

**RATE CONTRACT**

**HARYANA RENEWABLE ENERGY DEVELOPMENT AGENCY (HAREDA)**

(NEW & RENEWABLE ENERGY DEPARTMENT, HARYANA)

Akshay Urja Bhawan, Institutional Plot No. 1, Sector-17, Panchkula

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Rate Contract No. **DRE-HAREDA/2018-19/ 1140-44**

**Dated: 22.02.2019**

To

1. M/s Ethos Power Private Limited,  
Office No. 121-123, 1st Floor, DLF Star Tower, Sector-30, NH-8,  
Gurugram-122001.  
Email: [Lokesh.kumar@ethospower.in](mailto:Lokesh.kumar@ethospower.in),  
Contact no.: 0124-4228153.
2. M/s Ojaskar Vidyut LLP,  
SCO- 3 , New Yadav Market,  
Jhajjar Chowk, Rewari, Haryana.  
E.mail: [ojaskarvidyut@gmail.com](mailto:ojaskarvidyut@gmail.com),  
Contact No.: 7056303951.
3. M/s Orbit Techsol Private Limited,  
1K-46, NIT, Faridabad, Haryana – 121004.  
E.mail: [orbittechsolindia@gmail.com](mailto:orbittechsolindia@gmail.com),  
Contact No.: 9711117394.
4. M/s Rhine Solar Limited,  
417 EPIP Phase-III, Kundli Industrial Estate,  
Sonapat, Haryana.  
E.Mail: [rajesh@rhinesolar.in](mailto:rajesh@rhinesolar.in),  
Contact No.: 0130-2371332.
5. M/s Ultimate Sun Systems Pvt Ltd.,  
309, Unitech Arcadia, South City-II, Sector-49,  
Gurgaon-122018, Haryana.  
E.Mail: [info@ultimatesunsystems.com](mailto:info@ultimatesunsystems.com),  
Contact No.: 0124-4087863.

**SUBJECT: RATE CONTRACT FOR DESIGN, SUPPLY, ERECTION, TESTING & COMMISSIONING OF GRID CONNECTED ROOFTOP SOLAR POWER PLANTS IN THE STATE OF HARYANA.**

Reference: (i) This office tender enquiry opened on 30.11.2018.

(ii) Your quotation submitted against the said tender enquiry followed by your subsequent last letter.

1. You are hereby informed that your above referred tender read with subsequent letter mentioned above for the stores specified in the schedule- A annexed has been accepted. This Rate Contract will be governed by the terms and conditions given in schedule-B. The rate contract and the schedules annexured here to shall be sole responsibility of this Rate Contract/ transaction.
2. This rate contract for design, Supply, Erection, Testing & Commissioning of Grid Connected Rooftop Solar Power Plants, including comprehensive maintenance for a period of 5 years, at various places in State of Haryana, including supply of Bi Directional Meter & CT/PT (if required) with five years warrantee of complete system along with Comprehensive Maintenance Contract (CMC), as per terms & conditions of the DNIT, shall be valid for one year from the date of its issue or up to placement of work order/s of cumulative capacity of 30 MW, whichever the earlier.
3. The other terms and conditions and specifications not mentioned in the schedule- B & C, shall be as per DNIT.
4. Please acknowledge receipt of this Rate Contract within a week's time from the date of issue by returning the second copy duly signed and stamped by authorized representative of your firm.
5. This Rate Contract contains 30 pages, including this page.

**Annexures:**

1. Schedule "A" - Description of Stores, Prices, Duties/ Taxes.
2. Schedule "B" - General Terms & Conditions of the Contract.
3. Schedule "C" -Technical Specifications Of Grid Connected Rooftop Solar Power Plants.

Encl: As above

-sd-  
(O.D.Sharma)  
Project Director,  
for Director,  
New & Renewable Energy  
Department Haryana, Panchkula.

**DESCRIPTION OF STORES, PRICES, DUTIES/ TAXES**

**Approved Rates & Firms:**

| Sr. No. of item | Description of System/Item                                | Final Rates (approved by HPPC) including installation, commissioning, Warrantee, CMC, GST / taxes/ duties etc. (Rs. Per watt) | Name of the firm whose rates have been approved | Ratio of the work to be allotted with |
|-----------------|---|---|---|---------------------------------------|
| A-1             | GCRT Solar Power Plant Without Battery Bank (1-10 kWp)    | 49.50   | M/s Rhine Solar Ltd.                            | 50%                                   |
|                 |   |   | M/s Ojaskar Vidyut LLP                          | 50%                                   |
| A-2             | GCRT Solar Power Plant Without Battery Bank (11-100 kWp)  | 41.70   | M/s Ethos Power Private Limited.                | 70%                                   |
|                 |   |   | M/s Rhine Solar Limited                         | 15%                                   |
|                 |   |   | M/s Ojaskar Vidyut LLP                          | 15%                                   |
| A-3             | GCRT Solar Power Plant Without Battery Bank (101-500 kWp) | 40.25   | M/s Ultimate Sun Systems Pvt. Ltd.              | 50%                                   |
|                 |   |   | M/s Ethos Power Private Ltd.                    | 15%                                   |
|                 |   |   | M/s Ojaskar Vidyut LLP.                         | 15%                                   |
|                 |   |   | M/s Rhine Solar Limited                         | 10%                                   |
|                 |   |   | M/s Orbit Techsol Private Limited               | 10%                                   |
| B-1             | GCRT Hybrid Solar Power Plant With Battery Bank (2 kWp)   | 99.00   | M/s Ojaskar Vidyut LLP                          | 50%                                   |
|                 |   |   | M/s Orbit Techsol Private Limited               | 50%                                   |
| B-2             | GCRT Hybrid Solar Power Plant With Battery Bank (3 kWp)   | 87.00   | M/s Ojaskar Vidyut LLP                          | 50%                                   |
|                 |   |   | M/s Orbit Techsol Private Limited               | 50%                                   |
| B-3             | GCRT Hybrid Solar Power Plant With Battery Bank (5 kWp)   | 81.75   | M/s Ojaskar Vidyut LLP                          | 50%                                   |
|                 |   |   | M/s Orbit Techsol Private Limited               | 50%                                   |
| B-4             | GCRT Hybrid Solar Power Plant With Battery Bank (7.5 kWp) | 80.00   | M/s Ojaskar Vidyut LLP                          | 50%                                   |
|                 |   |   | M/s Orbit Techsol Private Limited               | 50%                                   |

