand. In case of a fatal or disabling injury accident to any person at construction site due to lapses by the contractor, the victim and/or his/her dependents shall be compensated by the contractor as per statutory requirements. However, if considered necessary BHEL shall have the right to impose appropriate financial penalty on contractor and recover the same from payments due to the contractor for suitably compensating the victim and/or his/her dependence before imposing any such penalty. Appropriate enquiry shall be held by BHEL giving opportunity to the contractor for presenting his case. Above safety conditions are not exhaustive but gives an idea for the contractor and contractor shall adhere to all safety precaution given by the Engineer at site.
The Contactor shall take all measures at the sites of the work to protect all persons from accidents and shall be bound to bear the expenses of defense of every suit, action or other proceeding at law that may be brought by any persons for injury sustained or death owing to neglect of the above precautions and to pay any such persons such compensation or which may with the consent of the Contractor be paid to compromise any claim by any such person should such claim proceeding be filed against BHEL, the Contractor hereby agrees to indemnify BHEL against the same
7. The contractor shall arrange at his cost adequate lighting facilities e.g. flood lighting, hand lamps, area lighting etc. at various levels for safe and proper working operations during night hours at the work spot as well as at the pre-assembly area.
8. The contractor shall be responsible for provision of all the safety notices and safety equipment as enjoined on him by the application of relevant statutory regulation / provisions and/or as called upon by BHEL from time to time. He shall be held responsible for any violation of statutory regulations (local, state or central) and BHEL instruction that may endanger safety of men, equipment and material.
9. The contractor shall provide temporary fencing wherever required as a safety measure against accident and damage to properties. Suitable caution notices shall be displayed where access to any part is found to be unsafe and hazardous.



3-10-21


	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

10. It will be the responsibility of the contractor to ensure safe lifting of the equipment, taking due precaution to avoid any accident and damage to other equipment and personnel. All requisite tests and inspection of handling equipment, tools & tackle shall be periodically done by the contractor by engaging only the COMPETENT PERSONS as per law. Defective equipment or uncertified shall be removed from service. Any equipment shall not be loaded in excess of its recommended safe working load.
11. The contractor should conduct periodical first –aid classes to keep his supervisor and Engineers properly trained for attending to any emergency.
12. The contractor shall arrange induction safety training for all employees before assigning work. In addition, awareness program, mock drill at regular intervals and daily tool box meetings shall be arranged.
13. All portable electric tools used by the contractor shall have safe plugging system to source of power and be appropriately earthed. Only electricians licensed by appropriate statutory authority shall be employed by the contractor to carry out all types of electrical works. Details of earth resource and their test date to be given to BHEL safety officer as per the prescribed formats of BHEL.
14. The contractor shall carefully follow the safety requirement of BHEL/ the purchaser with the regard to voltages used in critical areas.
15. The contractor shall use only properly insulated and armored cables which conform to the requirement of Indian Electricity Act and Rules for all wiring, electrical applications at site. BHEL reserves the right to replace any unsafe electrical installations, wiring, cabling etc. at the cost of the contractor. All electrical appliances used in the work shall be in good working condition and shall be properly earthed. No maintenance work shall be carried out on live equipment. The contractor shall maintain adequate number of qualified electricians to maintain his temporary electrical installations.
16. Suitable scaffolds shall be provided for workman for all works that cannot safely be done from the ground, or from solid construction except in the case of short duration of work which can be done safely from ladders. When a ladder is used, it shall be of rigid construction made of steel. The steps shall have a minimum width of 45 cm and a maximum rise of 30 cm. Suitable handholds of good quality wood or steel shall be provided and the ladder shall be given an inclination not steeper than ¼ horizontal and 1 vertical.





	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

17. Scaffolding or staging more than 3.6 m above the ground floor, swung or suspended from an overhead support or erected with stationery support shall have a guard rail properly bolted, braced or otherwise secured, at least 90 cm above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from savor, from swaying, from the building or structure.
18. Working platforms, gangways and stairways shall be so constructed that they do not sag unduly or unequally and if the height of the platform gangways provided is more than 3.6 m above ground level or floor level, they shall be closely boarded and shall have adequate width which shall not be less than 750 mm and be suitably fenced as described above.
19. Every opening in the floor or a building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 90 cm.
20. Wherever there is open excavation in ground, they shall be fenced off by suitable railing and danger signals installed at night so as to prevent persons slipping into the excavations.
21. Safe means of access shall be provided to all working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 m in the length while the width between side rails in rung ladder shall in no case be less than app. 29.2 cm for ladder upto and including 3 m in length. For longer ladders this width shall be increased at least ¼" for each additional foot of length.
22. Adequate precautions shall be taken to prevent danger for electrical equipment. No materials on any of the sites of work shall be so stacked or placed as to cause danger or inconvenience to any person or the public.
23. Electric wiring and other dangerous pump of hoisting appliances should be provided with efficient safe guards. When workers employed on electrical installations which are already energized, insulting mats, wearing apparel, such as gloves, sleeves and boots as may be necessary should be provided. The worker should not wear any rings, watches and carry keys or other materials which are good conductor of electricity.
Hoisting appliance should be provided with such means as will reduce to the minimum the risk of any part of a suspended load becoming accidentally displaced.

	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
	GROUP : REG(Renewable Energy Group)	Rev no	00


24. These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent, place at work spot. The persons responsible for compliance of the safety code shall be named therein by the Contractor

25. Keeping the work area clean/ free from debris, removed scaffoldings, scraps, insulation/sheeting wastage /cut pieces, temporary structures, packing woods etc. will be in the scope of the contractor. Such cleanings have to be done by contractor within quoted rate, on daily basis by an identified group.


Page 19 of 24

31/07/21

Signature and seal of Bidder

	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

Chapter VIII

Payment

1. PAYMENTS

Bills shall be raised by Contractor on and after completion of work recording and verification of work measurement as per **Chapter-7 (Page 16-17)** of GCC attached in this NIT. **Any bill without Verified Measurement Sheet and duly filled and signed Format WAM6/WAM7 shall not be entertained by BHEL.** Payments to Contractors shall be made as follows:


1.1. Running Account Bills (RA Bills)

- a) These are for interim payments when the contract is in progress. The bills for such interim payments are to be prepared by Contractor in prescribed formats (**RA Bill forms – WAM6**).
- b) Payments shall be made according to the extent of work done as per measurements taken up to the end of the calendar month and in line with the terms of payments described in the Tender documents.
- c) The payment for running bills will normally be released within 45 days of submission of **execution of work subject to acceptance and submission of running bill complete in all respects with all supporting documents like verified measurement sheet and format WAM6.** It is the responsibility of the contractor to make his own arrangements for making timely payments towards labour wages, statutory payments, outstanding dues etc and other dues in the meanwhile. Following documents shall be submitted by bidder:

- Invoice - 01 original for buyer + 03 extra.
- Duly filled and stamped RA bill format WAM 6.
- LR/GR/Material Receipt copy
- List of all tools and tackles with calibration certificates.
- Test Reports of all BoS supplied by the Bidder and warranty card.
- Closure of BHEL raised quality punch points(along with Final Bills)
- For Final Bill Commissioning report, Handover certificate & training certificate
- Details of payment of PF and ESI of labours.
- Progress Schedule

During the Operation & maintenance following documents are required for processing O&M Bills

- Invoice - 01 original for buyer + 03 extra.
- Duly filled and stamped RA bill format WAM 6.
- Monthly O&M report duly signed by BHEL/Customer
- List of all tools and tackles with calibration certificates.

	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

- Details of payment of PF and ESI of labours.
 - Copy of Maintenance register , Monthly Generation report, Cleaning report as per the attached format available in this tender, O&M report dully signed by the Customer/BHEL representative.
- In case of any discrepancy in material supplied or service rendered or work executed by contractor, BHEL shall indicate the discrepancy, and payment shall be made within 45 days from the day of removal of such discrepancy.
 - Recoveries on account of electricity, water, Liquidated Damages, all applicable statutory deductions like TDS under Income Tax, GST TDS, BOCW other Taxes. shall be made as per terms of contract.
- d) Full rates for the work done shall be allowed only if the quantum of work has been done as per the specifications stipulated in the contract. If the work is not executed as per the stipulated specifications, BHEL may ask the contractor to re do the work according to the required specifications, without any extra cost. However, where this is not considered necessary 'OR' where the part work is done due to factors like non-availability of material to be supplied by BHEL 'OR' non availability of fronts 'OR' non availability of drawings, fraction payment against full rate, as is considered reasonable, may be allowed with due regard for the work remaining to be done. BHEL decision in this regard will be final and binding on the contractor.
- e) All preconditions noted in the NIT for release of payment shall be necessarily complied with by the contractor while submitting the claim for payment.

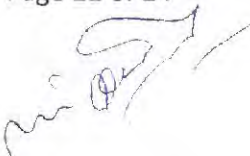
1.2. Final Bill


Final Bill' is used for final payment on closing of Running Account for works or for single payment after completion of works. 'Final Bill' shall be submitted as per prescribed format **WAM7** after completion of works as per scope and upon material reconciliation, along with the following.

- a) Duly Filled and verified Final Bill Format WAM7
- b) 'No Claim Certificate' by contractor
- c) For Final Bill Commissioning report, Handover certificate & training certificate
- d) Clearance certificates wherever applicable viz Clearance Certificates from Customer, various Statutory Authorities like Labour department, PF Authorities, Commercial Tax Department, etc

BHEL shall settle the final bills after deducting all liabilities of Contractor to BHEL.

Payment of Final bill shall be released within 45 days after acceptance of final Invoice submitted along with all document mentioned as above to this office.





	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

Refund of Retention Amount shall be along with 'Final Bill'. No interest shall be applicable on retention amount.

- 1.3. BHEL shall release payment through **Electronic Fund Transfer (EFT)/RTGS**. In order to implement this system, Contractor to furnish details pertaining to his Bank Accounts where proceeds will be transferred through BHEL's banker, as per prescribed formats.


1.4. **Security Deposit**

The security deposit amount shall be retained until fulfilment of contractual obligation. After completion of scope and fulfillment of all contractual obligations as per contract, contractor shall submit request of return of security deposit as per **Format WAM10**.


Page 22 of 24

31/07/21

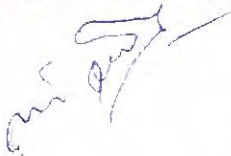
Signature and seal of Bidder


	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

Chapter IX:
Performance Monitoring

1. Performance Monitoring

- 1.1. Performance of the contractor is monitored through various reports/reviews and shall be jointly evaluated every month for unit wise identified packages as per prescribed formats. Based on the net weighted scores obtained, Contractors shall be rated 'Good' or 'Satisfactory' or 'Unsatisfactory'
- 1.2. In case of any dispute on performance rating and the contractor refuses to sign on the performance rating given by BHEL package In-charge, the same shall be reviewed by BHEL site In-charge/Construction Manager and his decision shall be final.
- 1.3. Performance of the contractor will be taken into consideration for assessing the capacity of the bidder to execute future jobs under tender, as detailed in the Notice Inviting Tender.
- 1.4. In case of 'Unsatisfactory performance' for a continuous period of three or more months for a package or packages, BHEL has the right to get the balance works executed at the risk and cost of the contractor.
- 1.5. In case of 'Unsatisfactory performance' in a financial year, BHEL reserves the right to put on hold such Contractors for a period of six months for similar package or similar packages




	Special Conditions of Contract (SCC)	Doc. No:-	REG2021-20210253
		Part	04/05
Rudrapur	GROUP : REG(Renewable Energy Group)	Rev no	00

Chapter X


Performance Guarantee

1. PERFORMANCE GUARANTEE FOR WORKMANSHIP

1.1. The Contractor will be responsible for the quality of the workmanship of the work undertaken and shall ensure that the systems are in proper working condition for the period of Maintenance Contract as defined in the Conditions of Contract, for good workmanship. In the event of the Contractor failing to repair the defective works within the time specified by the Engineer, BHEL may proceed to undertake the repairs of such defective works at the Contractor's risk and cost, without prejudice to any other rights and recover the same from the Guarantee money.

1.2. BHEL shall release the Security Deposit subject to the following

- a) Contractor has submitted 'Final Bill'
- b) Maintenance period as per contract has expired
- c) Contractor has furnished 'No Claim Certificate' in specified format
- d) Contractor has carried out the works required to be carried out by him during the period of Maintenance and all expenses incurred by BHEL on carrying out such works is included for adjustment from the Guarantee money refundable.

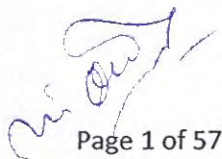
 Rudrapur	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

**6.5 MWp (DC) / 5 MW (AC) GRID INTERACTIVE GROUND
MOUNTED SOLAR POWER PLANT
NALANDA UNIVERSITY –RAJGIR BIHAR**

GENERAL & TECHNICAL SPECIFICATION
FOR
SUPPLY OF BoS, INSTALLATION, TESTING &
COMMISSIONING ALONGWITH 5-YEARS CMC


IMPORTANT NOTE

**“BIDDER IS REQUESTED TO VISIT THE SITE IN PERSON
AND THEN SUBMIT THEIR BEST OFFER. ANY TYPE OF
DENIAL /OBJECTION SHALL NOT BE ENTERTAINED
AFTER FINALIZATION OF ORDER.”**


Page 1 of 57



Signature and seal of Bidder

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

BRIEF ABOUT THE PROJECT:

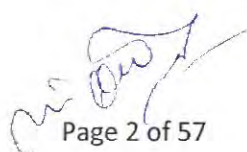
The proposed campus of Nalanda University is planned to be developed on a mostly flat terrain in the foot hill of Nalanda Hills. The site is located in Gangatic plains area of Southern Bihar.

Site is located along the Patna - Rajgir Highway and is well connected with the city of Rajgir, Bihar. Total area of the site is approximately 455 acres ("Site") out of which 20 acres area has been allotted and marked for the Ground Mounted Solar PV System and associated job for setting up 5MWp AC, ILR1.3/6.5MWp DC Capacity Grid Connected Ground Mounted Solar PV system including DESIGN, PROCUREMENT, INSTALLATION, TESTING, COMMISSIONING and 5 YEARS CMC at the permanent campus of Nalanda University (NU), Nalanda, Rajgir, Bihar.

SALIENT FEATURES


S No	Particulars	Detail
Detail of Location		
1	Site	Nalanda University
2	Location	Rajgir
3	District	Nalanda
4	State	Bihar
5	Pin Code	803 116
6	Site Latitude	25.00° N
7	Site Longitude	85.22° E
8	Nearest Railway Station	Rajgir Railway Station
9	Annual Average Temperature	26 °C
Technical *		
10	Capacity of Power Plant	5MWp AC/ 6.5MWp DC
11	Type of solar system	Ground Mounted
12	Installable area offered	20Acre single piece of land
13	No of PV Modules	>20,000 nos
14	Power optimizer	>5000 Nos
15	No of string inverters	>50 nos
16	PV Module Mounting	Seasonal Tilt Type
17	Mounting Tilt angles	10° , 25° & 35°
18	Grid interfacing voltage	415V
19	CUF	>19% on commissioning

Above indicated technical data is tentative & will be finalized up on having clarity over make & rating of string inverters & power optimizers.