Following make of the modules, inverter/PCU & Battery Bank for respective firms have been approved with the system

| Sr. No. | Name of Firm                       | Make of Modules   | Make of Inverter/PCU  | Make of Battery Bank | State of Billing | Capacity of the firm (per Months) |
|---------|------------------------------------|---|---|----------------------|------------------|-----------------------------------|
| 1       | M/s Ethos Power Private Limited.   | a. Himalayan Solar,<br>b. Enfros,<br>c. Mundra Solar (Adani),<br>d. Exide Ind.,<br>e. Icon Solar-En Power,<br>f. Vikram Solar,<br>g. Waaree | a. Ethos Power,<br>b. ABB India Limited,<br>c. Delta Power,<br>d. Sungrow Power,<br>e. Shenzhen Senergy Technologies                      | ---                  | Haryana          | 2000 kWp                          |
| 2       | M/s Ojaskar Vidyut LLP             | a. Enfros,<br>b. IB Solar,<br>c. Satvik,<br>d. NeoSolar,<br>e. Jakson.  | a. Enertech,<br>b. Polycab,<br>c. Delta,<br>d. UTL .<br>e. Consul Neowatt,<br>f. ABB,<br>g. Statcon                                       | Ojaskar              | Haryana          | 1500 kWp                          |
| 3       | M/s Orbit Techsol Private Limited  | a. NEOSOL,<br>b. ENFROS,<br>c. MAHARISHI SOLAR,<br>d. SAATVIK GREEN<br>e. IB SOLAR  | a. Delta,<br>b. UTL,<br>c. Enertech,  | Orbit Techsol        | Haryana          | 1200 kWp                          |
| 4       | M/s Rhine Solar Ltd.               | Rhine Solar   | a. Solax<br>b. K Star<br>c. Kaco<br>d. Microlyte<br>e. Delta<br>f. ABB<br>g. Power One<br>h. Enetrtech<br>i. Statcon<br>j. Consul Neowatt | ---                  | Haryana          | 7000 kWp                          |
| 5       | M/s Ultimate Sun Systems Pvt. Ltd. | a. Adani,<br>b. Saatvik Green,<br>c. Waaree,<br>d. Navitas,<br>e. Jakson<br>f. Goldi Solar  | a. Delta,<br>b. Waaree,<br>c. ABB,<br>d. SMA  | ---                  | Haryana          | 2000 kWp                          |

The test reports of the above make of modules/ inverters/PCUs/ battery bank are to be provided by the supplier at the time of inspection of the material, the above makes of modules & inverters/PCUs/Battery Bank have been approved for supply with the GCRT solar power plants under this rate contract.

**GENERAL TERMS AND CONDITIONS OF CONTRACT**

**1. SCOPE OF WORK/DESCRIPTION OF STORES**

Annual Rate Contract for tentative aggregate capacity of 20MWp of Grid Connected Rooftop (GCRT) SPV Power Plants without battery bank or with LiFePO4 Battery Bank for design, Supply, Erection, Testing & Commissioning including comprehensive maintenance for a period of 5 years at various places in State of Haryana, including supply of Solar Generation & Bi-Directional Meters with CT/PT (if required).

**2. SECURITY DEPOSIT / PERFORMANCE SECURITY DEPOSIT:**

The successful tenderer shall have to deposit the Security Deposit (SD) equivalent to 5% (0.2% in case of eligible MSEs, 2% in case of Haryana Based other firms/enterprises) of the estimated value as per rate contract allotted to the firm within 15 days from the date of issue of the letter for depositing the security deposit. The Security deposit shall be deposited at one time instead of work order wise as per undertaking given by the bidders on 22.01.2019. The EMD of such successful bidders shall be released on submission of SD in the shape of DD or Bank guarantee valid for a period of five year & six months. After the successful completion of the work order, the SD shall be treated as Performance Security Deposit (PSD) & shall be released on successful completion of the warrantee period of five years from the date of commissioning of the project. In case of delays, the validity of the SD/PSD will be extended by the firm failing which it will be encashed.

**3. TERMS AND CONDITIONS FOR PAYMENTS**

3.1 The payments shall be made by the indenting department/organisation as per the following terms and conditions:

- a. 80% after installation of the system and signing of Provisional Joint Commissioning Report by Supplier, representative of user organization & P.O. of the concerned district.
- b. Balance 20% payment within 30 days on submission of Final Joint Commissioning Report (JCR), supported with satisfactory performance report, bill of material, photographs of complete system duly signed by the supplier, district PO and end user. However, if the supplier submits the Solar Generation meter (with CT, if required) and Bi-Directional meter (with CT/PT, if required) and there is delay on the part of DISCOMs for installation of Net Meter beyond 15 Days of submission of the meters to DISCOMs or beyond 15 days of installation of system which ever is later, then balance payment to the Supplier may be released within next 15 days on the basis of Provisional Joint Commissioning Report.

3.2 Income Tax shall be deducted at source as per rules.

**4. TIME SCHEDULE, INSPECTION, COMMISSIONING, PENALTY/ LIQUIDATED DAMAGES:**

A. The time schedule for these systems shall be as under:

| Capacity of Solar Power Plant          | Time period for completing the work which includes inspection, supply, installation and commissioning | Time period for supply of material at site | Date for the pre dispatch/at site inspection of material to be offered by the supplier # |
|--|---|--|--|
| 1                                      | 2   | 3  | 4  |
| 1kWp -10 kWp<br>(Category A-1, B1-B4)  | 120 days from the date of work order  | 110 days from the date of work order       | Atleast 15 days prior to last date of supply of the system                               |
| 11 kWp- 500 kWp<br>(Category A-2& A-3) | 120 days from the date of work order  | 105 days from the date of work order       | Atleast 15 days prior to last date of supply of the system.                              |

# Although the supplier shall give the date of inspection in the inspection offer which should reach in the office of NRE Department/HAREDA/ indenting department at least 10 days before the date of inspection proposed by the supplier. To illustrate it further, if the last date of supply is 31<sup>st</sup> March and supplier sends the inspection call on 30<sup>th</sup> March for inspection on 31<sup>st</sup> March, the inspection date shall be considered as 9<sup>th</sup> April (10 days notice) & period from 1<sup>st</sup> April to 9<sup>th</sup> April shall be under penalty clause. However, the Director, NRE/HAREDA/ indenting department may have the right to re-schedule the date of inspection. It shall be the sole responsibility of the supplier to complete the commissioning of systems in the defined time period. Time period is the essence of the contract. GCRT Solar Power plant will be taken as commissioned on the date of start of inverter and ready to synchronize, it will not depend the installation of solar generation meter/Bi-Directional meter by DISCOMs. However, submission of the solar generation meter (with CT, if required)/ bidirectional meter along with CT/PT shall be submitted to the DISCOMs for testing and installation.

- (i) The systems may be inspected at site. However, on the request of the supplier, the Director, New & Renewable Energy Department/HAREDA/ indenting department may consider to allow to inspect the material of the systems irrespective of any capacity at supplier's premises of the firm or at site before erection.
- (ii) After receipt of call for inspection with date for the inspection, the material shall be inspected by the Director, New & Renewable Energy Department/HAREDA/ indenting department or a committee authorized for this purpose. Material shall be dispatched after acceptance of the same by the Inspection Committee, if inspected at premises of the firm; the same shall be installed and commissioned after acceptance by the Inspection Committee, if inspected at site. However, the supplier may start civil work at any time even before the inspection of material.
- (iii) If the proposal for pre-dispatch inspection is received within defined & valid time period in the office of Director, New & Renewable Energy Department/HAREDA/ indenting department from the supplier and inspection is not carried out by the New & Renewable Energy Department due to any reasons within specified time of receipt of such letter, the time period for supply, installation & commissioning will be extended equivalent to delayed period, till the date of actual inspection and no penalty will be imposed for this extended period.

- (iv) It shall be the sole responsibility of the supplier to complete the commissioning of systems in the defined time period. Time period is the essence of the contract.
- (v) The New & Renewable Energy Department/HAREDA/ indenting department through its duly authorized representative(s) shall have at all reasonable times access to the contractor/ bidders premises or works and shall have the power at all reasonable time to inspect and examine the materials and workmanship of the works during its manufacture, supply, installation etc.
- (vi) The supplier has to provide the Solar Generation meter (with CT, if required) and Bi-Directional meter (with CT/PT, if required) at the time of inspection of material so that it may be submitted to the DISCOMs timely for testing and installation.
- (vii) At the time of inspection the supplier has to provide all the documents related to purchase of major components of the Project and premium receipts related to insurance (if applicable) of components of Projects.
- (viii) The contractor/ bidder are required to get the entire lot of the ordered material inspected at one time, before the supply of the materials. In case the contractor/ bidder fails to get the entire lot inspected at one time, the total expenses of the further inspection will be borne by the supplier/contractor/ bidder.
- (ix) New & Renewable Energy Department/HAREDA/ indenting department will bear the inspector's cost at only one manufacturing plant. If a component is produced in more than one location, then the cost of positioning the inspection in the second and subsequent plants would be borne by the successful Bidder at their cost.
- (x) The inspection by New & Renewable Energy Department/HAREDA/ indenting department and issue of dispatch instruction thereof shall in no way limit the liabilities and responsibilities of the contractor/ bidder in respect of the agreed quality assurance forming a part of the contract.
- (xi) In case the material offered for inspection fails to meet the specifications stipulated in DNIT /Order /Contract and the material is rejected by the Inspecting Committee or complete material is not available for inspection, New & Renewable Energy Department/HAREDA/ indenting department will levy a penalty at 0.1% of the order value. In case the material offered for inspection fails during the 2nd inspection also, the Indenting Department will have the right to increase the penalty to 0.25% of the order value. In case, the material offered fails during the 3rd and final inspection also, the firm will be liable for penal action including forfeiture of EMD/PSD, risk purchase, debarring/blacklisting in future, and no further opportunity for inspection will be provided to the supplier firm.
- (xii) The inspection report should be submitted to New & Renewable Energy Department/HAREDA/ indenting department within seven days from the date of inspection either by hand or by e-mail/fax. Similarly, the commissioning report should be submitted to the concerned district office and an advance copy to New & Renewable Energy Department/HAREDA/ indenting department within seven days from the date of commissioning either by hand and by e-mail/fax. The district office after verification will issue the JCR or shall report any discrepancy to the supplier with a copy to New & Renewable Energy Department/HAREDA within seven days. In case of discrepancy in the

system commissioned, the commissioning date shall be counted from the date when the discrepancy has been removed to the entire satisfaction of District Office & User/HAREDA.

- (xiii) The installation work shall be carried out under the close supervision of the Project Officer/Asstt. Project Officer of the district & the user. The final inspection after installation/commissioning shall be carried out by district office and user. The supplier should plan his activities in such a way that the entire process for supply, installation and commissioning after inspection of the systems is completed within the allowed time. Therefore, it is necessary & in the interest of the supplier to get inspected the material well in advance before the stipulated delivery time in case of bigger systems which require considerable time in their installation & commissioning so as to avoid delay penalty. The supplier shall provide without any extra charge, all materials, tools, testing equipments, labour and assistance of very kind which the inspecting officer may consider necessary for any test or examination. New & Renewable Energy Department/HAREDA can also get the functionality of the system tested from any MNRE approved test centre/laboratory and the expenses shall be borne by the supplier. Rejected material (if any) will have to be replaced by the supplier at its costs within 15 days of issue of such notice.
- (xiv) Before the goods and equipment are taken over by the user, the supplier shall supply operation and maintenance manuals. These shall be in such details as will enable the user to operate, maintain, adjust and repair all parts of the works as stated in the specifications. The manuals shall be in the ruling language (English or Hindi). Unless and otherwise agreed, the goods and equipment shall not be considered to be completed for the purposes of taking over until such manuals have been supplied to the purchaser/user.
- (xv) If the goods/services or any section fails to pass the Tests, the supplier may require such tests to be repeated on the same terms and conditions. All costs to which the purchaser may be put to by the repetition of the tests under this sub-clause shall be deducted from the contract price.
- (xvi) The purchaser has the right to pick up sample for random testing of any of the component of the system or complete system at any of the stage offer for pre-dispatch inspection, erecting of material, post commissioning for any kind of laboratory testing. The expenditure on the tests will be borne by the supplier. However, one each work order of more than Rs. 100.00 lakh, during pre-dispatch, one sample of the major component/ s will be randomly selected by the inspection team for laboratory testing.

B. Further in addition to the above following are the conditions for execution of the project:

- a. Before placing the work order it will have to ensure that site is clear and feasible in all respect for installation of system/ plant. However, it will be the sole responsibility of the supplier to be satisfied with the site through visit under intimation to PO/APO of the district within 30 days of placing of work order. Request, if any, received from the supplier for any extension on ground of issue of site clearance after above said period will out rightly be rejected.



- b. The time for and date of delivery (includes supply, installation & commissioning) stipulated in the work order shall be deemed to be the essence of the contract and should the contractor fail to complete the work (includes supply, installation & commissioning) within the period prescribed for such delivery penalty @ **2% of the work value per month** subject to max. of 10% of the work order value recoverable. Once the maximum is reached, the New & Renewable Energy Department/indenting department may consider termination of the work order. For the purpose of calculation of penalty, month will be considered of 30 days and the week of 7 days. In case of non-payment by the contractor, recovery will be made from his bills or amount of Earnest money or security deposited with Director, New & Renewable Energy Department or through legal process, provide also that :
- i. No recovery of penalty will be made if the Director, New & Renewable Energy Department/HAREDA/ indenting department accepts the delayed supplies by extending the delivery period by recording in writing that the exceptional circumstances were beyond the control of the supplier and there was no loss to the Government on written request by the supplier, with proper documentation establishing the reasons for delay were beyond the control of the supplier, before the expiry of the allowed time. Requests for extension received after the expiry of the allowed timeline shall not be entertained and shall be subject to penalty.
  - ii. The supplies, if any, made beyond the time limit for completion of the project defined in the work order will require prior approval of the Director, New & Renewable Energy Department /HAREDA/ indenting department even the same are with penalty means supplier has no right to deliver the material with applicable penalty clause without the written concurrence of the Director, HAREDA/ indenting department.
  - iii. On the failure of the supplier/s to make supply within the extended period or otherwise and the receipt of such information in the office of the Director, New & Renewable Energy Department/HAREDA/ indenting department, risk purchase at the cost of the supplier will be made by the Director, New & Renewable Energy Department/HAREDA after the maximum penalty is reached by obtaining consent from the L2, L3 bidders or approved supplier/s or approved RC holder of DGS&D, GOI or any State empanelled supplier or by inviting short terms quotations from the Registered and other known suppliers within next two months. The difference of excess cost thus, incurred will be recovered from the supplier from his pending bills, earnest money or security whichever is available. This procedure will be adopted after serving a registered notice to the supplier to supply stores within 15 days.
- c. The Contractor shall not;
- (i) Without the consent in writing of New & Renewable Energy Department/HAREDA transfer, assign or sublet the work under this contract or any substantial part thereof to any other party. New & Renewable Energy Department/HAREDA shall have at all reasonable time access to the works being carried out by the contractor under this contract. All the work shall be carried out by the contractor to the satisfaction of New & Renewable Energy Department/HAREDA.
  - (ii) Disclose details of the conditions governing this contract to unauthorized persons (Indenting against this contract is permissible only for the bonafide use of

Governments departments and quasi public and not for private parties or for the private use of the Government officers).