Page 2 of 57



Signature and seal of Bidder

 Rudrapur	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

1. NAME OF WORK: -

Supply of BOS, installation, testing, commissioning along with 5-years CMC of 6.5 MWp(DC) / 5 MW(AC) grid connected Ground Mounted Solar Power Plant at Nalanda University- Rajgir, Bihar.


2. SCOPE OF WORK: -

The scope of work shall include **"Supply of BoS, Installation, commissioning & testing of 6.5 MWp (DC)/5 MWp (AC) ground-based grid interactive solar power plant along with comprehensive operation & maintenance for 5 years, in the premises of Nalanda University, Rajgir- Bihar"**.

Scope of work includes:

- (a) Installation of Module Mounting Structure (MMS) as per approved design & drawing. Structure shall be supplied by BHEL. Civil work related to foundation of module mounting structure shall be carried out by BHEL though other agency.
- (b) Mounting & commissioning of PV modules. PV Modules shall be provided by BHEL.
- (c) Mounting & commissioning of Power Optimizer. Power Optimizer shall be provided by BHEL.
- (d) Installation & commissioning of solar Inverters/Power Conditioning Units. Inverters/ Power Conditioning Unit shall be provided by BHEL.
- (e) Supply, installation & commissioning of ACDB along with other protective devices (if required) such as switch fuse unit (SFU), disconnecting switch box etc.
- (f) Supply & laying/fixing of DC cables through conduit pipe/cable tray. Supply of connectors, cables lug, gland, conduit pipe/ cable tray & other required accessories shall be part of contractor's scope.
- (g) Supply & laying/fixing of AC (LT & HT) cables of required length & size through cable tray/trenches. Supply of connectors, cables lug, gland, cable tray & other required accessories including civil work shall be part of contractor's scope.
- (h) Supply, installation & commissioning of LT panels including foundation work.
- (i) Supply & installation of bus trunking system to provide connection between LT panel & Primary Side of Transformer.
- (j) Installation of 3nos transformers – 415V/11kV (2.5MVA each) included its civil foundation shall be done by other agency & considered out of the contractor's scope.
- (k) Termination & charging of 3 Nos transformers – 415V/11kV (2.5MVA each) will be the responsibility of the contractor.
- (l) Supply & installation of earthing system. Adequate earthing shall be provided as per requirement of the project.

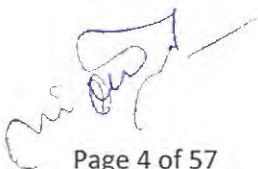



	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00


- (m) Supply & installation of Lightning & surge voltage protection. Adequate number of lightning arresters shall be provided by the contractor.
- (n) Design, supply, installation & commissioning of CCTV based surveillance system including IP rated cameras with required mounting arrangement, IP rated termination box, cable, hoods, centralized DVR system & other required accessories.
- (o) Supply & Installation of safety system including all required aspects not limited to fire detection system/firefighting system.
- (p) Net metering of the plant shall be part of contractor's scope including all required supply, liaising with DISCOM, respective authorities at Nalanda University & all other local authorities (if required).
- (q) Co-ordination and approval from SECI, BERC, DISCOM and third part vetting as well.
- (r) Comprehensive insurance, transportation of BoS to site & storage at site.
- (s) Contractor to arrest the overall voltage drop to maximum 2%.

Scope of work: - **“Comprehensive maintenance of the plant (for 5 years)”** includes:

- (a) Cleaning of modules once in every 15 days during the O&M period.
- (b) Maintaining miscellaneous spares, tools & tackle, etc. during O&M period.
- (c) Deputation of manpower (1 Engineer + 1 Diploma Engineer + 2 Electrician) at site to ensure smooth operation of the plant.





 Rudrapur	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

GENERAL SPECIFICATION

1. DEFINITION: -

A Grid connected ground mounted Solar Photo Voltaic (SPV) power plant consists of SPV array, Module Mounting Structure, Array Junction Boxes, Optimizer, PCU / String Inverter consisting of Maximum Power Point Tracker (MPPT), DC & AC cables, transformers, AC Distribution Board with MFM, LT panels, SCADA with all accessories for the remote monitoring, Switches and Controls & Protections with earthing and lightning protections along with CCTV based surveillance system. PV Array is mounted on a suitable structure.

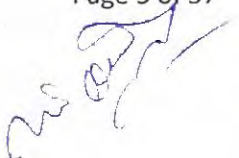
Grid tied SPV system is without battery and should be designed with necessary features to supplement the grid power during day time. Components and parts used in the SPV power plants including the PV modules, metallic structures, cables, junction box, switches, PCU / String Inverter etc., should conform to the BIS or IEC or international specifications, wherever such specifications are available and applicable.


Solar PV system shall consist of following equipment/components.

- Solar PV modules consisting of required number of Crystalline PV modules.
- Mounting structures
- Grid interactive Power Conditioning Unit with Remote Monitoring System (SCADA).
- 0.4/11 KV Step up Transformers, ACBD & LT panels (2 MW capacity each).
- Junction Boxes.
- Earthing and lightning protections.
- IR/UV protected DC Cables, HT & LT AC Cables, cable tray, pipes and accessories.
- CCTV based surveillance system.

2. GENERAL REQUIREMENT: -

- (a) The system shall be completed with PV modules, inverters/PCU, junction box, ACDB, DCDB, Cables, Earthing & Lightning protection, Transformer, LT panel, performance & weather Monitoring, Communication interface, CCTV Surveillance system & any other equipment(s) necessary for safe and efficient operation of grid connected ground based solar power plant.
- (b) All the fittings & accessories that might not have been mentioned specifically in the specification but are necessary for the plant, shall be deemed to be included in the specification and shall be supplied & fixed without any extra cost.
- (c) The equipment/items under BoS shall conform in all respects to high standards of engineering, design and workmanship and be capable of performing in commercial operation up to Bidder's guarantee in a manner acceptable to the BHEL, who will interpret the meaning of drawings, specification and shall have the power to reject any work or materials, which is his judgment are not in full accordance therewith.

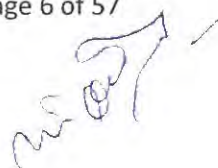



	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
		Rev no	00
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)		


- (d) Installation shall be done by licensed Engineer who has adequate experience with installation of the PV System. A checkout procedure should be developed to ensure an efficient and complete installation.
- (e) Contractor shall be responsible to obtain all necessary statutory & other clearance in well advance from the competent authorities.
- (f) Any kind of coordination, liaison, authority supervision / approval etc. & preparation of related documents etc. shall be in the scope of contractor. All kind of required approvals shall be taken by the contractor on behalf of client. No extra charges to be paid to contractor for these.
- (g) All the necessary co-ordination with authorities at BHEL/Nalanda University regard installation, commissioning & testing shall be carried out by contractor on prior base.
- (h) Power supply, Water Supply & One Internet Connection shall be provided to the contractor at one predefined point to the solar farm, from that point onwards, everything shall be in the scope of Solar Contractor. Power will be measured through a sub meter which shall be arranged by the contractor as per given specification in this document. Charges for the power & internet to be reimbursed to the BHEL, while provision for water meter to be kept in the system at present for water part of this.
- (i) Considering the reliability of the grid, no electrical storage batteries shall be required as excess electricity generated by the solar panels which are not required by the equipment/ devices in the building premises shall be exported to grid.
- (j) All Electrical High Side Equipment starting with Transformer of 415 V to 11 KV, its related earthing, UPS for 11 KV System, Safety Equipment for 11 S/S, 11 KV Panels etc. will be provided by client at desired location.
- (k) This scope shall also include providing competent manpower for dealing with SLDC requirements to generate & provide adequate data to State Load Dispatch Centre on behalf of client as per requirement.
- (l) All necessary support as on required shall be extended by the contractor for subsidy to the client for the project.
- (m) Supplier shall follow the latest engineering practice to ensure long-term compatibility requirement and continuity of equipment supply and the safety of the operating staff.

3. SITE MOBILIZATION: -

A notice shall be given by the contractor to BHEL for the site mobilization. Contractor shall deploy adequate qualified manpower as per the contract requirement within 7 days from award of work. Details of manpower shall be forwarded to BHEL before the deployment (within 3 days from award of work). The contractor shall arrange at his own expense all erection & construction equipment, tools & tackles, plant and equipment required for execution of the



31/07/21


 Rudrapur	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

work. Details of machinery, equipment, tools & tackle to be used, are also required to be forwarded BHEL.

Moreover, on site mobilization, contractor shall arrange following on first priority: -

(i) Unloading, safe storage and movement of supplied items received at site:

- (a) Contractor shall organize all necessary resources such as labour, machinery and tools, cranes, hydra, forklifts, transportation trucks/ trolleys, lifting accessories etc. for unloading the BHEL supplied items from the transport vehicle reaching identified location at site and subsequent movement to storage yards/sheds.
- (b) Similar arrangements shall also be made by contractor for movement of the stored items from storage yards/sheds to the exact construction locations within the project site.
- (c) Contractor shall maintain proper registers/ files/ records of invoices, LRs, delivery challans, material receipt certificates etc. Also, proper records shall be maintained to keep track of material entry (for storage) and material issue (for construction).
- (d) All such documents shall be suitably preserved for further handing over to BHEL.
- (e) Safety of items shall be in contractor scope. Accordingly, contractor will make all requisite arrangements for safe storage and preservation of BHEL supplied material.
- (f) All the equipment shall be handled very carefully to prevent any damage or loss. No untested wire ropes / slings etc. shall be used for unloading / handling. The equipment shall be properly protected to prevent damage either to the equipment or to the floor where they are stored. The equipment from the stores shall be moved to the actual location at the appropriate time so as to avoid damage of such equipment at site.
- (g) The material received shall be properly inspected for any damage caused during transit and the Goods Receipt Document of the Transporter shall be acknowledged after verifying the condition of goods received. Any damage shall be immediately reported to BHEL. In cases when such information is not given to BHEL in time – it will be presumed that material was received in good condition by contractor and damage may have taken place at a later stage. Such damage or loss shall be attributable to the contractor.
- (h) Contractor shall ensure that while lifting slings shall be put over the points indicated on the equipment or as indicated in the manufacturer's drawings. Slings / shackles of proper size shall be used for all lifting and rigging purposes. All care shall be taken to safe guard the equipment against any damage.
- (i) Contractor shall be responsible for examining all the plant and materials issued to him and notify the Engineer immediately of any damage, shortage, discrepancy etc. before they are moved out of the stores / storage area. The contractor shall be solely responsible for any shortages or damages in transit, handling, storage and erection of the equipment once received by him.

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

- (j) The contractor shall maintain an accurate and exhaustive record-detailing out the list of all equipment received by him for the purpose of erection and keep such record open for the inspection of the engineer at any time.
- (k) All the material in the custody of contractor and stored in the open or dusty locations must be covered with suitable weather proof covering material wherever applicable and shall be blocked up on raised level above ground.
- (l) The contractor shall hand over all parts / materials supplied by BHEL and remaining extra over the normal requirement with proper identification tags and measurements to BHEL before site closure. Such intimation will be given in writing to BHEL well in time.
- (m) It shall be the responsibility of the contractor to keep the work / storage areas in neat, tidy and working conditions. All surplus/unusable packing and other materials shall be removed and deposited at location(s) as identified within the project premises.
- (n) All suitable lifting arrangement and local transport arrangement within premises for material handling at stores/yard/siding of BHEL/Customer/Contractor are included in scope.
- (o) Quoted rates for various items shall include cost of unloading, safe storage & transporting to the place of erection & disposal of the packing material at a designed place given by customer. No extra payment shall be made for all these activities.**

(ii) Preservation of components


- (a) After taking delivery from BHEL / customer's stores, plant materials storage shall be subjected to the following protection besides other provisions indicated in these specifications elsewhere.
- (b) Items stored outdoors shall be stacked up at least six inches (6") off the ground. Items should not be stored in a low lying area where water logging is a possibility.
- (c) Electrical items shall be stored indoors or otherwise protected against getting wet/ damaged, using suitable measures and should be protected from direct rain.

(iii) Security & safekeeping of BHEL supplied material.

For all system capacities and in all situations – it is the prime responsibility of the contractor to ensure security and safekeeping of the BHEL supplied material till handing over of complete system in working condition to customer. The contractor will make their own assessment based on prevailing condition at site and will make all arrangements for security and safekeeping of BHEL supplied material. The contractor shall also indemnify BHEL towards any loss incurred towards loss of damage to BHEL supplied material.

In case of damage/theft of any item till the handing over of plant, the item shall be provided/replaced by the contractor free of cost. Any kind of theft shall be reported in proper manner & contractor will solely responsible for the all legal activities



 Rudrapur	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

No extra payment will be made for arrangement & deployment of the required number of security personnel. Quoted rates for various items shall include the cost of safe storage at site, irrespective of whether the material is supplied by BHEL or contractor.

4. SUPPLY TO BE MADE BY BHEL: - (SCOPE OF SUPPLY only)

Following items shall be supplied by BHEL at site -.

S.No.	Item Description	Remarks
1.	PV MODULE	ONLY SUPPLY
2.	MODULE MOUNTING STRUCTURE	ONLY SUPPLY
3.	INVERTERS/PCU & OPTIMIZERS	ONLY SUPPLY

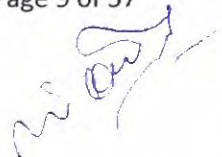
Contractor has to identify central area within the CUSTOMER/USER premises for unloading and storing of BHEL supplied items. Subsequent arrangement for unloading, safekeeping, shifting of the material to site for installation shall be part of services to be offered by the contractor associated with BHEL supplied items.


5. SERVICE TOWARDS INSTALLATION TO BE PROVIDED BY BHEL: -

S.No.	Item Description	Remarks
1.	LEVELLING, COMPACTING & GRADING WORK	IN OTHER AGENCY'S SCOPE
2.	FOUNDATION/PIILING WORK OF PEDESTAL	IN OTHER AGENCY'S SCOPE
3.	INSTALLATION OF "LEG" OF MMS Note : Assistance to be provided for final installation of MMS to avoid any mismatch during installation of other section of MMS like Rafter and Purlin which is in the scope of bidder	(Only LEG)IN OTHER AGENCY'S SCOPE
4.	FENCING WORK	IN OTHER AGENCY'S SCOPE
5.	DRAINAGE WORK	IN OTHER AGENCY'S SCOPE
6.	CONSTRUCTION OF ROAD/PATHWAYS	IN OTHER AGENCY'S SCOPE
7.	SUPPLY & INSTALLATION OF LIGHTING POLES	IN OTHER AGENCY'S SCOPE
8.	INSTALLATION OF CLEANING SYSTEM	IN OTHER AGENCY'S SCOPE

Notes: -

1. BHEL's scope includes only supply of PV modules, Inverters/Power Conditioning unit, Mounting Structure, Optimizer. Civil work related to foundation of module mounting structure shall also be part of BHEL scope and done by other agency.