- d. In the event of the contractor failing duly and properly to fulfil or committing breach of any of the terms and conditions of the tender or repeatedly supplying goods liable to rejection hereunder or failing, declining, neglecting/ or delaying to comply with any demand or requisition or otherwise not executing the same in accordance with the terms of this tender, or if the bidder or his agents or servants being guilty of fraud in respect of the contract or any other contract entered into by the contractor or any of his partners or representatives thereof with Government directing, giving, promising or offering any bribes, gratuity, gift, loan, perquisite, reward or advantage pecuniary or otherwise to any person in the employment of Government in any way relating to such officers or person of persons, office or employment or if the contractor or any of his partners become insolvent or apply for relief as insolvent debtor or commence any insolvency proceedings or make any composition with his/ their creditors or attempts to do so then without prejudice to Government rights and remedies otherwise, New & Renewable Energy Department/HAREDA/Government shall be entitled to terminate this contract forthwith and to **blacklist the contractor** for a period as deemed fit by the competent authority and purchase or procure or arrange from Government's stocks or otherwise at the contractor's risk and at the absolute discretion of the Director, New & Renewable Energy Department/HAREDA as regards the manner, place or time of such purchases, such supplies as have not been supplied or have been rejected under this agreement or are required subsequently by Government there under and in cases where issues in replacement are made from Government's stocks or supplies, the cost of value of stocks or supplies together with all incidental charges or expenses, shall be recoverable from the contractor on demand and the contractor shall not be entitled to benefit from any profit which may accrue to Government.

## 5. PRICE FALL CLAUSE

- (i) The prices charged for the stores supplied under the Contract by the Contractor shall in no event exceed the lowest price at which the Contractor sells the Stores or offer to sell stores of identical description to any Department of the Central Government or any Department of a State Government or any statutory undertaking of the Central or a State Government, as the case may be, during the period till all Orders placed during the currency of Contract is completed.
- (ii) If at any time during the said period, the Contractor reduces the Sale price, sells or offers to sell such stores, with same specification, irrespective of quantity to any organization(s) including the Purchaser or any Statutory Undertaking of the Central or a State Government, as the case may be, at a price lower than the price chargeable under this Contract, he shall forthwith notify such reduction or Sale or offer of Sale to the Director, New & Renewable Energy Department, Haryana/HAREDA and the price payable under the Contract for the stores supplied after the date of coming into force of such reduction or sale or offer of sale stand correspondingly reduced. The above stipulation will, however, not apply to:
- (a) Export/deemed Export by the Contractor
  - (b) Sale/ normal replacement.

- (iii) The Contractor shall furnish the following certificate to the Paying Authority along with each bill for payment for supplies made against the Contract.

“I/We certify that there has been no reduction in sale price of the Stores of Description identical to the Stores supplied to the Government under the contract herein and such Stores have not been offered/sold by me/us to any organization(s) including the purchaser or any Department of Central Government or any Department of a State Government or any statutory Undertaking of the Central or State Government as the case may be up to the date of the bill of supplies against all orders placed during the currency of the Contract at a price lower than the price charged to the Government under the Contract except for quantity of Stores as mentioned at para (ii) above.

NOTE: The Contractor will also inform the Paying Authority and the Director, New & Renewable Energy Department, Haryana/HAREDA as soon as the supplies against all the Supply Orders placed against the Rate Contract are completed.

## 6. WARRANTY

- (i) The Warranty period shall be five (5) years for complete system from the date of commissioning and handing over of the system (or as per latest MNRE, GoI guidelines). The contractor shall rectify defects developed in the system within Warranty period promptly. **The procedure to rectify the complaint/service to be provided during warrantee period** is as follows :

During the warrantee period, the firm shall ensure proper functioning of the systems and complaint, if any, forwarded to the supplier against the system, will have to be attended within 72 hours of forwarding such complaints. If any part is to be procured then the user is to be informed and the systems shall be rectified within 7 days. The procedure to rectify the complaints shall be as under:

- a) The notice through E-mail/hard copy to rectify the complaints shall be issued by the HQ/district officer/User to the supplier with copy to the New & Renewable Energy Department/HAREDA. This shall be followed by two reminders on 3 days intervals each. The district office shall maintain proper record of the complaints.

Even after this, the complaints remain unattended the penalty @ Rs.100 per day per system will be imposed from the expiry of 13 days & same will be deducted from the payment due to the supplier / out of the Performance Security Deposit/ bank Guarantee. The firm if failed to repair/ replace the defective system within next 10 days after expiry of the earlier specified 13 days of forwarding of the complaint then concerned ADC-cum-CPO shall forward the case to the Director, HAREDA along with estimated expenditure for the replacement/ repair. Director, HAREDA may consider repairing / replacing such defective system on the cost of the supplier. This repair/ replacement will be got from the payment due to the supplier and if required, it will be got by revoking the PSD. If the value of the penalty amount or cost incurred on rectification of the system or the cumulative amount of penalty & expenditure cost of rectification, which ever the earlier, across 25% of the value of the PSD of the respective work order value, the firm shall deemed to be considered as unfit to participate in all the tenders floated by New & Renewable Energy Department/HAREDA in future for a period of one year, effective from the date of

communication to be conveyed by New & Renewable Energy Department/HAREDA in written and shall be treated as unsatisfactory performer.

- b) If the whole PSD/ bank guarantee is utilized and the complaints are still pending then an e-mail/registered notice will be sent to the firm to attend the complaint within 15 days.
- c) If the firm still does not attend the complaint within the above mentioned period then the firm may be blacklisted and a legal proceeding may be initiated against the firm for Breach the agreement.
- d) The supplier shall affirm as per standards for quality that any thing to be furnished shall be new, free from all defects and faults in material, workmanship and manufacture, shall be of the highest grade and consistent with established and generally accepted standards for material of the type ordered, shall be in full conformity with the specifications, drawing or samples, if any and shall if operable, operate properly.
- e) Performance of Equipment: In addition to the warranty as already provided, the supplier shall guarantee satisfactory performance of the equipment and shall be responsible for the period or upto the date specified in sub-clause (iii) here of after the equipment has been accepted by the New & Renewable Energy Department/HAREDA to the extent for any defects that may develop such defect shall be removed at his own cost when called upon to do so by the New & Renewable Energy Department/HAREDA.
- f) New & Renewable Energy Department/HAREDA/the consignee will have the liberty to get the sample for the item(s) supplied tested from any of the Govt. approved lab. at any time during the installation or warranty period to ascertain the performance of the item(s) as per DNIT specifications. If during the lab test, sample fails then supplier has to repair/ replace the defective systems within 15 days of issue of such notice. If on the request of the supplier more than one samples are drawn for lab test and any one of them fail the lab test, bidder has to replace all the defective system at his own cost.
- g) The Contractor in consultation with concerned Project Officer will conduct training programme for users, focusing on main features, operation and maintenance of the systems. After successful supply/commissioning of the system and training, the system will be handed over to the person designated by the end user.
- h) The Contractor/ supplier shall continue to provide spare parts for at least two years after the expiry of warranty period at the users cost. If the contractor fails to continue to supply spare parts and services to users then New & Renewable Energy Department/HAREDA shall take appropriate action against the firm which can be to ban the supplier for participating in future tenders of the New & Renewable Energy Department/HAREDA.