	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

2. Any other item(s) except BHEL's scope, which is not explicitly identified or listed herein & to be required for the completion of work shall be part of contractor's scope. The same shall be supplied, installed & commissioned under this contract to ensure completion of the system and facilitate proper operation & easy maintenance. No extra cost for such item(s) shall be absorbed by BHEL.

6. CODE & STANDARD: -

All supplied items pertaining to contractor's scope shall comply relevant prevailing or latest Indian / international standard for the safety aspects & ensuring expected service life & weather resistance. Installation, commissioning & testing of plant shall be done in accordance with the guidelines issued by MNRE, SECI, BERC & other relevant Central/local Government Agency. During the installation, commissioning & testing of the plant, contractor shall be responsible for the comply of Indian Electricity Rules-1956.


7. ADDITIONAL SAFETY ARRANGEMENT FOR COMPLIANCE OF HSE/OHSAS REQUIREMENT

All necessary items required for compliance of safety norms as per SCC of this Tender document will be arranged and deployed by the contractor at the erection site.

All safety compliances as noted under SCC has to be mandatorily complied with. However, cost on this account is already built up within major heads of the BoQ.

8. REMOVAL OF TEMPORARY WORK & MATERIAL

Contractor shall remove all the temporary work carried out as per requirement in the execution of plant work including Debris, garbage etc., time to time during the progress of work. Extra quantity of materials used to carry out the execution of the plant shall be listed out by the contractor & to be examined by Engineer In-charge. Extra material shall be removed as per the instruction given to the contractor by Engineer In-charge.

 Rudrapur	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

9. DRAWING & DOCUMENTATION: -

BHEL shall provide following approved drawings & documents to the contractor:

S No	Category	DRG/DOC Title	Type
1	Structure Design	Module Mounting Structure	Drawing
2		Analysis & Design of Support structure	Document
3	Electrical	Module Layout	Drawing
4		Earthing Procedure	Document
5	Data Sheet	SPV Module Datasheet	Document
6		PCU/Inverter Datasheet	Document
7	Quality Plan	SPV Module MQP	Document
8		Field Quality Plan (FQP)	Document
9	Documents	PG Test Procedure	Document
10		Inspection Categorization Plan	Document

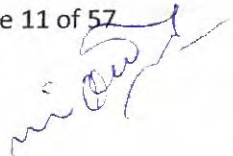
Contractor shall submit following drawings & documents to BHEL for approval:

S No	Category	DRG/DOC Title	Type
1	Data Sheet	DC cables Datasheet	Document
2		AC Power cables(LT/HT) Datasheet	Document
3	Electrical	LT Panel GA	Drawing
4		Single line Diagram	Drawing
5		Lightning Protection System	Drawing
6		Main LT Panel GA with SLD	Drawing
7	Quality Plan	DC cable MQP	Document
8		AC Power Cable (LT/HT) MQP	Document
9	Documents	O&M Manual	Document


It is essential that the owner have complete documentation on the system. System documentation should include an owner's manual and copies of relevant drawings for whatever system maintenance might be required in the future.

10. INSPECTION & TESTING: -

Quality Assurance Plan (QAP) for each supplied item shall be submitted by contractor for prior approval to the BHEL. Inspection shall be carried out as per approved QAP. The contractor has to arrange complete visit & give a call for



3/10/22

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00


the Inspection & testing in prior (at least 7 days). The Company's/Engineer's Representative or duly authorized inspector shall be entitled to attend the said tests and/or inspection. All related cost for PDI to be bared by the contractor. If the Company's inspector fails to attend the test and or inspection at the time mutually agreed or if it is agreed between the parties that the Company's inspector shall not do so, then the Contractor may proceed with the test and/or inspection in the absence of the Company's inspector and provide the Company with a third party certified report of the results thereof.

Tests which required to be performed at site shall also be in the scope of contractor. Tests of materials, equipment, systems and workmanship shall include but are not limited to the tests referred to in and required by the Contract Specifications.

- The Supplier shall carryout all routine tests as specified in relevant standards on all major components in presence of the BHEL's representative (or third party nominated by NALANDA UNIVERSITY/BHEL for this purpose) at manufacturer's premises before dispatch of the material and furnish copies of test reports for BHEL's approval. If required, stage wise inspection will be carried out by the BHEL.
- Supplier shall carryout all routine and functional tests as specified in the relevant standards on the assemble SPV Plant with all accessories of the equipment in the presence of the BHEL's representative before dispatch and furnish copies of the test reports for approval before dispatch.
- Equipment shall not be dispatched unless the test certificates are duly approved by the BHEL.
- Two sets of copies of the complied and approved test certificates shall be submitted to the BHEL.

11. CAPACITY UTILIZATION FACTOR (CUF): -

The Capacity Utilization Factor (CUF) to be maintained minimum 19% or as per third party approval. Contractor are responsible to make all the arrangement such as timely cleaning of module, routine inspection of equipment, timely repairing or replacement of equipment etc., to maintain the same.

 Rudrapur	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

TECHNICAL SPECIFICATION

1. Installation & commissioning of BHEL supplied items

1.1. PV Module: -

Bidder shall do the erection of the SPV module as per approved layout design of BHEL. Bidder shall implement the interconnection as per these drawings. Required number of nuts and bolts for the erection of Modules shall be supplied by bidders. These will be **made of SS 304 material - NUTS, BOLTS AND PLAIN WASHERS.**

Installation activity shall include placing on base, bolting, clamping with Structure material, Other fasteners like Clamp, brackets, M6 Screws shall also be supplied as required additionally.

Interconnection of SPV modules with Power Optimizer

Bidder shall interconnect the SPV modules to Optimizer as follows:

- a) Each module is fitted with Optimizer integrally with a junction box having positive and negative polarity cables (4 Sqmm).

Bidder to check the module technical parameter along with Sr. No before final installation and fill the data in given format. Bidder shall mark the string and inverter number on both sides of the string.

1.2. Power Optimizer:

Bidder shall do the erection of the Power Optimizer as per approved Single Line Diagram and layout design of BHEL. Bidder shall implement the interconnection as per these drawings. Required number of nuts and bolts for the erection of Optimizer shall be supplied by bidders. These will be **made of SS 304 material - NUTS, BOLTS AND PLAIN WASHERS.**


4:1 Optimizers shall be used with 4 modules per optimizer for the optimization of solar power.

Installation activity shall include placing on base, bolting, clamping with Structure material, Ferrule Marking near String. Other fasteners like Clamp, brackets, M6 Screws shall also be supplied as required additionally

Series interconnection of Optimizer to form strings

Bidder shall interconnect Optimizer as follows:

- a) Each Optimizer is fitted integrally with a junction box having positive and negative polarity cables (4 Sqmm).
- b) Positive cable of one Optimizer shall be connected to the negative cable of adjacent Optimizer. **The cables have MC4 type of connectors to be supplied by contractor.** One polarity cable has male type connector, while the other has female type connector.
- c) This way, Optimizer shall be connected in series. Each set of connections is called as a series string. Series formation may change as per approved layout and design.

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
		Rev no	00
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)		

Interconnection of Optimizer (4:1) strings to string inverters

- Bidder shall connect each series string of Min 21 Nos Optimizers to the DCDB/string inverter using 1Cx 4 cable, copper, XLPO, unarmored as per TUV 2pfg 1169/08.2007.
- MC4 connectors shall have rating of 1000VDC (IEC), rated current of 30A, Type approved by TUV Rhineland for product safety. **MC4 connector shall be supplied by Bidder.**
- Min. Two sets of tool kits (with box enclosure) shall be supplied by bidder. This shall include crimping plier MC4, open end spanner set MC4, stripping plier MC4, socket wrench insert to tighten, socket wrench insert to secure etc.

Required number of MC-4 Connectors each set having a pair of male and female parts, to join both the cables along with ferrules shall be supplied by Bidder.

Bidder to check the Optimizer parameter along with Sr. No before final installation and fill the data in given format. Bidder shall mark the string and inverter number on both sides of the string.

1.3. Inverter & Accessories:

Design & drawing for mounting arrangement of PCU/inverter shall be submitted by the contractor for further approval.

Inverter shall be mounted on structures as per the approved drawing.

Minimum ground clearance shall be 500 mm.

Supply, fabrication & erection of structure (including civil work for the structure foundation) shall be the part of Contractor's scope.

Galvanized structure (minimum thickness of galvanizing 85 micron in accordance with IS: 4759, IS: 2629, IS: 2633) shall be used. Fasteners such as Nut, Bolt, Plain Washer, Brackets etc. to be used should be made of SS304 material.

Canopy (if required) made of GI sheet of minimum 2mm thick shall also be provided by contractor to protect the inverters/PCU from weather

Earthing of inverter shall be done by 2.5/4 sqmm CU wire **green color.**


1.4. Erection of Module Mounting Structure:

Bidder shall do the installation of the Module Mounting structure as per approved layout design of BHEL provided along with the tender. Required number of nuts and bolts for the erection of Modules shall be supplied by bidder. Wherever, welding is carried out, bidder shall arrange for proper grinding and cleaning of the weld surfaces, followed by application of Metal primer and Metallic aluminum paint. Pre-Galvanized parts shall be sprayed with Zinc spray after work.

Required number of nuts and bolts for the installation of MMS shall be supplied by bidders.

Column structure of the MMS shall be embedded in concrete piles by the Civil Contractor. However, Bidder shall provide assistance during the installation of Column to maintain proper alignment and to avoid any mismatch during the installation of other MMS section which in scope of the Bidder.




 Rudrapur	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

Bidder may refer MMS drawing 24012100001 Rev 01 for module mounting details. Bidder to supply **SS 304 grade** Nuts, bolts & washers of M6, M10, M16 mentioned in the MMS drawing. Approximately, M6 = 1,62,000 nos, M10 = 60,000 nos and M16 = 12,000 nos will be required.

If any other size is required to complete the installation work bidder shall provide the same without any extra cost to BHEL.

Note: ALL NUTS, BOLTS AND PLAIN & SPRING WASHERS shall be made of SS 304.

2. SUPPLY & INSTALLATION OF ACDB:-

2.1. Supply of ACDB

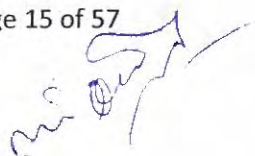
ACDB shall be supplied by contractor as per following specification: -

- AC Distribution Panel Board (DPB) shall control the AC power from PCU/ inverter, and should have necessary surge protection devices, MCB/MCCBs & AC circuit breaker with phase indication of R, Y, B. Interconnection from ACDB to mains at LT Bus bar while in grid tied mode.
- All switches and the circuit breakers, connectors should conform to IEC 60947, part I, II and III/ IS60947 part I, II and III.
- The changeover switches, cabling work should be undertaken by the bidder as part of the project.
- All the panels shall be metal clad, totally enclosed, rigid, structure mounted, air -insulated, cubical type suitable for operation on three phase, 415V, 50 Hz.
- The panels shall be designed for minimum expected ambient temperature of 45 degrees Celsius, 80 percent humidity and dusty weather.
- All panels will have protection of **IP65 or better**.
- It shall have AC disconnect switch and proper earthing arrangements
- It should conform to Indian Electricity Act and rules (till last amendment).
- All 415V AC devices / equipment like bus support insulators, circuit breakers, SPDs, VTs etc., mounted inside the switchgear shall be suitable for continuous operation and satisfactory performance under the following supply conditions: -


Variation in supply voltage	:	+/- 10%
Variation in supply frequency	:	+/- 3 Hz

2.2. Installation of ACDB/ACCB: -

- Design & drawing for mounting arrangement shall be submitted by the contractor for further approval.
- ACDB/ACCB shall be mounted on structures as per the approved drawing.



3/10/21

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

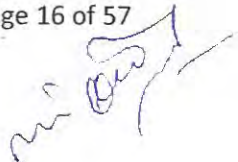
- Minimum ground clearance shall be 500 mm.
- Supply, fabrication & erection of structure (including civil work for the structure foundation) shall be part of contractor's scope.
- Galvanized structure (minimum thickness of galvanizing 85 micron in accordance with IS: 4759, IS: 2629, IS: 2633) shall be used. Fasteners such as Nut, Bolt, Plain Washer, Brackets etc. to be used should be made of **SS304** material.
- Canopy (if required) made of GI sheet of minimum 2mm thick shall also be provided by contractor to protect the ACDB/ACCB from weather.

3. DC CABLES:-


3.1. Supply of DC cable

4 SQMM Single core multi strand copper conductor XLPO insulated & sheath DC cables shall be used for Solar Installation. DC Cable shall be supplied by contractor as per following specification: -

- Temp. Range: -10 Degree C to +90 Degree C.
- Voltage Grade - 1.1 kV.
- Excellent resistance to heat, cold, water, oil, abrasion, UV radiation.
- Short Circuit temp: 250 degrees (for 5 sec).
- Flexible – Class 5 (as per IEC 60228).
- DC cable shall be single core multi strand Electrolytic Annealed Tinned Copper Conductor.
- The construction of DC Cable shall be in a two-layer construction with a low smoke halogen-free, flame retardant and sunlight resistant electron beam Cross-linked compound outer layer and halogen-free thermoset polyolefin inner layer. DC cables insulation & sheath shall also confirm:
 - Suitable for continuous operating temperature of 90°C wet or dry
 - Vertical Flame Performance: EN 60332-1 or equivalent
 - Excellent UV and Ozone resistant
 - Suitable for wet, damp and humid locations
 - Specially designed for excellent flexibility
 - Compatible with all major connectors
 - Cold bend and impact: -40°C
- 4 SQMM cable's outer layer/sheath shall be of "RED & BLACK Colour" (50%-50% of each colour of total quantity). Outer layer/sheath with partial "RED" colour is also accepted.
- Cable shall have marked ^{CE}Manufacturer's Name, ^{SA}insulating material, conductor size, voltage class & standard on its surface at every 600 mm centers.



3-11-21

 Rudrapur	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

3.2. DC CABLING: -

(I) Routing of DC cable below the SPV modules:

1Cx4 cables connecting the SPV module strings to DCDB/inverters shall be suitably routed below the SPV modules and along the horizontal purlin member of MMS structure. Also, the cables shall be fastened to the purlin using UV resistant **cable ties that shall be in contractor scope of supply**. Spacing between two adjacent cable ties shall be so chosen as to ensure that there is no loose hanging of cables.


Cable ties, nylon polyamide 6.6 UV stabilized black, UL94 flammability rating V2, operating temperature up to 85 deg C, shall be used to arrest any possibility of movement or sagging. Width of the cable ties shall be minimum 4.5 mm. Length shall be so chosen as to ensure that the bunched cables are held firmly to the MMS structure. BHEL/CUSTOMER approval shall be obtained for the selected brand and sizes of cable tie.