## **7. FORCE MAJEURE:**

- (i) Notwithstanding the provisions of clauses contained in this deed; the contractor shall not be liable for forfeiture of its performance security, liquidated damages, termination for default, if he is unable to fulfill his obligation under this deed due to event of force majeure circumstances.

- (ii) For purpose of this clause, "Force majeure" means an event beyond the control of the contractor and not involving the contractor's fault or negligence and not foreseeable. Such events may include, but are not restricted to, acts of Govt. either in its sovereign or contractual capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and fright embargoes.
- (iii) Obstruction in procurement of components /raw material by the firm from the manufacturers with whom they have tied up for execution of the projects under this tender shall not be covered under force majeure condition. The bidders are advised to make suitable arrangements for timely supply of parts and components for implementation of the tendered projects within allowed timeframe.
- (iv) However, if a force majeure situation arises, the contractor shall immediately notify the "HAREDA" in writing. The decision of the Director General, HAREDA in above conditions shall be final.

## **8. ARBITRATION:**

If any question, dispute or difference what so ever shall arises between New & Renewable Energy Department/HAREDA and the contractor, in the connection with this agreement except as to matters, the decisions for which have been specifically provided, either party may forth with give to the other notice in writing of existence of such question, dispute or difference and the same shall be referred to the sole arbitration of the Principal Secretary, to Govt. Haryana, New & Renewable Energy Department or a person nominated by him/her. This reference shall be governed by the Indian Arbitration Act and the rules made thereunder. The award in such arbitration shall be final and binding on both the parties. Work under the agreement shall be continuing during the arbitration proceedings unless the New & Renewable Energy Department/HAREDA or the arbitrator directs otherwise.

## **9. JURISDICTION FOR SETTLING DISPUTES**

Where a contractor has not agreed to Sole Arbitration Clause of the Conditions of the Rate Contract, Governing contracts the dispute/claims arising out of the contract entered into with him will be subject to the jurisdiction of Civil Court Panchkula.

## **10. OTHER TERMS AND CONDITIONS:**

- 10.1 The price quoted should be FOR anywhere in the State of Haryana inclusive of all taxes and duties, custom duty, excise duty, service tax, sales tax, C.S.T., local taxes, GST, Income Tax, Surcharge on income tax etc. if any, including 5 years warranty (or as notified in the bid) of the complete system/ plant. A supplier/ contractor shall be entirely responsible for all taxes, duties, license fees, etc. All taxes payable as per Government income tax & service tax norms will be payable by the contractor. If any new tax/duty is levied during the contract period the same will be borne by the firm exclusively. TDS will be deducted from the payment of the contractor as per the prevalent laws and rules of Government of India and Government of Haryana state in this regard.

- 10.2 Material shall be strictly as per DNIT specifications. If there is any left out specification, the same shall be considered as per the latest specifications applicable as per MNRE/ BIS/International Standards.
- 10.3 In case of any ambiguity in interpretation of any of the clauses/ provision of the said rate contract/DNIT, the decision of the Director, HAREDA shall be final and binding.
- 10.4 It shall be the sole responsibility of the contractor to get verified the quality & quantity of the supplied material at the site of delivery.
- 10.5 The Contractor shall indemnify the HAREDA against all third party claims of Infringement of patent, royalty's trademark or industrial design rights arising from use to the goods or any part thereof.
- 10.6 All demurrage, wharfage and other expenses incurred due to delayed clearance of the material or any other reason shall be to the account of the contractor.
- 10.7 HAREDA may at any time terminate the contract by giving written notice to the contractor without compensation to the contractor, if it becomes bankrupt or otherwise insolvent, provided that such termination will not prejudice or affect any right of action or remedy, which has accrued or will accrue thereafter to the HAREDA.
- 10.8 HAREDA, may by written notice sent to the supplier, terminate the contract, in whole or in part at any time for its convenience.
- 10.9 Any material /instrument required to complete /successful running of the project which is not mentioned in the DNIT will be provided by the bidder in the quoted rates only and no additional payment shall be made.
- 10.10 The firm shall put up a MS iron display board (at least of the size 3'x2'), whereas asked by the HAREDA, duly painted at site indicating salient features like year of installation, capacity of system, cost, technology, important technical parameters etc. along with the names of MNRE, GoI and HAREDA as the sponsoring agency after approval of the same from HAREDA.
- 10.11 EMD/PSD is liable to be forfeited in case of evidence of cartel formation by the bidder(s). Further, in case where cartel formation amongst the manufacturers-suppliers is apparent, complaint shall be filed with the Competition Commission of India and/or other appropriate forum.
- 10.12 Supplier shall issue the bill of the material at the time of supply of the material at site as per prevailing rules.

## **11. OPERATION AND MAINTENANCE MANUAL:**

The supplier shall provide the guidelines containing DO's & DO NOT's in Hindi and English for Operation and Maintenance of the complete system to the user for proper maintenance of the system.

Note:

**Placing of any work order under this rate contract will require prior approval/ sanction of the Director, HAREDA. The contractors may not accept any work order, referring to this rate contract, without the prior approval/ sanction of the Director, HAREDA.**

**DETAILED TECHNICAL SPECIFICATIONS**

(Grid Connected Solar Rooftop Photo Voltaic (SPV) power plant-with/without battery bank)

**The projects shall be installed and commissioned as per the technical specifications given below.**

**1. DEFINITION**

A Grid Connected Solar Rooftop Photo Voltaic (SPV) power plant consists of SPV array, Module Mounting Structure, Inverter/Power Conditioning Unit (PCU) consisting of Maximum Power Point Tracker (MPPT), and Controls & Protections, interconnect cables and switches. PV Array is mounted on a suitable structure. Grid connected SPV power plant may be with or 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, inverters/PCUs, battery 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 equipments/components.
- Solar PV modules consisting of required number of Crystalline PV cells.
- Grid interactive Inverter with Remote Monitoring System
- LiFePO4 Battery bank (for Hybrid System)
- Mounting structures
- Junction Boxes.
- Earthing and lightening protections.
- IR/UV protected PVC Cables, pipes and accessories

**2. SOLAR PHOTOVOLTAIC MODULES:**

- (i) The PV modules shall be of indigenous make.
- (ii) The efficiency of the PV modules should be minimum 16% and fill factor should be more than 70%.
- (iii) Modules of mono/poly crystalline type can be used.
- (iv) The PV modules used must qualify to the latest edition of IEC PV module qualification test or equivalent BIS standards Crystalline Silicon Solar Cell Modules. In addition, the modules must conform to IEC 61730 Part-1 - requirements for construction & Part 2 – requirements for testing, for safety qualification or equivalent IS. a) For the PV modules to be used in a highly corrosive atmosphere throughout their lifetime, they must qualify to IEC 61701. Certificate for module qualification from IEC or equivalent to be submitted as part of the bid offer. Self undertaking from manufacturer / supplier that the modules being supplied are as per above. The Potential Induced Degradation (PID) test for solar modules will be mandatory. It should be valid during the operational period.
- (v) Module shall consists of Solar Cell of minimum 4 Bus Bar technology. At the time of supply the supplier shall submit the certificate from the manufacturer of the module certifying that he has supplied the modules to ..... (name of supplier) strictly manufactured as per BOM of IEC certificate mentioning the technology of the solar cell (as per Performa- VI).
- (vi) The modules of the manufacturers who are having OEM and co-certification will not

- be considered as qualified modules.
- (vii) The total solar PV array capacity should not be less than allocated capacity (kWp) and should comprise of solar crystalline modules of minimum 300 Wp (with 72 cells) and above wattage for the project above 5 kWp and of minimum 250 Wp (with 60 cells) and above wattage for the project upto 5kWp. Module capacity less than minimum of these wattage shall not be accepted.
  - (viii) Protective devices against surges at the DC side shall be provided. Low voltage drop bypass diodes shall be provided.
  - (ix) PV modules must be tested and approved by one of the IEC authorized test centres and shall meet the latest higher side specifications prescribed by MNRE/HAREDA.
  - (x) The module frame shall be made of corrosion resistant materials, preferably having anodized aluminum.
  - (xi) The bidder shall carefully design & accommodate requisite numbers of the modules to achieve the rated power in his bid.
  - (xii) Other general requirement for the PV modules and subsystems shall be the Following:
    - a) The rated output power of any supplied module shall have tolerance of plus 3% or above.
    - b) The peak-power point voltage and the peak-power point current of any supplied module and/or any module string (series connected modules) shall not vary by more than 2 (two) per cent from the respective arithmetic means for all modules and/or for all module strings, as the case may be.
    - c) The module shall be provided with a junction box with weather proof lid of sealed type and IP-65 rated.
    - d) I-V curves at STC shall be provided with the module.
  - (xiii) The module should have the following minimum information laminated inside the module.
    - Made in India (to be subscribed in words )
    - Company name /logo
    - Model number (it should indicate the voltage and rated wattage of the module )
    - Serial number
    - Year of make

### **3. Warranties:**

- a) Material Warranty:
  - (i) Material Warranty is defined as: The manufacturer should warrant the Solar Module(s) to be free from the defects and/or failures specified below for a period not less than twenty five (25) years from the date of commissioning of the system
  - (ii) Defects and/or failures due to manufacturing
  - (iii) Defects and/or failures due to quality of materials
  - (iv) Non conformity to specifications due to faulty manufacturing and/or inspection processes. If the solar Module(s) fails to conform to this warranty, the manufacturer will repair or replace the solar module(s), at the Owners sole option.



**b) Performance Warranty:**

- (i) The predicted electrical degradation of power generated not exceeding 20% of the minimum rated power over the 25 year period and not more than 10% after ten years period of the full rated original output.

**4. ARRAY STRUCTURE (MODULE MOUNTING STRUCTURE):**

**Module mounting structure (MMS)** should be of anodised aluminium or Hot Dipped Galvanised Iron (HDGI), of prescribed Specifications given below, for mounting of SPV modules at site. The panel frame structure should be capable of withstanding a minimum wind speed load of 150 KM per hour, after grouting and installation. MMS should be sturdy & designed to assist SPV Modules to render maximum output. The hardware (fasteners) used for installation of SPV Modules & MMS should be of suitable Stainless Steel (SS 304). Each MMS should be with minimum four legs grouted on pedestals of minimum 300X300X250 mm with anchoring/ chipping & chemical sealing of foundation based on RCC roof. Foundation bolts of stainless /GI steel should be at least 300 mm long.

Its size should be with reference to the specifications of the selected make SPV modules. Anti Theft Nut Bolts of SS (with washers) should be used for mounting modules for better theft proofing.

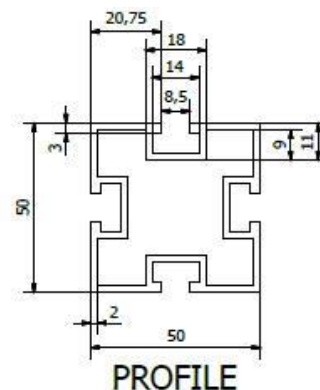
**4.1 Aluminium structure should meet the following minimum specifications:**

**A. Structure Assembly Main Components:**

1. Purlin
2. Leg & Base Plate
3. Rafter (with cleat)

**B. Component Details:**

**1. Purlin/Rafter (Design is indicative)**



- Cross section Length: 50mm, Cross section Width: 50mm, Thickness: 02mm
- Component Length – As per PV modules table designed
- Tolerance:  $\pm 5\%$

**Cleat:**

- Cross sectional length – 135mm, Cross sectional width – 50mm, Thickness – 5mm
- Tolerance:  $\pm 5\%$

**2. Leg & Base Plate**

**(a) Base Plate:**

- Cross sectional Length: 75mm, Cross sectional Height: 75mm, Thickness: 5mm
- Component Length: 150mm with two holes on base area for fixing of J Bolts
- Tolerance:  $\pm 5\%$

(b) Leg attached to base plate

- Cross sectional length – 50mm, Cross sectional width – 50mm, Thickness – 5mm
- Component Length – 3808mm ((or as per site requirement of tilt angle and may vary with the required height of structure) with two holes on bottom area for fixing with base plate and one hole on top are for fixing of Rafter
- Tolerance:  $\pm 5\%$

**4.2 Hot Dipped Galvanised Iron (HDGI) structure should meet the following minimum specifications:**

|               |                        |
|---------------|------------------------|
| Rafter        | : 60mmX60mmX3.2mm      |
| Purlin        | : 90mmX45mmX15mmX2.6mm |
| Vertical Post | : 60mmX60mmX3.2mm      |
| Base Plate    | : 200mmX200mmX8mm      |
| Top Plate     | : 176mmX176mmX8mm      |

**4.3 Foundation:**

The CC foundation shall have to be designed on the basis of the weight of the structure with module and minimum wind speed of the site, i.e. 150 Km/hour. Normally, each MMS should be with minimum four legs grouted on pedestals of proper size. However, for sheds CC work will not be required. The structure shall be grouted with fasteners with chemical sealing to withstand the required wind velocity. Angle of inclination shall be between  $15^{\circ}$  to  $30^{\circ}$ , however, maybe changed as per site requirement.

CC Pillar size shall be: 300X300

For Pillars: Cement: Concrete: Sand Ratio :: 1:2:3

Screws shall be Grouted in the Slab of roof up to depth of 50 mm.

Lengths of rafter/Purlin may be changed as per site requirement.