(II) Routing of DC cable through Conduit pipe & GI cable trays

- UV-stabilized HDPE/uPVC conduit adequate diameter with a minimum wall thickness of 1.5mm, shall be used wherever required for covering DC cable.
- Where 1Cx4 cables run between two adjacent rows of structure and also where the cables run up to string inverters, routing shall be on GI cable trays, perforated type, with GI cover of minimum 2mm thick, coupler plates, GI hardware as per relevant IS standard. Suitable flexible PVC conduit shall be used wherever required for covering cable at entry into GI cable tray.
- **Supply of all related accessories including conduit pipe, cable tray, tray cover, hardware, etc shall be under contractor's scope.**

(III) Termination & Ferruling of DC Cable

- 1Cx4 cables of positive and negative polarities originating from SPV module strings shall be terminated at the DC input side of string inverters using MC4 connectors that are in contractor scope of supply for both ends.
- For 1Cx4sqmm DC solar array cable, contractor shall provide UV resistant ferrules printed with source/destination identification of cable connection. Printing details shall be submitted for BHEL/CUSTOMER approval during detailed engineering. Printing shall be of appropriate size to ensure readability.
- Ferrules shall be provided on both the termination ends: module end, inverter end.
- **Supply of ferrule shall be in contractor scope.** Make shall be reputed brand. Approval for make/ type/ color/ dimension etc. shall be obtained from BHEL/CUSTOMER prior to procurement.

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

4. AC Power CABLES: -

4.1. Supply of AC Power Cable (Inverter to ACDB)

All kind of AC cable shall be supplied by contractor: -

LT AC CABLE (Inverter to ACDB): - Supply of 4 Core XLPE insulation & PVC sheath "ST-2", electrolytic class-2 copper conductor, un-armored cables to be used for transmission of between inverter to ACDB.

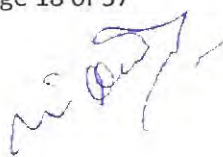
LT AC Cable shall be supplied by contractor as per following specification: -


- Temp. Range: -10 Degree C to +90 Degree C.
- Short Circuit temp: - 250 Degree.
- Voltage rating: 1.1 kV.
- Conductor: - electrolytic class-2 copper conductor.
- Insulation: - Cross Link Polyethylene.
- Inner & Outer Sheath: - PVC sheath "ST-2" type.
- Excellent resistance to heat, cold, water, oil, abrasion, UV radiation.
- Flexibility as per relevant standard.

4.2. AC CABLING: PVC or, XLPE insulated and PVC sheathed single or, multi-core multi-stranded un-armoured copper/ armoured aluminum cables of voltage grade 1.1 kV to 11 kV shall be used for transmitting the power. Laying & termination of cable shall be in contractor's scope. Evacuation of the solar energy shall be done on 11kV into main HT panel through 415 V/11 kV Step up transformer.

Laying of cables to be done: -

- **Through Cable Tray:** - GI cable trays of required size to be used for the laying of cables, perforated type, with GI cover of minimum 2mm thick, coupler plates, GI hardware as per relevant IS standard.
- **Through underground Trenches:** - Routing of AC HT & LT cable through underground trenches shall be done in accordance with IS:1225. Typical trench details/dimensions are below only for tender purpose. During detailed engineering, cable trench layouts and cross section drawings as per IS: 1255 shall be submitted for BHEL/CUSTOMER approval.
 - i. Total trench depth = 750 mm minimum
 - ii. Trench width = As per number of cables/ HDPE pipes
 - iii. Trench shall have layers one over the other as below (from bottom to top):
 - Bottom layer shall be sand of IS:383 with 75mm minimum thick.
 - Power cables shall be laid over the sand layer.
 - Another layer of sand of 75 mm minimum thick.
 - Single layer of brick as protective cover
 - Layer of sand of IS:383 with 75mm minimum thick




 Rudrapur	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

- All communication cables shall be laid within HDPE pipe
- Layer of sand of IS:383 with 75mm minimum thick
- Single layer of brick as protective cover
- Trench shall, then, be filled with refill soil and compacted

Note: -

1. All termination accessories such as nickel plated brass double compression cable glands, cable lugs, SS304 bolts/ nuts/ plain and spring washers shall be in contractor scope of supply. Termination shall be carried out using appropriate tools and torque setting as per BHEL/CUSTOMER approval.
2. **At pathway/road/drain/trench crossings, cables shall be routed through GI pipe of appropriate size that shall be in contractor scope of supply** and technical details / brand etc. shall be submitted for BHEL/CUSTOMER approval. It shall be ensured that a maximum of 60% of inner space of GI pipe shall be occupied by cables.
3. Contractor shall take utmost care in laying the cables in order to prevent damages on outer sheath and inner insulation. In case cables found to be damaged/ cut after the laying in trenches, contractor shall remove the damaged portion and join the cut pieces using appropriate cable jointing kits that shall be in contractor scope of supply.

5. AC LT Power CABLES: -

5.1. Supply of AC LT Power Cable (ACDB to LT Panel)

LT AC CABLE (ACDB to LT Panel): - Supply of 4 Core XLPE insulation & PVC sheath "ST-2", electrolytic class-2 Aluminum conductor, armored cables to be used for transmission of between ACDB to LT Panel.

LT AC Cable shall be supplied by contractor as per following specification: -

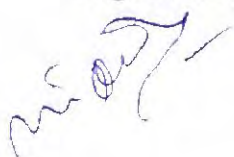
- Temp. Range: -10 Degree C to +90 Degree C.
- Short Circuit temp: - 250 Degree.
- Voltage rating: 1.1 kV.
- Conductor: - electrolytic class-2 aluminum conductor.
- Insulation: - Cross Link Polyethylene.
- Inner & Outer Sheath: - PVC sheath "ST-2" type.
- Excellent resistance to heat, cold, water, oil, abrasion, UV radiation.
- Flexibility as per relevant standard.


5.2. AC LT Power Cable laying as mentioned in clause 4.2 above .

6. AC LT Power Bus Duct

DESIGN, SUPPLY & INSTALLATION OF BUS TRUNKING SYSTEMS

LT panel & transformer shall be connected through bus duct trunking system. Contractor shall design & provide bus duct with all termination accessories including civil work as per following specification: -




	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

- Sandwich type bus trunking for use on 3 phase 4 wire as per IEC-60439-6.
- Power Rating : 2000 KW
- Voltage : 415 Volt
- Conductor : Aluminum/copper
- Current rating : 3200 Amp
- Short Circuit : 50 KA for 1 Sec, Peak short circuit withstand of 105 KA minimum
- Ambient Temperature : 45 degree

Contractor shall provide all related accessories like elbow, flange end, adopter box, copper flexible jumpers, canopy, supporting structure, etc.

Any civil work (if any) associated with the system shall be taken care by the contractor.

Related GA & layout drawings shall be submitted for approval.

7. AC HT (11 kV) 3 core power cabling from transformer to HT Panel

7.1. HT AC Cable supply

HT AC CABLE: - 3 Core XLPE insulation & PVC sheath "ST-2", class-2 Aluminum conductor, armored cables to be used for transmission of between HT side of transformer to the existing HT panel.

HT AC Cable shall be supplied by contractor as per following specification: -

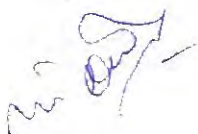
- Temp. Range: -10 Degree C to +90 Degree C.
- Short Circuit temp: - 250 Degree.
- Voltage rating: -11 kV.
- Excellent resistance to heat, cold, water, oil, abrasion, UV radiation.
- Flexibility as per the relevant standard.
- Cables shall have XLPE insulation and PVC sheath ST-2, three-core class-2 Aluminum Conductor & armor.

Note: The contractor has to submit the routine test & type test reports of the cables (DC & AC - LT/HT) issued by the NABL & NABL accredited laboratories.


Contractor's scope of work shall also have covered fixing/laying of the cables.

Note for Cable laying

All accessories for cable laying, including **clamps, hooks, ties, double compression cable glands, cable lugs, SS304 bolts/ nuts/ plain and spring washers, anchoring arrangement shall be in contractor's scope of supply.** Cutting the wall/surface and making good the same as required is also included in the scope of the contractor. The



31/01/21

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

Cable lengths supplied to site will NOT be in cut to size condition. Contractor has to arrange for cutting of the cables and jointing by using suitable cable jointing kits. All arrangement, tools & tackles in this regard will be in Contractor's scope.

Generally, jointing of cables in the run between two ends is not allowed. Hence, utmost care has to be taken while cutting required length of cables. The joints, as required otherwise due to any particular reason - shall be made only after getting prior consent from BHEL.

Contractor will submit scheme for cable laying within 15 days of site mobilization. This scheme will include following details:

- (A) Approximate length of various sizes of cables based on routing agreed with customer/user during joint assessment at site.
- (B) Approximate requirement of laying through Conduits, Trays, Excavation etc.
- (C) Contractor to purchase the quantity of conduits, trays etc. after getting written acceptance from BHEL.

IDENTIFICATION & MARKING OF CABLE

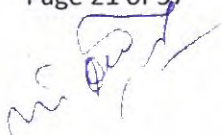

- Cable tags shall be provided at both ends of the cables: at SPV modules, string Inverters, data loggers, ACDB/ACCB, LT panels and so on.
- Cable tag shall be of rectangular shape.
- Cable tag shall be of 2mm thick aluminum with number punched (embossed) on it and securely attached to the cable by not less than two turns of 20 SWG GI wire conforming to IS:280.
- Reference shall be made to "Cable installation methodology" of this specification. Contractor shall submit the technical details of cable tags, ID numbering scheme for BHEL/ CUSTOMER approval during detailed engineering.
- Cable route markers and joint markers for underground cables shall be provided along the route of the cables as per section "Cable installation methodology" of this specification.


8. SUPPLY & INSTALLATION OF CONDUITS: -

Contractor shall supply along with all accessories for laying of cable through it and install medium class PVC conduit along with accessories in surface/recess including cutting the wall and making good the same in case of recessed conduit as required. Conduits pipes shall be lay as per the approved drawing/make list/ Instruction provided by BHEL/Customer.

HDPE pipe of PE63 grade, pressure rating PN6, appropriate nominal diameter and as per IS: 4984 (1995) shall be used. It shall be ensured that a max of 60% of inner space shall be occupied by the cables.

Method of measurement shall be as detailed against SI. No. 6 above. The Scheme for laying of cable trays, conduits shall be submitted by contractor for approval of

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
		Rev no	00
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)		

BHEL. After getting clearance from BHEL only – contractor shall make procurement of required quantity of cable trays, conduits etc.

9. SUPPLY & INSTALLATION OF CABLE TRAY: -

Contractor shall supply along with all accessories for laying of cable through cable tray and install suitable size of Cable tray along with accessories in surface/recess including cutting the wall and making good the same in case of recessed tray as required. Cable Tray shall be lay as per the approved drawing/make list/ Instruction provided by BHEL/Customer. The Cable Tray shall be of GI material.

All couplers, fixing screws, 45/90-degree bends, intersections, dividers are included in scope.

For cable routing through exposed surfaces to rain – Cable Tray lid and Standoff brackets (for suitably raising the tray above surface for rain protection by minimum 50 mm) shall be used. Also, for important indoor locations Cable Tray lid shall be used for best aesthetic purpose.

The Scheme for laying of cable trays, conduits shall be submitted by contractor for approval of BHEL. After getting clearance from BHEL only – contractor shall make procurement of required quantity, particular size of cable trays.

Contractor has to supply and install cable tray with accessories. Cable Tray shall be laid as per instruction given by BHEL/Customer.

10. Supply and Installation of EARTHING STRIP: -

Vendor has to supply and install earthing strip (GI Strip) having size of 20x5 mm & earthing wire (copper, green – 2.5sqmm) for DC & AC earthing.

The Scheme for laying of Earthing strips shall be submitted by contractor for approval of BHEL. After getting clearance from BHEL only – contractor shall make procurement of earthing strip material in required quantity, particular size.

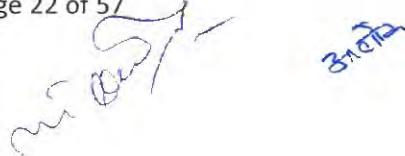
11. Supply of Earthing material and Installation after making suitable pit as per standard : -


Earthing is essential for the protection of the equipment & manpower. Two main grounds used equipments are:

- System earth: System earth is earth which is used to ground one leg of the circuit. For example, in AC circuits the Neutral is earthed while in DC supply +ve is earthed.
- Equipment earth: In case of equipment earthing all non-current carrying metal parts should be bonded together and connected to earth to prevent shock to the man power and also the protection of the equipment in case of any accidental contact.

To prevent the damage due to lightning the one terminal of the lightning protection arrangement is also earthed. The provision for lightning & surge protection of the SPV power source is required to be made.

In case the SPV Array cannot be installed close to the equipment to be powered and a separate earthing has to be provided for SPV System, it shall be ensured that



	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

all the earths are bonded together to prevent the development of potential difference between any two earths.

Earth resistance shall not be more than 1 ohm. It shall be ensured that all the earths are bonded together to make them at the same potential.

The earthing conductor shall be rated for the maximum short circuit current & shall be 1.56 times the short circuit current. The area of cross – section shall not be less than 1.6 Sqmm in any case.


The array structure of the PV modules shall be grounded properly using adequate numbers of earthing pits. All metal casing / shielding of the plant shall be thoroughly grounded to ensure safety of the power plant.

SURGE PROTECTION DEVICE (SPD):

Internal surge protection shall consist of three MOV type arrestors connected from +ve and –ve terminals to earth (via Y arrangement) for higher withstand of the continuous PV-DC voltage during earth fault condition. SPD shall have safe disconnection and short circuit interruption arrangements through integrated DC in-built bypass fuse (parallel) which should get tripped during failure mode of MOV, extinguishing DC arc safely in order to protect the installation against fire hazards. Nominal discharge current (Imin) at 8/20 micro seconds shall be minimum 10 kA with maximum discharge current (Imax) at 8/20 micro seconds minimum 20 kA with visual indication (through mechanical flag) in modules to monitor the life of SPD.

Earthing for PV Array: -

- (i) The photovoltaic modules and other components of power plant requires adequate earthing for protecting against any serious faults as guided by IEC 60364. The bidder needs to provide relevant certifications for the same.
- (ii) The earthing system shall be provided according to the IS 3043 supported with design calculations.
- (iii) Necessary provision shall be made for bolted isolating joints of each earthing pit for periodic checking of earth resistance.
- (iv) Each string/ array and MMS of the plant shall be grounded properly. The array structures are to be connected to earth pits as per IS standards. Necessary provision shall be made for bolted isolating joints of each earthing pit for periodic checking of earth resistance.
- (v) The complete earthing system shall be mechanically & electrically connected to provide independent return to earth.
- (vi) For each earth pit, a necessary test point shall be provided.
- (vii) In compliance to Rule 11 and 61 of Indian Electricity Rules, 1956 (as amended up to date), all non-current carrying metal parts shall be earthed with two separate and distinct earth continuity conductors to an efficient earth electrode.
- (viii) Contractor shall submit the detailed specifications of the array earthing.

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

EARTHING MATERIAL: -

Solar array MMS structures, string inverters, data loggers, ACCB/ACDB boxes, LTPDB etc. shall be provided with appropriate earthing for protection against faults as guided by IEC 60364-4-41/60364-5-54 and IEC 61140.

Earthing system shall be designed with consideration of the soil resistivity of the project site.

Chemical earthing electrodes of 3m minimum long, 50 mm minimum diameter, perforated GI pipe, chemical compound filled, double walled shall be installed at the ground level outside the buildings. For each electrode, earth chamber shall be constructed using brick masonry.


The Earth chamber(tentative) shall have features as follows:

- Square sized with 300mm x 300mm minimum inner opening. Exact size shall be chosen to ensure ease of maintenance operation using spanners etc.
- Brick wall thickness all around = 115 mm minimum.
- Depth of chamber = 500 mm minimum below FGL.
- Projection of chamber above FGL = 150mm minimum
- Top of electrode shall have minimum clearance of 100 mm below cover plate.
- Cover plate, cast iron of 5mm minimum thickness, square shaped to fit the opening of chamber, painted with red oxide and two coatings of black paint both sides.
- Cover plate shall have suitable lifting hooks and padlocking arrangement.
- Both the outer and inner walls of the brick wall shall be plastered and painted as per relevant clauses of "General civil works" of this specification.
- **Supply and installation of all materials shall be in vendor scope.**

General points:

- All items related to earthing ve electrodes, GI flats, hardware etc. in vendor scope of supply.
- GI bolts, nuts, plain washers shall be used. Spring washers shall be zinc/epoxy coated.
- Wherever applicable, welding for GI flats shall be carried out using electric arc welding. Both the flats shall be overlapped for the full width where they are in perpendicular direction in same plane. Where the connection is along same line, both flats shall be overlapped for a minimum of 50mm. L-bend with weld length of 50mm minimum shall be adopted wherever overlap length to be ensured.
- Resistance of welded joint shall not be more than that of GI flat.
- Welds shall be treated with red oxide for rust protection and then coated with bitumen compound for corrosion protection.
- While laying earthing electrodes, adding/mixing of chemical compound and water around the electrode in the dug hole shall be as per instructions of OEM. Vendor shall ensure visit of OEM engineer to site at the time of installation for proper guidance/ supervision.



	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

12. Integration of Power

SUPPLY & INSTALLATION OF LT PANEL: -

LT panel (rating 2000 KW) shall be provided by contractor.

The scope covers supply, installation, testing and commissioning of power panels, incorporating circuit breakers, fuse units, busbars, interconnections, earthing etc. meeting the requirements shown in equipment schedule and the drawings.

General Requirement: -

- Power Rating : 2000 KW
- Voltage : 415 Volt
- Incoming feeder & : 21 Nos. (160 Amp for each)
current rating
- Outgoing feeder & : 1no (3200 Amp – termination to be
current rating done through bus duct on LT side of
transformer)
- Short Circuit : 50 KA for 1 Sec, Peak short circuit
withstand of 105 KA minimum
- Ambient Temperature : 50 degree
- Ingress Protection : IP-65
- Communication : Modbus protocol/ provision for SCADA
Interfacing

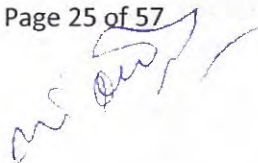

STANDARDS: As per schedule of Indian standard. The PCCs & MCCs shall comply with the latest edition of relevant Indian standards and Indian Electricity rules and regulations. The following Indian Standards shall be complied with:


TYPE OF M.V. SWITCH GEAR:

- All the PCC's / PDB's / MCC's shall be metal clad, totally enclosed, rigid, floor / wall mounted, air - insulation, cubical type suitable for operation on three phase / single phase, 415 / 230 volts, 50 Hz. neutral effectively / Non effectively grounded at transformer and short circuit level not less than 30 MVA at 415 volts.
- The PCC's / MCC's shall be designed the withstand and heaviest condition at site, with minimum expected ambient temperature of 55 degree celsius, 90 percent humidity and dusty weather.
- Should confirm to Indian Electricity Act and rules. (as amended up to ate) & approval of FIA. of India.

STRUCTURE for LT panel :

- The PCCs, MCCs & PDBs shall be metal clad enclosed and be fabricated out of high quality CRCA sheet, suitable for indoor installation having dead front operated and floor mounting type.

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

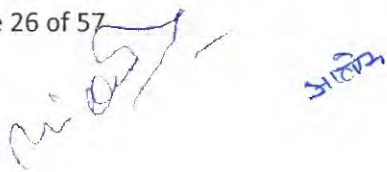
- All CRCA sheet steel used in the construction of PCCs / MCCs / PDBs shall be 2 mm thick and shall be folded and braced as necessary to provided a rigid support for all components. Joints of any kind in sheet shall be seam welded, all welding slag grounded off and welding pits wiped smooth with plumber metal.
- The PCCs / MCCs / PDBs shall be totally enclosed, completely dust and vermin proof and degree of protection being not less than IP-51 to IS 2147. Gaskets between all adjacent units and beneath all covers shall be provided to render the joints dust proof. All doors and covers shall be fully gasket with foam rubber and / or rubber strips and shall be lockable.
- All panels and covers shall be properly fitted and secured with the frame, and holes in the panel correctly positioned. Fixing screw shall enter into holes taped into an adequate thickness of metal or provided with bolts and nuts. Self threading screws shall not be used in the construction of PCCs /MCCs / PDBs.
- **A base channel of 75 mm x 75 mm x 5 mm thick shall be provided at the bottom.**
- PCCs / MCCs /PDBs shall arranged in multi-tier formation. The PCCs / MCCs / PDBs shall be of adequate size with a provision of 20 percent spare space to accommodate possible future additional switch gear. The size of the PCCs / MCCs / PDBs shall be designed in such a way that the internal space is sufficient for hot air movement, and the electrical component does not attain temperature more than 45 degree celsius. If necessary openings shall provided for natural ventilation, but the said openings shall be screened with fine weld mesh.
- Knockout holes of appropriate size and number shall be provided in the PCCs / MCCs/ PDBs in conformity with number, and size of incoming and outgoing conduits / cables.
- Alternatively the PCCs / MCCs / PDBs shall provided with removable sheet plates at top and bottom to drill holes for cable / conduit entry at site.
- The PCCs / MCCs / PDBs shall be designed to facilitate easy inspection, maintenance and repair.
- The PCCs / MCCs / PDBs shall be sufficiently rugged in design and shall support the equipment without distortion under normal and short circuit condition, they shall be suitable braced for short circuit duty.


PAINTING:

All sheet steel work shall undergo a process of decreasing pickling in acid, cold rinsing, phosphating, pesivating and then sprayed with a high corrosion resistant primer. The primer shall be backed in an oven. The finishing treatment shall be by application. Three coats of synthetic enamel paint of approved colour shall be applied by spray and stoves in dust free atmosphere or the panel shall be powder coated.

CIRCUIT COMPARTMENT:

- Each circuit breaker and switch fuse units shall be housed in separate compartments and shall be enclosed an all sides. Sheet steel hinged lockable door shall be duly inter locked with the breaker /switch fuse units in ON and



	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

OFF position. Safety interlocks shall be from being drawn out when the breaker is in ON position.

- The door shall not form as integral part of the drawout position of the circuit breaker. All instruments and indicating lamp shall be mounted on the compartment door. Sheet steel barriers shall be provided between the tires in a vertical section.

INSTRUMENT COMPARTMENT:


Separate and adequate compartment shall provided for accommodating instruments, indicating lamp, control contactors, relays and control fuses etc. These components shall be accessible for testing and maintenance without any danger of accidental contact with live parts of the circuit breaker, switch fuse units, busbars and connections.

BUSBARS:

- The busbar shall be air insulated and made high quality, high conductivity, high strength copper and as per relevant IS code. The busbar shall of three phases and neutral system with separate neutral and earth bar. the busbar and interconnection between busbar and various components shall be of high conductivity, hard drawn, electrolytic copper. the busbar shall be of rectangular cross section designed to withstand full load current for phase busbar and full rated current for neutral busbar and shall be extensible type on either side. The busbar shall be rated for the frame size of the main incoming breaker but in any case not less than 200 amp capacity. The busbar shall have uniform cross section through out the length.
- The busbar and interconnection shall be insulated with heat shrinkable PVC sleeves and be colour coded in red, Yellow, Blue and Black to identify the three phases and neutral of the system. The busbar shall be supported on unbreakable, non hygroscopic DMC insulated supports at sufficiently close interval to prevent busbar sag and shall effectively withstand electromagnetic stresses in the event of short circuit capacity of 50 KA RMS symmetrical for one second and a peak short circuit withstand of 105 KA minimum.
- The busbar shall be housed in a separate compartment. The busbar shall be isolated with 3 mm thick bakalite sheet to avoid any accidental contact. The busbar shall be arranged such that minimum clearance between the busbar are maintained as per below.
 - Between phases : 27 mm min.
 - Between phases and neutral : 25 mm min.
 - Between phases and earth : 25 mm min.
 - Between neutral and earth : 23 mm min.
- All busbar connection shall be done by drilling holes in busbars and connecting by chromium plated brass bolt and nuts. Additional cross section of busbar shall be provided in all PCCs / MCCs / PDBs to cover-up the holes drilled in the busbars. Spring and flat washers shall be used for tightening the bolts.
- All connection between busbar and circuit breaker / switches and between circuit breaker/switches and cable terminals shall be through solid copper

[Handwritten signature]

[Handwritten signature]

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

strips of proper size to carry full rated current. These strips shall be insulated with insulating strips.

ELECTRICAL POWER & CONTROL WIRING CONNECTION


- Terminal for both incoming and outgoing cable shall be suitable for 1100 volts grade, aluminum/copper conductor PVC insulated and sheathed, armoured cable and shall be suitable for connections of solder less sockets for the cable size as indicated on the appended drawing for the PCCs, MCCs, PDBs.
- Both control and power wiring shall be brought out in cable alley for ease of external connections, operation and maintenance.
- Both control and power terminals shall properly be shrouded.
- 10% spare terminal shall be provided on each terminal block. Sufficient terminals shall be provided on each terminal block so that not more than one outgoing wire connected per terminal.
- Terminal strip for power and control shall preferably be separated from each other by suitable barriers of enclosures.
- Wiring inside the module for power, control protection and instrument etc. shall be done with use of 660/1100 confirming to IS 694 and IS 8130. Power wiring inside the starter module shall be rated for full current rating of contactor, but not less than 4 sq mm cross section area. For current transformer circuits, 2.5 sq mm copper conductor wire shall be used. Other control wiring shall be done with 2.5 sq mm copper conductor wires. Wires for connections to the door shall be flexible. All conductors shall be crimped with solder less sockets at the ends before connections are made to the terminals.
- Control power for the motor starter module shall be taken from the respective module switchgear outgoing from R phase and Neutral. Control wiring shall have control fuse (HRC type).
- Particular care shall be taken to ensure that the layout of wiring neat and orderly. Identification ferrules shall be filled to all the wire termination for ease of identification and to facilitate and testing. Suitable washers shall be used for all copper and aluminium connections.
- Final wiring diagram of the PCC, MCC, PDB power and control circuit with ferrules number shall be submitted along with the PCC/MCC/PDB as one of the documents.

TERMINALS

The outgoing terminals and neural link shall be brought out to a cable alley suitably located and accessible from the panel front. The current transformer for instrument metering shall mounted on the disconnecting type terminal blocks. No direct connection of incoming and outgoing cables to internal components connection of the distribution board is permitted, only one conductor may be connected in one terminal.

WIREWAYS

A horizontal PVC wire way with screwed covers shall provided at the top to take interconnecting control wiring between different vertical sections.

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

CABLE COMPARTMENT

Cable compartment of adequate size shall be provided in the PCCs, MCCs, PDBS for easy termination of all incoming and outgoing cables entering from bottom or top. Adequate support shall be provided in the cable compartment shall be brought out to terminal blocks in the cable compartment.

EARTHING for LT Panel

- Copper earth busbar of 25 mm x 3 mm shall be provided in the PCCs, MCCs, PDBS for the entire length of panel. The frame work of the PCCs, MCCs, PDBs shall be connected to this earth busbar. Provisions shall be made for connection from earth busbar to the main earthing bar coming from the earth pit on both side of the PCCs, MCCs, PDBs.
- The earth continuity conductor of each incoming and outgoing feeder shall be connected to this earth bar. The armour shall be properly connected with earthing clamp and the clamp shall be ultimately bounded with the earth bar.

LABELS

- Engraved PVC labels shall be provided on all incoming and outgoing feeders. Single line circuit diagram showing the arrangements of circuit inside the distribution board shall be pasted on inside of the panel door and covered with transparent laminated plastic sheet.


NAME PLATE for LT panel

A name plate with panel designation in bold letter shall be fixed at top of the central in panel. A separate name plate giving feeder giving feeder details shall be provided for each feeder module door. Inside the feeder compartment, the electrical component, equipments, accessories like Switchgear, contactor, lamp, relays etc. shall suitably be identified by providing stickers. Engraved name plates shall preferably be of 3 ply, (red-white-red or black-white-black) lamicold sheet. However black engraved perplex sheet name plates shall also be applicable. Engraving shall be done with square groove cutters. Name plate shall be fastened by counter sunk screws and not by adhesives.

DANGER NOTICE PLATE for LT panel

- The danger plate shall be affixed in a permanent manner on operating side of the panel.
- The danger notice plate shall indicate danger notice both in Hindi and English and with a sign of skull and bones.
- The danger notice plate in general shall meet to requirements of local inspecting authorities.
- Overall dimension of the danger notice plate shall be 200 mm wide and 150 mm high. The danger notice plate shall be made from minimum 1.6 mm thick mild steel sheet and after due pretreatment to the plate, the same shall be painted white with vitreous enamel paint on both front and rear surface of the plate.
- The letter, the figure, the conventional skull and bones shall etc. shall be positioned on the plate as per recommendations of IS : 2551-1982.

[Handwritten signature and blue stamp]

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

- The said letter, the figure and the sign of skull and bones be painted in single red colour as per IS : 5-1978.
- The danger plate shall have rounded corners. Locations of fixing holes for the plate shall be decided to suit design of the panel.
- The danger notice plate, if possible, be of ISI certification mark.

INTERNAL COMPONENTS

- The PCC / MCC / PDB shall be equipped complete with all type of required number of air circuit breakers, switch fuse unit, contactor, relays, fuses, meters, instruments, indicating lamps, push buttons, equipment, fittings, busbar, cable boxes, cable glands etc. and all the necessary internal connections/wiring as required and as indicated on relevant drawings. Components necessary for proper complete functioning of the PCC / MCC / PDB but not indicated on the drawings shall be supplied and installed on the PCC / MCC / PDB.
- All part of the PCC / MCC/ PDB carrying current including the components, connections, joints and instruments shall be capable of carrying their specified rated current continuously, without temperature rise exceeding the acceptable values of the relevant specifications at any part of the PCC / MCC / PDB.
- All units of the same rating and specifications shall be fully interchangeable.

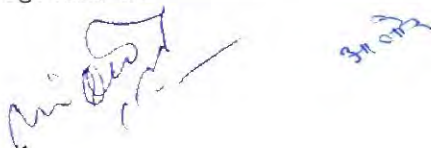
INSPECTIONS


Each equipment should inspect and witness by client & consultant.