Sufficient numbers of vertical post shall be provided so that the structure may not bent.

**5. Specifications For Inverter/Power Conditioning Unit (PCU):**

As SPV array produce direct current electricity, it is necessary to convert this direct current into alternating current and adjust the voltage levels to match the grid voltage. Conversion shall be achieved using an electronic Inverter and the associated control and protection devices. All these components of the system are termed the “Inverter”. In addition, the inverter shall also house MPPT (Maximum Power Point Tracker), an interface between Solar PV array & the Inverter, to the power conditioning unit/inverter should also be DG set interactive, if necessary. Inverter output should be compatible with the grid frequency. Typical technical features of the inverter shall be as follows:

| Specifications of Inverter |  |
|----------------------------|--|
| Parameters                 | Detailed Specifications  |
| Switching devices          | IGBT   |
| Capacity                   | The Rated Capacity of the Inverter shall not be less than the solar PV array capacity. |
| Control                    | Microprocessor /DSP  |
| Nominal Voltage            | 230V/415V as the case may be   |

|  |  |
|--|--|
| Voltage range                          | Single Phase: Shall work from 180 Volts to 270 Volts;<br>Three Phase: Shall work from 180 Volts to 270 Volts per phase   |
| Operating frequency/ range             | 50 Hz(47to52 Hz)   |
| Grid Frequency Synchronization range   | ± 3 Hz or more (shall also compatible for Synchronization with DG Set)   |
| Waveform                               | Sine Wave  |
| Harmonics                              | AC side total harmonic current distortion <5%  |
| Ripple                                 | DC voltage ripple content shall not be more than 1%.   |
| Efficiency                             | <ol style="list-style-type: none"> <li>1. The inverters should be tested as per IEC standards/ as per latest MNRE Specification. The following criteria should be followed :</li> <li>2. The benchmarking efficiency criteria for the Grid tied ( central/string) inverter <ul style="list-style-type: none"> <li>• At nominal voltage and full load is &gt;95%</li> <li>• For load &gt;25% is &gt;92%.</li> </ul> </li> <li>3. The benchmarking efficiency criteria for Grid Tied PCU of capacity &lt; 5KW: &gt;85%and for capacity ≥ 5KW: ≥90%</li> <li>4. No load losses should not be more than 5%.</li> </ol> |
| Losses                                 | Maximumlossesinsleepmode:2Wper5kW<br>Maximumlossesinstand-bymode:10W   |
| Casing protection levels               | Degree of protection: Minimum IP-21 and 22for indoor useandIP65 certification for out door use   |
| Temperature                            | Shouldwithstandfrom-10to+50 deg Celsius  |
| Humidity                               | Shouldwithstandupto95%(relative humidity)  |
| Operation                              | Completely automatic including wake up, synchronization  |
| MPPT                                   | Maximum power point tracker shall be integrated in the inverter to maximize energy drawn from the array. MPPT range must be suitable to individual array voltages in power packs   |
| Protections                            | Mains Under / Over Voltage   |
|  | Over current   |
|  | Over/Under grid frequency  |
|  | Over temperature   |
|  | Short circuit  |
|  | Lightening   |
|  | Surge voltage induced at output due to external source   |
|  | Anti Islanding (for grid synch. mode)  |
| Battery Under Voltage and Over Voltage |  |
| System Monitoring Parameters           | Inverter/PCU voltage & current<br>Mains Voltage, Current & Frequency   |
| Recommended LCD Display on Front Panel | Accurate displays on the front panel:  |
|  | DC input voltage   |
|  | DC current   |
|  | AC Voltage ( all 3 phases, in case of 3 phase)<br>AC current ( all 3 phases in case of 3 phase)  |

|                         |  |
|-------------------------|--|
|                         | Ambient temperature  |
|                         | Instantaneous & cumulative output power  |
|                         | Daily DC energy produced   |
|                         | Battery Voltage (in case of Hybrid PCU)  |
| Communication interface | RS 485 / RS 232<br>PCU shall also house MPPT (Maximum Power Point Tracker), an interface between Solar PV array to the power conditioning unit/inverter should also be DG set interactive.   |
| Power Factor            | > 0.9  |
| THD                     | <3%  |
| Test Certificates       | The inverter should be tested from the MNRE approved test centres / NABL /BIS /IEC accredited/authorised testing- calibration laboratories. In case of imported power conditioning units, these should be approved by international test houses. |

- a) Three phase inverter shall be used with each power plant system (10kW and/or above) but in case of less than 10 kWp single phase inverter can be used as per site requirement. The inverter of single phase shall be installed if grid supply is of single phase and that of three phase shall be installed if grid supply is of three phase.
- b) Inverter/PCU shall be capable of complete automatic operation including wake-up, synchronization & shutdown.
- c) The output of power factor of inverter/PCU is suitable for all voltage ranges or sink of reactive power, inverter should have internal protection arrangement against any sustainable fault in feeder line and against the lightning on feeder.
- d) Built-in meter and data logger to monitor plant performance through external computer shall be provided (Providing Computer is not part of DNIT & is in the scope of user).
- e) **Anti-islanding (Protection against Islanding of grid):** The inverter/PCU shall have anti islanding protection in conformity to IEEE 1547/UL 1741/ IEC 62116/IS16169 or equivalent BIS standard.
- f) Successful Bidders/Supplier shall be responsible for galvanic isolation of solar roof top power plant (>100kWp) with electrical grid or LT panel.
- g) In Inverter/PCU, there shall be a direct current isolation provided at the output by means of a suitable isolating transformer. If Isolation Transformer is not incorporated with Inverter, there shall be a separate Isolation Transformer of suitable rating provided at the output side of inverter units for capacity more than 100 kW.
- h) The inverter generated harmonics, flicker, DC injection limits, Voltage Range, Frequency Range and Anti-Islanding measures at the point of connection to the utility services should follow the latest CEA (Technical Standards for Connectivity Distribution Generation Resources) Guidelines.
- i) The inverter should comply with applicable IEC/ equivalent BIS standard for

efficiency measurements and environmental tests as per standard codes IS/IEC 61683 and IEC 60068-2 (1,2,14,30)/ Equivalent BIS Std./EN50530,IEC 61727 (all clauses except clause 5.2.2). in case of clause 5.2.2, it should withstand the over/under frequency in the range 47 to 52 Hz.

- j) The MPPT units environmental testing should qualify IEC 60068-2 (1, 2, 14, 30)/ Equivalent BIS std. The junction boxes/ enclosures should be IP 65 (for outdoor)/ IP 54 (indoor) and as per IEC 529 specifications.

**6. BATTERY**

The battery should be Lithium Ferro Phosphate (LiFePO4) having given capacity. The other feature of battery should be:-

| S.No. | Description  | Specification            |
|-------|--|--------------------------|
| 1.    | Battery Type   | LiFePO4                  |
| 2.    | Working temperature range ( both for charging & discharging) | 20-60 Deg. C             |
| 3.    | Minimum capacity of individual Cells                         | 3.2V 40Ah                |
| 4.    | Type of Cell   | Prismatic or Cylindrical |

The Cell and Battery should be got tested as per IEC 62133-2012 or BIS specifications with MNRE/ NABL/IEC accredited test centre/ laboratory as per IEC/ BIS standard IEC 62133, IEC 61960 & UL1642: Safety of LiFePo4 battery

The Lithium Ferro Phosphate battery needs a very good “Battery Management System (BMS)” to ensure the proper charging and discharging of each cell of battery with proper protection of battery when temperature is reaching beyond battery permissible limits.