- The PCC / MCC / PDB shall be inspected and checked as per inspection manual of the PCC / MCC / PDB manufacturer.
- Various electrical components and accessories of the PCC / MCC / PDB shall be checked as per drawing for the respective PCC / MCC / PDB.
- The PCC / MCC / PDB shall be checked for rigid mounting, earthing connections, proper rating and size of components, internal wiring, etc. All mechanical fasteners and electrical connections shall be checked and tightened before installation.
- Type test certificates for all ACB for similar rating shall be submitted.

Test :

- Prior to dispatch of the PCC / MCC / PDB following tests shall be carried out.
- Mechanical endurance test shall carried out by closing and opening of all the ACB's, MCB's switches etc.
- Over voltage and Insulation resistance test shall be carried out between phases and between phase to earth bus, keeping the isolating switch in ON position. Similar test shall be carried out keeping the isolating switch in closed position.
- All the interlocks, controls and tripping mechanism of the switch gears shall be tested for their proper functioning.



	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

COMPONENTS:

GENERAL

- The type, size, and rating of the components shall be as indicated on the relevant drawings.
- While selection of the capacity of the components resulting from the prevailing conditions like room temperature shall be allowed for the Thermal and magnetic trip rating shall be compensated for the ambient temperature.
- The rating indicated on the drawings are rating anticipated at prevailing site condition.

(i) Air Circuit Breaker


The Circuit Breakers shall be 3/4 pole as specified, Microprocessor based with LCD display, air break drawout type having electrical closing arrangements as defined in the SLD. ACB shall be provided with built in over load, short circuit and earth fault protection. Circuit Breaker carriage shall be mounted on guides to ensure correct alignment. Isolating contacts shall be of the self-alignment type. Breakers shall have three distinct and separate operation positions. Circuit Breaker shall be provided with spring assisted operating mechanism. Circuitbreaker Shall be suitable for minimum fault level 50kA for 1 second ($I_{cs} = I_{cu} = I_{cw} = 50kA$) & Making capacity 2.1 times breaking capacity.

The circuit breaker ratings shall be as follows:


- Rated Voltage : 415V \pm 10%
- RMS symmetrical breaking : 50 KA (minimum) capacity at rated voltage.
- Rated short time current : Not less than 50KA for 1 sec.
- Rated operating duty (P2) : 0-3sec-CO-3min-CO.

The circuit breaker shall be provided with the following.

- 6 NO & 6 NC spare auxiliary contacts wired to terminal blocks.
- 24V DC Shunt Trip Coil for Breakers
- One mechanical position indicator.
- indicating lamps to show 'ON-OFF', and Auto-Trip conditions.
- Mechanical emergency trip push button.
- Easily removable arc chutes for effective arc quenching.
- Mechanical trip button, integral with the breaker shall be provided at the front.
- Padlocking facility in 'OFF' position.
- Operating handle interlocked with the front cover for safety.
- All breakers to have thermal, magnetic and under voltage releases.
- Triple pole, ambient temperature compensated, adjustable, direct acting thermal release.
- Triple pole, direct acting, adjustable upto 12 times rated current short-circuit trips with time
- delay upto 0.3 seconds for discrimination obtained through rugged and non-aging mechanical means.
- The timing device shall be independent of power supply.



31/1/21

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

- Under voltage releases to have inherent delay to prevent tripping on transient voltage dips.

Following safety interlocks shall be provided on the circuit breakers:

- The operation of the circuit breaker shall not be possible unless it is in :
 - i. Service Position
 - ii. Withdrawn to test position.
 - iii. Fully drawn-out.
 - iv. Bus coupler interlocking with two incomers (when two incomers are on, bus coupler shall not be possible to close in service position).

Further it shall not be possible to close the circuit breaker without completing the auxiliary circuits between the fixed and moving portion. All interlocks shall be effective in Service Position.

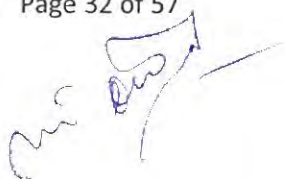
- The withdrawal or racking in of the circuit breaker without completing the auxiliary circuit between the fixed and moving portion.
- The door of the circuit breaker portion, if any, shall open only if the circuit breaker is in the open position.
- Safety shutters operated automatically by the movement of the circuit breaker shall ensure that the live parts are fully shrouded when the circuit breaker is withdrawn.
- The circuit breaker carriage shall be earthed before the main contacts are plugged in.
- Potential free contact for on/off/trip status monitoring to be provided for completely compatible interface with centralized building automation.
- Auto self starting required after power failure.


(ii) Miniature Circuit Breaker

Miniature circuit breakers shall be quick make and break and break type conform with British standard BS : 3871 (Part-I) 1965, IEC 898-1995 and IS : 8828 (1996). The housing of MCBs shall be heat resistant and having a high impact strength. The fault current of MCBs shall not be less than 9000 amps, at 230 volts. The MCBs shall be flush mounted and shall be provided with trip free manual operating mechanism with mechanical "ON" and "OFF" indications.

The circuit breaker dollies shall be of trip free pattern to prevent closing the breaker on a fault current. Tightening torque at terminals shall be not less than 2.5 Nm. Power losses should not be more than as specified in IEC 898-1995.

The MCB contact shall be silver nickel and silver graphite alloy and tip coated with silver.




	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

Proper arc chutes shall be provided to quench the arc immediately. MCB's shall be provided with magnetic fluid plunger relay 3 as for over current and short circuit protection. The over load or short circuit devices shall have a common trip bar in the case of DP and TPN miniature circuit breakers.

All the MCB's shall be tested and certified as per Indian Standard, prior to Installation. For protection of electric circuits with equipment that does not cause surge current (i.e. lighting and socket outlet circuits) 'B' curve MCB to be used in which magnetic releases operates between 3 and 5 In.

For protection of electric circuits with equipment that cause surge current (i.e. inductive and motor circuits) 'C' curve MCB to be used in which magnetic releases operates between 5 and 10 In. For protection of electric circuits with equipment that cause surge current (i.e. transformer, heavy start motors circuits) 'D' curve MCB to be used in which magnetic releases operates between 10 and 15 In. Auto self starting required after power failure.

(iii) Fuse

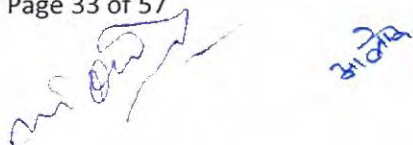
Fuses shall be of high rupturing capacity (HRC) fuse links and shall be in accordance with IS :2000-1962 and having rupturing capacity of not less than 35 MVA at 415 Volts. The backup fuse rating for each motor / equipment. HRC fuses shall be of English Electric make or approved equal.


(iv) Moulded Case Circuit Breaker

Moulded case circuit breakers shall be conforming with IEC 60947-2 and IS 13947 -2. The MCCB shall be air break type and having quick make quick break with trip free operating mechanism. Housing of the MCCB shall be of heat resistant and flame-retardant insulating material. All the MCCB should be provided with adjustable thermal and magnetic release and with rotary handles.

Operating handle of the MCCB shall be in front and clearly indicate ON / OFF / TRIP positions. The electrical contact of the circuit breaker shall be of high conducting non-deteriorating silver alloy contacts. Shall be equal to system short circuit level i.e. 50 kA/65 kA (Minimum) $(I_{cs} = I_{cu})$. (I_{cs}) = Service Short circuit breaking capacity (I_{cu}) = Rated ultimate short circuit breaking capacity. Icw as per manufacturer's design for higher ratings, if applicable, shall be 50 kA for 1 sec.

The MCCB shall be provided with thermal / magnetic type bi-metal over load release and electro-magnetic short circuit protection device. All the releases shall operate on common trip busbar so that in case of operation of any one of the releases in any of the three phases, it will cut off all the three phases and thereby single phasing of the system is avoided.



	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
		Rev no	00
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)		

The MCCB whenever called for in the appendix drawings shall be provided with an earth fault relay. The MCCB shall provide two sets of extra auxiliary contacts with connections for additional controls at future date. The electrical parameters of the MCCB shall be as per the descriptions given in the appended drawings.

(v) Contractors:

The contactor shall meet with the requirements of IS : 2959 and BS : 775.

The contactors shall have minimum making and breaking capacity in accordance with utilization category AC 3 and shall be suitable for minimum class II intermittent duty.

If the contactor forms part of a distribution board then a separate enclosure is not required, but the installation of the contactor shall be such that it is not possible to make an accidental contact with live parts.

(vi) Meter :

The meter should meet the following requirement unless and otherwise specified in the bill of material or drawings.

Ammeter : The Ammeter should be digital type 96 x 96 mm size having facility to read current parameters.

Voltmeter : The Voltmeter should be digital type 96 x 96 mm size having facility to read voltage parameters.

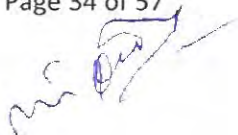
KWH METER : Digital KWH meter 96 x 96 x 80 mm size Acc Class 1.0 suitable for true RMS reading having reverse LED. Optically isolated pulse output having pulse with 500 ms and pulse amplitude 12 volts. It should be with RS 485 port with open protocol.


(vii) LOAD MANAGER:

The load manager should meet the following requirement unless and otherwise specified in the bill of material or drawings.

Load Manager (For Incoming Feeders) : The load manager should having facility to read voltage current harmonics power parameters. It should contain real time clock. The meter should be field programmable and to generate high / low profile for all power parameters with date & time, also able to store previous period integrated data. The meter should have RS 485 port with open protocol for networking purpose. All the programming should be pass word protected.

Load Manager (For other Feeders) : Load manager facility to measure A, V, PF, kW, KWH with RS 485 port with open protocol for networking. The meter should be totally field programmable and having a password protection. Size should be 96 x 96 mm.




	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

(viii) CURRENT TRANSFORMER:

Where ammeter are called for, CT's shall provided for current measuring. Each phase shall be provided with separate CT of class 1 accuracy and suitable VA burden for operation of associated metering and controls. Current transformer shall be in accordance with IS : 2705-19 64 as amended up to date.

(ix) PUSH BUTTON :

The push button unit shall comprise of the contact element, a fixing holder , and push button actuator. The push button shall be momentary contact type. The contacts shall be of silver alloy and rated at 10 Amps. continuous current rating. The actuator shall be of stranded type and colour as per its usage for ON, OFF and Trip.

(x) INDICATING LAMP :

Indicating Lamp shall be transformer operated low voltage rated and shall supplied complete with translucent covers to diffuse the lamp light. Colour shade for the indicating lamps shall be as below :

- ON indicating lamp : Red
- OFF indicating lamp : Green
- TRIP indicating lamp : Amber
- PHASE indicating lamp : Red, Yellow, Blue.


(xi) SPECIAL REQUIREMENTS:

- Bottom most feeder shall be minimum 300 mm above the bottom of panel base frame.
- Necessary floor stand to be provided whenever required along with the panels.

(xii) Testing & Co-ordination :

Testing and setting the relay set – point and co-ordination between relay on LT/HT fuses, breaker, setting shall be done by contractor. The down stream of the setting should be provided.

- The following drawings & document shall be submitted before procurement/manufacturing for approval from the client.
 1. General arrangement and Fabrication details.
 2. Power wiring diagram of the panel.
 3. Control wiring diagram of panel.
 4. C.T. ratios with connection.
 5. Material list with make, catalogue nos and
- Testing and setting the relay set – point and co-ordination between relay on LT/HT fuses, breaker, setting shall be done by contractor. The down stream of the setting should be provided.
- 3. The relay should be tested by reputed agencies and test report of the relay should be submitted by the contractor.

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

Note: Panels shall also equipped with Transient Voltage Surge Suppressor (TVSS) for protection against transient voltage surges. Digital Ammeter & Digital Voltmeter with their inbuilt selector switches and Digital Load manager which performs as a multifunction meter are provided on the front side of the cubicle. LTPDB is also provided with a Breaker Control Switch (TNC) for electrically operating the ACB. NO & NC contacts for ACB are provided to communicate the On, OFF and Trip status & control to/by SCADA.

Test and Test Reports

- The Supplier shall carryout all routine tests as specified in relevant standards on all major components in presence of the BHEL's representative (or third party nominated by NALANDA UNIVERISTY for this purpose) at manufacturer's premises before dispatch of the material and furnish copies of test reports for BHEL's approval. If required, stage wise inspection will be carried out by the BHEL.
- Supplier shall carryout all routine and functional tests as specified in the relevant standards on the assemble SPV Plant with all accessories of the equipment in the presence of the BHEL's representative before dispatch and furnish copies of the test reports for approval before dispatch.
- Equipment shall not be dispatched unless the test certificates are duly approved by the BHEL.
- Two sets of copies of the complied and approved test certificates shall be submitted to the BHEL.


Drawings


The contractor shall furnish the following drawings

- General arrangement and dimensioned layout.
- Schematic Drawing showing the requirement of SV panel, power condition unit(s), junction Boxes. AC and DC Distribution Boards, meters etc.
- Power Flow Schematic.
- Earthing & Lightning arrestor Layout.
- Structural drawing along with foundation details.
- Itemized bill of material for complete SV plant covering all the components and associated accessories.
- Overall layout showing SV Plant in the allocated space of the campus.
- Detail architectural, Civil & Structural plan for the buildings to be constructed.
- Format for reports and charts for analysis various parameters.

13. RATING & NAME PLATE, DISPLAY BOARD & DANGER BOARD: -

Each main and auxiliary item of plant shall have permanently attached to it a rating name plate in a conspicuous position, This shall be of a non- corrodible material preferably chromium plated steel to stand the prevalent atmosphere condition as indicated. The inscription shall be engraved in black on the plate or as plate or as otherwise specified in section C/D.



	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

- The size of the rating and name plate shall depend upon space availability but an inscription shall be approved by the Engineer. The plates shall be reasonably sized of clarity and clear inscription.
- In case of indoor equipment, the plate shall be of transparent plastic material with black lettering engraved on the back.
- The name plates shall be screwed to the body of the equipment.

In addition to this, Vendor shall use danger boards, wherever required, to ensure safety of the persons during the work at site. For all other places where it is required to fix danger plates as per Good Engineering practice and as per Latest Electricity Act stipulations – the same shall be complied with.

14. FIRE FIGHTING SYSTEM: -

Firefighting system shall be part of contractor's scope. This includes supply & installation of following equipments: -

Fire Extinguisher: - The firefighting system for the proposed power plant for fire protection shall be consisting of:

- Portable fire extinguishers
- The installation of Fire Extinguishers should confirm to TAC regulations and BIS standards.

Vendor shall provide fire extinguishers as follows for fighting fire electrical wiring, live machinery fires and flammable liquid/ gas as per recommendation by relevant fire safety authority and as per relevant standards IS: 2171 and IS: 10658 marked. DCP type (ABC) 9Kg designed/tested IS 15683/ IS: 13849 with safety release valve, NRV and CE approved valve. Dry powder IS 14609 with standard accessories.

Each fire extinguisher shall be checked once in every two-year span.

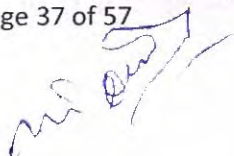
Fire Buckets Set: - Fire buckets set in each section of solar farm shall be installed at provided location. Each set shall contain 3 nos. of bucket hanging on stand with canopy. Bucket shall confirm IS:2546-1974.

15. LIGHTNING & SURGE VOLTAGE PROTECTION: -


A lightning and overvoltage concept shall be designed according to IEC 62305 (all parts) and discussed with other relevant project members to guarantee that the system will not have a negative influence on other Installation at the Nalanda University.

Grounding and lightning protection system, including step and total voltage calculation, risk assessment according to IEC 62305-2

The Lightning Arrestor (LA) will be Early Streamer Emission (ESE) type. This lightning rod is made of stainless steel and epoxy resin. The specific function of this lightning rod is producing an upward stream of ionized particles pointed towards the clouds that will channel the electrical discharge produced at the time of lightning.



3/12/21

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

To properly ground the lightning surges, earthing is provided to each lightning arrester by providing **two earth pits (Copper plate earthing 600x600x3.15 mm) which are connected to lightning arrester with suitable Cu size cable / Cu Strip (20x3 mm) in accordance with IS-3043.**

The source of over voltage can be lightning or other atmospheric disturbances. Main aim of over voltage protection is to reduce the over voltage to a tolerable level before it reaches the PV or other sub-system components. The bidder needs to provide relevant certifications for the same.

Necessary concrete foundation for holding the lightning conductor in position to be made after giving due consideration to shadow on PV array, maximum wind speed and maintenance requirement at site in future.

The lightning conductor shall be earthed through flats and connected to the earth mats as per applicable Indian Standards with earth pits. Each lightning conductor shall be fitted with individual earth pit as per required Standards including accessories, and providing masonry enclosure with cast iron cover plate having locking arrangement, watering pipe using charcoal or coke and salt as required as per provisions of IS.


If necessary, more numbers of lightning conductors may be provided.

Contractor shall submit the drawings and detailed specifications of the PV array lightning protection equipment.

16. CCTV Surveillance System: -

Contractor's scope includes design, supply, installation & commissioning, operating & maintaining a complete day night CCTV based surveillance system for the solar farm covering all keys areas for surveillance point of view, including IP rated cameras with required mounting arrangement, IP rated termination box, cable, hoods, centralized DVR system which shall be capable to have last 180 days 24x7 data storage of CCTV footage in it. Remote base operation facility shall be provided for the system.

Minimum resolution shall be 1MP 720p HD for dome & 2MP 1080p HD for Bullet cameras, IR based night vision cameras to be used for security purpose. Contractor has to provide complete solution by using fix + PTZ cameras as required to cover the total solar farm area. Sufficient capacity of NVR with minimum 30days back up to be provided with cloud-based backup with necessary licensing etc. All the misc. accessories like connecting wires, POE switches, IP66 junction boxes, pole / other mounting arrangements, etc. shall be provided as per requirement. Real-time screening via cloud /internet to be made available with access parameters to the client as required.

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

All the component of system shall be in with latest IEC Codes & relevant standards.

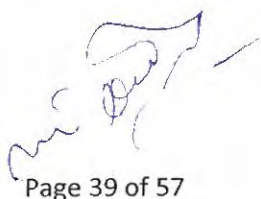
17. Net Metering including supply & installation of net meter, gross meters, CT and other items and accessories

This line item pertains to liaison part with DISCOM. Activity will start from co-ordination with customer and submission of application form to DISCOM for installation of bidirectional meter. Subsequently


- arranging issue of net meter (either from local DISCOM or through approved supplier)
- Calibration of meter through recognized lab of local DISCOM
- Arranging Testing of new meter
- Getting replacement order from DISCOM office after inspection of Old/existing energy Meter
- Getting estimates done for issue of Solar Meter
- Arranging order from DISCOM for installation of Bidirectional Meter.

Cost of Bidirectional Meter, Solar Meter, Government receipts for calibration etc. shall be borne by Bidder. In case, such items are to be arranged through the contractor – the cost of supply & installation has been covered elsewhere. Minor accessories required during installation of bidirectional meter shall be in the scope of the contractor. The contractor has to co-ordinate with the agency for installation of net meter at site and the contractor will provide required manpower assistance during installation of the Net Meter.

Bidder to note that Net meter practices varies from DISCOM to DISCOM. Bidder to ensure particular DISCOM guideline state/Area. All equipment like CTs, PTs, Meter Box, Meter(Net/RE) Cable including procurement, DISCOM testing and installation shall be done by Bidder Only.




31/07/21

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

Part 'B'

CIVIL & EARTH WORK

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

1. Foundation for Inverter , ACDB, LT Panle Etc

Contractor shall prepare earth for making foundation for installing inverter, ACDB, LT panel, lightning arrester & firefighting system. All building material such as cement, sand aggregate, galvanized steel (galvanizing thickness 85 micron), GI clamp, GI bracket, SS304 made nut, bolt & washer etc. shall be supplied by contractor.

For the foundation Cement Concrete 1:1.5:3 (1 cement, 1.5 coarse sand & 3 graded stone aggregate 20mm nominal size) to be used. These will be mixed to get a compressive strength of 20 N/mm² (M20 Concrete Grade).

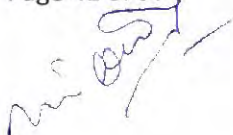
Cement shall be good ISI Portland cement of reputed make. Cement bags shall bear ISI certification mark and date of manufacture. The sand shall be of river sand, clean & free from organic impurities. C.C. (1:1.5:3) concrete shall be mixed well in watertight platform in proportion as specified All ingredients in required proportion shall be mixed, first dry & than required quantity of water shall be added. Mixing shall be turned over twice or thrice, so that surface of the coarse aggregate coated with cement & concrete shall be used within half an hour of mixing. Any quantity remaining unused after an hour of mixing will not be allowed to use. The casted pedestals shall be cured minimum for ten days after completion of work. It shall keep well-watered & shall be protected from direct heat of sunlight by means of wet gunny bags.


Cement shall be procured by Vendor conforming to BIS: 8112 and / or BIS: 1489 Specification latest edition or higher Grade. The cement shall be stored by the Vendor in such suitable covered and lockable stores, well protected from climate and atmospheric effects. The cement go-down shall be constructed by the Vendor as per the drawing in CPWD specifications at his own cost. The cement in bags shall be stored in go-downs in easy countable position. Cement bags shall be used on first in first out basis. Cement stored for beyond 90 days will be required to be tested at Vendors cost, before use in works.

Concrete shall consist of cement, sand & graded stone in required proportion. Coarse aggregate for all concrete shall be graded crushed hard granite, trap or basalt stone and shall conform to the requirements. All materials shall be carefully & accurately measured in measuring box. Cement shall either be weighed or used in full bags. The required quantity of water shall be added by measuring in water cans. Concrete shall be mixed by mixer machine. Before any concrete is placed in position, all loose pieces of Timber, Stones, saw dust etc. shall be removed from the work. No concrete mixed 30 minutes' prior of placing in form shall be accepted. Proper water cement ratio shall be observed.

Mechanical mixing method shall be adopted for mixing of concrete. The mechanical needle vibrator or other approved methods shall be adopted for compaction of the mix. The concrete consolidation shall be through & no honeycomb work (rough, pitted surface or voids in concrete) shall be allowed.

All the formwork shall be provided by the Vendor at his cost & shall be thoroughly wetted before the concrete is placed in position. Formwork shall be of approved quality. Where timber is used, the face in contact with concrete shall be plain & made smooth. All the joints in formwork shall be perfectly close to prevent the




	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

loss of cement slurry from concrete. After the form works are complete, the Vendor shall get it checked for strength, suitability & levels. For this advance intimation shall be given for inspection.


Sufficient number of framework/shuttering shall be maintained by the contractor at site to match the pace of the work required at site.

SAMPLE TESTING: - Sampling and testing of concrete shall be carried out by drawing random sample during various stages of inspection. Guiding standard shall be IS: 516. **Cube Test on selected sample after 7 days curing & 28 days curing shall be conducted for compression strength.**

2. Earth Work

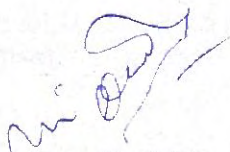
Excavation and Back Filling

Bidder has to above work for the installation of ACDB, LT Panel inverter and wherever is required.

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00


Part 'C'

Operation and Maintenance


Page 43 of 57



Signature and seal of Bidder

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

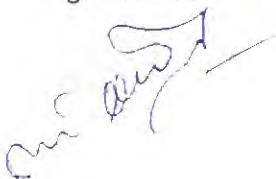
Operation and Maintenance


O& M period shall be started immediate effect after handing over of the plant. Contractor shall be responsible for the operation & maintenance of plant during the entire O&M period.

Experienced manpower (as detailed below) shall be deployed by contractor at site on regular basis.

S. No.	Designation	Number required	Work Experienced
1.	Engineer (Electrical)	01	5 Years
2.	Diploma Engineer(Electrical)	01	5 Years
3.	Electrician	02	5 Years

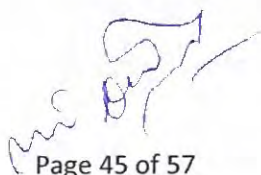
- O&M practices shall be strictly followed as per **Details mentioned in Chapter-01**
- O&M of Solar Power Plant shall be compliant with grid requirements to achieve committed energy generation.
- Deputation of qualified and experienced engineer/technicians till the O&M period at project site as mentioned above.
- Periodic cleaning of solar modules:** The modules shall be cleaned with water in a periodic interval of 15 days or as and when required as per actual site conditions. It's the responsibility of the bidder to get the modules cleaned during O & M Period.
- To maintain the maximum generation of the plant to meet the desired CUF.
- Periodic checks of the Modules, PCUs and BOS** shall be carried out as a part of routine preventive and breakdown maintenance.
- Immediate action for repair/replacement of defective Modules, Invertors/PCUs and other equipment as below:**
 - To communicate with manufacturer of the equipment regarding the defective item and its repair / replacement.
 - Inform BHEL about defective items.
 - To note down error codes as displayed in inverters.
 - Regular check of all earthing joints and material.
 - Immediate jointing/welding of earthing strip if found damaged.
- Immediate action shall be taken for removal of new plants / vegetation at site that will be causing shadow on PV panels or causing problem for operation of the plant.
- Supply of all spares as per spare list in Chapter 02.
- All the testing instruments required for Testing, Commissioning and O&M for the healthy operation of the Plant shall be maintained by the Bidder. The testing





 Rudrapur	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

equipment must be calibrated once in a year from NABL accredited labs and the certificate of calibration must be kept for reference as required.

11. **If negligence/ mal-operation on part of the Bidder's operator results in failure of equipment, such equipment should be repaired/replaced by the Bidder free of cost.**
12. **Online Performance Monitoring, controlling, troubleshooting, maintaining of logs & records.** A maintenance record register is to be maintained by the operator with effect from starting of O&M period to record the daily generation, regular maintenance work carried out as well as any preventive and breakdown maintenance along with the date of maintenance, reasons for the breakdown, duration of the breakdown, steps taken to attend the breakdown, etc.
13. *For any issues related to operation & maintenance, a dedicated/toll-free number shall be made available to the BHEL/Customer to **resolve within 72 hours**. Also, **an email ID** shall be provided by the bidder as optional contact for recording of complains and other official communications. If not attended within such stipulated time, a complaint may be raised by BHEL, pursuant to which, a penalty of **Rs. 10,000 / day**. If the outage of the plant is more than 30 days continuously, then the **10% CPBG amount shall be encashed** by BHEL and If the outage is exceeding more than 60 days than **complete CPBG amount shall be encashed** by BHEL. This will be applicable till 5 years of O&M as per the scope of the NIT.*
14. If any jobs covered in O&M Scope as per NIT are not carried out by the contractor / Bidders during the O&M period, the Engineer-In-Charge shall take appropriate action as deemed fit. BHEL/Customer reserves the right to make surprise checks/inspection visits at its own or through authorized representative to verify the O&M activities being carried out by the Bidder. Failure to adhere to above guidelines will result in penal action including debarring from participation in next tender.
15. The Operation & Maintenance of Solar Photovoltaic Power Plant would include wear, tear, overhauling, machine breakdown, smooth operation of plant for a period of 5 years.
16. The contractor shall supply **01 set of maintenance tools as per Chapter 02** to the primary customer and **01 set of maintenance tools as per Chapter 02** shall be kept at site for day to day maintenance purpose at no extra cost. 01 set supplied to the primary customer shall be kept at the place identified by the user.
17. Contractor/Bidder will have to take custody of BHEL supplied items at site, i.e. Cables, Modules etc, during whole O&M period.





	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

Chapter 01

Operation & Maintenance Guidelines Of Grid Connected SPV Plants

For the optimal operation of a SPV plant, maintenance must be carried out on a regular basis. All the components should be kept clean. It should be ensured that all the components are fastened well at their due place.

Maintenance guidelines for various components viz. solar panels, inverter, wiring etc. are discussed below:

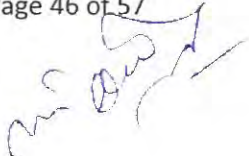
1. SOLAR PANELS:


Although the cleaning frequency for the panels will vary depending on soiling, it is recommended that:

- The panels are to be cleaned at least once weekly for ground mounted systems.
- Any bird droppings or spots should be cleaned regularly. Use soft water and a soft sponge or cloth for cleaning.
- Do not use detergent or any abrasive material for panel cleaning. Iso-propyl alcohol may be used to remove oil or grease stains.
- Do not spray water on the panel if the panel glass is cracked or the back side is perforated.
- Wipe water from module as soon as possible.
- The modules should not be cleaned when they are excessively hot. Early morning or Late evening is particularly good time for module cleaning.
- Check if there are any shade problems due to new vegetation or new building. If there are, make arrangements for removing the vegetation or moving the panels to a shade-free place.
- Ensure that the module terminal connections are not exposed while cleaning; this poses a risk of electric shock.
- Never use panels for any unintended use, e. g. drying clothes, chips etc. Ensure that monkeys or other animals do not damage the panels.
- Periodic check for tightness of all nuts and bolts (Specially for mounting nuts and bolts of Panels and structure)

2. Optimizer, Cables and Connection Boxes:

- Check the connections for corrosion and tightness.
- Check the connection box to make sure that the wires are tight, and the water seals are not damaged.
- There should be no vermin inside the box.
- Check the cable insulating sheath for cracks, breaks or burns. If the insulation is damaged, replace the wire.
- Make sure that the wire is clamped properly regularly and that it should not rub against any sharp edges or corners.
- If some wire needs to be changed, make sure it is of proper rating and type.




	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

3. Inverter:

- Remove any excess dust in heat sinks and ventilations. This should only be done with a dry cloth or brush.
- Check functionality of fans regularly and clean the fans when needed.
- Check that vermin have not infested the inverter. Typical signs of this include spider webs on ventilation grills or wasps' nests in heat sinks.
- Check functionality, e.g. automatic disconnection upon loss of grid power supply, at least once a month.
- Verify the state of DC/AC surge arrestors, cable connections, and circuit breakers.

4. Module Mounting Structure:

- Check for all fasteners like bolts & nuts for tightness every quarter.
- Replace damaged fasteners, if any.
- Changing tilt angle once in every 6months or as per the requirement.

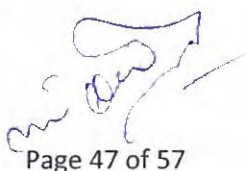
5. Shutting down the system:

- Disconnect system from all power sources in accordance with instructions for all other components used in the system.
- Completely cover system modules with an opaque material to prevent electricity from being generated while disconnecting conductors.
- To the extent possible, system shutdown will not be done during day time or peak generation.

6. Submission of O & M Report (OMR)

- The successful bidder shall submit the monthly O&M report mandatorily to BHEL as per the format enclosed at annexure-IV. Non-submission of the report shall be considered as —breach of contract and shall attract punitive actions as per the relevant provisions of the contract including


Note: A site register at all sites shall be maintained by the bidder in which all O&M activities shall be noted and shall be signed by the primary customer.



Page 47 of 57

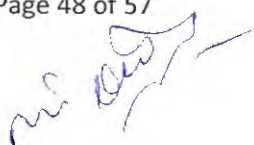
3/12/21


Signature and seal of Bidder

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

INSPECTION AND MAINTENANCE SCHEDULE:


Component	Activity	Description	Interval	By
PV Module	Cleaning	Clean any bird droppings / dark Spots on module	Regularly	User/ Technician
	Cleaning	Clean PV Modules with plain water or mild dish wash detergent. Do not used brushes, any types of solvent, abrasives, harsh detergent	Fortnightly or as per site conditions	User/ Technician
	Inspection for plants	Use infrared camera to inspect for hot spots , by pass diode failure.	Annual	User/ Technician
PV Array	Inspection	Check the PV Modules and racks for any damage, note down location & Serial No. Of damaged modules	Quarterly	User/ Technician
	Inspection	Determine if any new objects such as vegetation growth are causing shading of the array and remove them if possible	Quarterly	User/ Technician
	Vermin Removal	Remove bird nest or vermin from array or rack area	Annual	User/ Technician
Junction Boxes	Inspection	Inspect electrical boxes for corrosion or intrusion of water / insects	Annual	Electrician
		Seal boxes if required	Annual	Electrician
		Check position of switches and breakers	Annual	Electrician
		Checks operation of all protection devices	Annual	Electrician
Wiring	Inspection	Inspect cabling for signs of cracks, defects, loose connections, overheating ,short or open circuit and ground faults	Annual	Electrician
Optimizer	Inspection	Check the optimizer connection (MC4)	Quarterly	Electrician
Inverter	Inspection	Observed instantaneous operational indicators on the face plate of the inverter to ensure that the amount of power being generated is typical of conditions.	Monthly	Electrician




 Rudrapur	TECHNICAL SPECIFICATION GROUP : REG (RENEWABLE ENERGY GROUP)	Doc. No:-	REG2021-20210253
		Part	03/05
		Rev no	00


		Inspect inverter housing or shelter for physical maintenance if requires.	Monthly	Electrician
	Service	Clean or replace any air filters	As needed	Electrician
Instruments	Validation	Spot check monitoring instruments (Pyranometer etc) with standard instruments to ensure that they are operational and within specifications .	Annual	PV Specialist
Transformer	Inspection	Inspect transformer, temperature gauges , breaker, meter , connections	Annual	Electrician
Plant	Monitoring	Daily operation & performance monitoring	Daily	Site In-charge
	Data logger and weather monitoring	Check wiring and other equipments	Monthly or as required	Electrician
Spare Parts	Management	Manage inventory of spare parts	As needed	Site In-charge
Log Book	Documentation	Document all O&M activities in the log book available to all service personnel.	Continuous	Site In-charge

Note: A site register at all sites shall be maintained by the bidder in which all O&M activities shall be noted and shall be signed by the primary customer.


Page 49 of 57

31/07/21

Signature and seal of Bidder

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

Chapter 02 **SPARE AND MAINTENANCE TOOLS**

Spare List:

1. **MCCB: (Minimum inventory to be maintained all the time during the maintenance period)**

Sl. No.	MCCB Rating	Qty.	Make
1	4P 250 Amp	05	ABB/L&T/Schneider


2. **MC4 Connectors:** 50 pairs.
3. **SPD Type II –** 10 Nos.
4. Fuses, Cable glands and lugs of suitable sizes, nuts and bolts of suitable sizes.
5. DC cable -500 mts
6. AC cable as per requirement

Maintenance Tools:

1. Screw driver set suitable for the junction box, combiner box etc.
2. Allen Key set suitable for the junction box, combiner box etc.
3. Multi-meter and clamp-meter for day to day maintenance and routine check of the electrical equipment.
4. Infrared camera to check hot spots.
5. Other equipment is not listed above but required for smooth operation and maintenance shall be provided by bidder.

Note:

1. *The successful bidder shall supply & keep ready stock of tools, tackles and essential spares that will be needed for the day-to-day maintenance of the solar PV system. Above minimum set of spares shall be maintained in the plant itself for the entire period of warranty and Operation & Maintenance which upon its use shall be replenished to maintain above quantity.*
2. *Bidder shall provide calibration certificate of all tools within 30 days from the date of Work order.*
3. *Bidder shall renew the calibration certificate before the expiry date of current certificate and submit the same to BHEL.*

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

Monthly O & M Report
(Part A)

Month and year:


Name of the bidder:

NIT/PO ref no.:

Project Capacity:

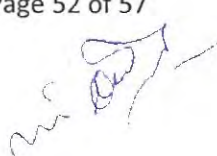
Name & Address of the site:


Component	Activity	Description	Date	Name & Signature	Remarks
PV Module	Cleaning	Immediately clean any bird droppings / dark Spots on module			
	Cleaning	Clean PV Modules with plain water or mild dish wash detergent. Do not use brushes, any types of solvent, abrasives, harsh detergent			
	Inspection for plants > 100 kWp	Use infrared camera to inspect for hot spots, by pass diode failure.			
PV Array	Inspection	Check the PV Modules and racks for any damage, note down location & Serial No. Of damaged modules			
	Inspection	Determine if any new objects such as vegetation growth are causing shading of the array and remove if any			
	Vermin Removal	Remove bird nest or vermin from array or rack area			
Junction Boxes	Inspection	Inspect electrical boxes for corrosion or intrusion of water / insects			
		Check position of switches and breakers			
		Check status of all protection devices			
Wiring	Inspection	Inspect cabling for signs of cracks, defects, loose connections, overheating, short or open circuit and ground faults			

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

		Observe instantaneous operational indicators on the faceplate			
Inverter	Inspection	Inspect inverter housing or shelter for physical maintenance if requires.			
	Service	Clean or replace any air filters			
Optimizer	Inspection	Check the optimizer connection (MC4)			
Instrument s	Validation	Verify monitoring instruments (Pyranometer etc) with standard instruments to ensure that they are operational within tolerance limits			
Transform er	Inspection	Inspect transformer, temperature gauges , breaker, meter , connections			
Plant	Monitoring	Daily operation & performance monitoring			
	Data logger and weather monitoring	Check wiring and other equipments			
Spare Parts	Management	Manage inventory of spare parts			
Log Book	Documentatio n	Document all O&M activities in the log book available to all service personnel.			

- Provide details of any replacement of systems/components, damages, plant/inverter shut down (planned/forced), breakdown, etc under remarks.
- **Daily register is to be maintained by the bidder at each location.** The same may be inspected by BHEL/ONGC or its authorised representative at any time 5 years of O&M period. The Register will have the information about the daily generation, Inverter downtime if any, grid outages.




	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

(Part B)

Sl.No.	Date	Generation kWh	Grid outage (hh:mm)	Inverter down period (hh:mm)	Remarks
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					

Total generation for the month in kWh:

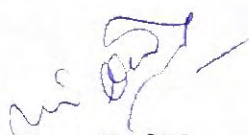
Cumulative generation since commissioning in kWh:

CUF for month in %:

Cumulative CUF since start of O&M in %:


Date:

Signature of the Authorized
signatory of the Bidder



अतिरिक्त

Signature and seal of Bidder

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

General Note for Bidder:

Following work also in scope of bidders: -

1. INTREGATION OF POWER, PROTECTION & CONTROL: -

Plant shall be equipped with adequate level of protection to ensure all safety aspect & smooth operation. **DCDB/Junction Box (if required) shall be provided by BHEL.** Contractor shall mount them on the structure. Commissioning & testing shall be contractor's scope.

On AC side, ACDB shall be equipped with required level of protection for overload and short circuit protection including SPD, MCCB etc. Disconnecting switches to isolate the DC and AC system for each inverter shall be maintained.

AC from inverters shall be fed into LT panel. Three LT panel (rating 2000 kW) shall be used for the integration of solar power. Solar power to be evacuated at 11 kV in to HT panel through 415 V/11 kV step up transformers.

A manual disconnect switch (manual isolators) beside automatic disconnection to grid would have to be provided at utility end to isolate the grid connection by the utility personal to carry out any maintenance. This switch shall be locked by the utility personal. Before the evacuation of power in to HT panel,

2. Testing:

Bidder shall organize all necessary tools/ measuring instruments required to operate the various electrical equipment at the time of commissioning: Digital megger 5KV with PI feature, Earth resistance tester, Phase sequence meter, Clamp meters etc., discharge rods, etc.

A. Pre-commissioning inspections / checks / tests on DC side

Bidder shall carry out following minimum pre-commissioning checks:

- Verification of firmness of SPV module interconnections (MC4)
- Verification of firmness of DC cable terminations at string inverters using torque wrench (for the specified torque values)
- Verification of firmness of RS485 cable terminations
- Verification of firmness of all earthing connections
- Cable megger/ continuity check for all DC power cables
- Measurement of open circuit voltage of individual strings
- Measurement of earth resistance at individual earth pits of solar array: (a) as disconnected from earth mat grid and also, (b) as connected to earth mat grid
- Submission of test reports to BHEL for acceptance.


B. Pre-commissioning inspections/checks/tests on AC side.

Basic checks

Tightness checks:

- Terminations of AC power cables at string inverters, data loggers, ACCB box, LTPDB panels.
- Terminations of Control/ Instrumentation/ Data/ Communication cables wherever applicable.
- Terminations of earthing at all electrical equipments/ panels.



	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
Rudrapur		Part	03/05
	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

- Terminations of earth chambers of bidder scope

C. Electrical continuity checks

Megger (1kV) checks for all 1.1kV grade cables

AC/DC supply checks at TBs of all electrical panels/ DBs.

D. Pre-commissioning electrical tests:

String inverters

- DC side open circuit voltage
- Bidder to provide technician support to service engineer of string inverters for all other pre-commissioning tests as per OEM checklist

E. Earth resistance measurements for all chambers of bidder scope

- With electrode connected to grid
- Without connecting electrode to grid

F. Performance Ratio and other Tests- Bidder has to clean PV modules timely to meet PR values as mentioned in attached NTPC scope of work.

3. Tools & Tackle and Spares

After completion of installation & commissioning of the power plant, necessary tools & tackles are to be provided free of cost by the bidder for maintenance purpose. List of tools and tackles to be supplied by the bidder for approval of specifications and make from [NAME OF THE ORGANISATION]/ owner.

Bidder shall provide following mandatory spares, consumables & various components of Solar PV plant for smooth running during O&M period. Bidder shall also replenish the consumed mandatory spares during the O&M period. The bidder shall also mention the source of supply.

- Solar DC cable of 500 M to be provided
- DC side Surge Arrestor, if applicable – 1 No

4. Safety Measure

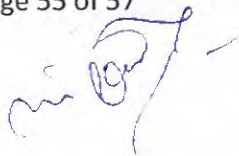
The bidder shall take entire responsibility for electrical safety of the installation(s) including connectivity with the grid and follow all the safety rules & regulations applicable as per Electricity Act, 2003 and CEA guidelines etc.


5. Assistance During SCADA installation: -

Performance of plant shall be remotely monitored by installing SCADA. SCADA system shall be supplied & commissioned by another party/agency. However, contractor will provide relevant technical support to the representative at site deputed by supplier for SCADA, at the time commissioning of SCADA.

6. TRIAL RUN & COMPLETION OF EXECUTION OF WORK: -

On completion of execution work, plant shall be under trial run for the three days. On the successful completion of trial run, final inspection shall be carried out by BHEL/third party. After final inspection, contractor shall furnish a declaration letter for the completion of execution work with all evidential proof.




	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

As the work progresses, the contractor shall continue to provide the required details and data for review by the Company's representative to assist in the expeditious inspection of the works when completed. The Company's Representative shall review promptly and revert within 14 days after receipt of such notice. If the works are found to be complete in all respect and carried out in accordance with the Contract, then the Company shall issue a Certificate of Completion and Acceptance work.

If some defects and/or deficiencies are noticed in the Works, the same shall be notified to the Contractor's in writing within 7 days after receipt of Contractor's notice. Such defects and/or deficiencies attributable to the Contractor's work and workmanship shall be rectified promptly by the Contractor at his own expenses for which no extension shall be granted. The Contractor shall thereafter repeat the procedure for giving notice as stated above. Should the Company fail to notify such defects and deficiencies to the Contractor within the said period, the Works shall be deemed to have been completed and accepted by the Company without comments.

7. TRAINING: -

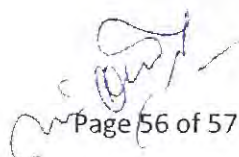
The Successful bidder shall provide necessary training at factor for mutually agreed duration and number of persons to enable the BHEL to maintain the system.

The bidder needs to submit the proposal completed in all aspects and clearly mentioning layout of the modules, actual requirement of the material in line with the price bid, work schedule/ PERT chart along with the implementation schedule etc. NALANDA UNIVERISTY may at its discretion ask for additional material or decrease the material requirements at the price quoted in the price bid.

8. **Pre- Construction:** The water, electricity and internet facilities to be maintained by the executing agency as others do at present at the site.


Post Construction: Main water source will be facilitated by the end User. The Executing agency has to ensure optimal use of the water to avoid loss. If there will be any unwanted challenged in getting electricity connection from SBPDCL in that case the User may provide the metered connection to run the site office of the executing agency. NIT Conditions Prevails.

9. **Material Quality Plan and inspection Call :** Bidder has to submit material quality plan (MQP) for items (Like AC/DC cables, LT/ACDBs panels etc.) supplied by bidder for approval by BHEL/Customer. Bidder shall raise Inspection call as per approved MQP. 7 days' prior intimation for inspection shall be provided by bidder.


Page 56 of 57




Signature and seal of Bidder

	TECHNICAL SPECIFICATION	Doc. No:-	REG2021-20210253
		Part	03/05
Rudrapur	GROUP : REG (RENEWABLE ENERGY GROUP)	Rev no	00

LIST OF ENCLOSURES:

Following enclosure makes the part of REG2021-20210253

- a) SCC
- b) GCC
- c) FQP
- d) MMS drawing
- e) Annexure 1 – Deviation sheet
- f) Annexure 2 - Make list
- g) Annexure 3 – Bill of Quantity
- h) Annexure 4 - Standard


Page 57 of 57

31/07/21

Signature and seal of Bidder