**7. INTEGRATION OF PV POWER WITH GRID:**

- (i) The output power from SPV would be fed to the inverters/PCU which converts DC produced by SPV array to AC and feeds it into the main electricity grid after synchronization. In case of grid failure, or low or high voltage, solar PV system shall be out of synchronization and shall be disconnected from the grid. 4 pole isolation of inverter output with respect to the grid connection need to be provided. Solar Generation Meter(s) and bidirectional energy meter, as per HERC Net Metering Regulations should also be installed in the campus/building of beneficiary.
- (ii) The solar generation meter and Bi-directional meter along with CT/PT (if required) with Surge Protection Device (SPD) should be of 0.2S accuracy class is in the scope of bidder. For LT connection the accuracy shall be as per requirement of DISCOMs.
- (iii) CEA guideline 2013 for interconnecting solar power with Grid shall be followed.
- (iv) Certification of Islanding protection in the inverter from the manufacturer of the equipment shall be mandatory. This shall be arranged by the supplier from the manufacturer.
- (v) Technical Standards for Interconnection:

| S.No. | Parameters                    | Requirements   | Reference  |
|-------|-------------------------------|--|--|
| 1.    | Overall Conditions of Service | Reference to regulations   | Conditions for Supply of Electricity of Distribution Licensees   |
| 2.    | Over all Grid Standards       | Reference to regulations   | Central Electricity Authority (Grid Standards) Regulations 2010  |
| 3.    | Equipment                     | Applicable industry standards  | IEC standards/IS   |
| 4.    | Safety and Supply             | Reference to regulations, Chapter III (General Safety Requirements)  | Central Electricity Authority (Measures of Safety and Electricity Supply) Regulations, 2010 and subsequent amendments                          |
| 5.    | Meters                        | Reference to regulations and additional conditions issued by the Commission.   | Central Electricity Authority (Installation & Operation of Meters) regulations 2006 and subsequent amendments                                  |
| 6.    | Harmonic Current              | Harmonic current injections from a generating station shall not exceed the limits specified in IEEE 519  | IEEE 519 relevant CEA (Technical Standards for Connectivity of the distributed generation resource) regulations 2013 and subsequent amendments |
| 7.    | Synchronization               | Photovoltaic system must be equipped with a grid frequency synchronization device, if the system is using synchronizer inherently built into the inverter than no separate synchronizer is required.                                 | Relevant CEA (Technical Standards for Connectivity of the distributed generation resources) regulations 2013 and subsequent amendments.        |
| 8.    | Voltage                       | The voltage-operating window should minimize nuisance tripping and should be under operating range of 80% to 110% of the nominal connected voltage. beyond a clearing time of 2 seconds, the Photovoltaic system must isolate itself |  |

|     |                             |  |  |
|-----|-----------------------------|--|--|
|     |                             | from the grid.   |  |
| 9.  | Flicker                     | Operation of Photovoltaic system shouldn't cause voltage flicker in excess of the limits stated in IEC 61000 or other equivalent Indian standards, if any  | Relevant CEA regulations 2013 and subsequent if any, (Technical Standards for Connectivity of the distributed generation resource) |
| 10. | Frequency                   | When the Distribution system frequency deviates outside the specified conditions (52 Hz on upper side and 47 Hz on lower side up to 0.2 sec), the Photovoltaic system shouldn't energize the grid and should shift to island mode. |  |
| 11. | DC Injection                | Photovoltaic system should not inject DC power more than 0.5% of full rated output at the interconnection point. or 1% of rated inverter output current into distribution system under any operating conditions                    |  |
| 12. | Power Factor                | While the output of the inverter is greater than 50%, a lagging power factor of greater than 0.9 shall be maintained   |  |
| 13. | Islanding and Disconnection | The Photovoltaic system in the event of voltage or frequency variations must island/ disconnect itself within IEC standard on stipulated period  |  |
| 14. | Overload and Overheat       | The inverter should have the facility to automatically switch off in case of overload or   |  |

|    |       |   |  |
|----|-------|---|--|
|    |       | overheating and should restart when normal conditions are restored  |  |
| 15 | Cable | For interconnecting Modules, Connecting modules and junction Boxes and junction boxes to inverter, DC copper cable of proper sizes shall be used. To connect inverter with AC panel aluminium cable of proper size shall be used. All the internal cables to be used in the systems shall be included in the cost while 100mtr. AC aluminium cable of proper size to be used to connect inverter/PCU to AC panel shall be included in the cost of the system. | Relevant CEA regulations 2013 and subsequent if any, (Technical Standards for Connectivity of the distributed generation resource) |

- a) All switches and the circuit breakers, connectors should conform to IEC 60947, part I, II and III/ IS60947 part I, II and III.
- b) The change-over switches, cabling work should be undertaken by the bidder as part of the project.

8. **JUNCTION BOXES FOR CABLES FROM SOLAR ARRAY:**

The junction boxes shall be made up of FRP (Hensel or equivalent make)/PP/ABS with dust, water and vermin proof. It should be provided with proper locking arrangements.

Series / Array Junction Box (SJB/AJB) (whichever is required): All the arrays of the modules shall be connected to DCCB. AJB shall have terminals of bus-bar arrangement of appropriate size Junction boxes shall have suitable cable entry with suitable glanding arrangement for both input and output cables. Suitable markings on the bus bars shall have to be provided to identify the bus bars etc. **Suitable ferrules shall also have to be provided to identify interconnections. Every AJB should have suitable arrangement Reverse Blocking diode of suitable rating. Suitable SPD, suitable Isolation switches to isolate the DC input to Inverter has to be installed in AJB for protection purpose.** Thus AJB should have DC isolator for disconnecting the arrays from inverter input. **If in any case diodes, HRC Fuses, SPDs and isolators are installed in the string inverters, then there is need to install these again in AJB. If some of these safety gadgets are not installed in String Inverter it should be installed in AJB.** Cable interconnection arrangement shall be



within conduit pipe on saddles installed properly. **Cable connection should be done in such a manner that fault findings if any, can be identified easily. The cables should be connected in such a manner that clamp meter can be comfortably inserted around the individual cables to measure the data like current, voltage etc.** AJB should also be marked as A1, A2, & so on. Wherever conduits are laid on wall/roof or ground, then it should be suitably laid in cable tray or appropriate civil structure which should be at least four inches above roof/ground level.

However, if the inverter/PCU is equipped with Junction Box, the cables may be connected directly to the ports provided in the inverter/PCU and no separate Junction Box is required.

#### **9. PROTECTION & SAFETY:**

Both AC & DC lines have suitable MCB/MCCB, Contractors, SPD, HRC Fuse etc to allow safe start up and shut down before & after string inverter installed in the system. String inverters should have protections for overload, surge current, high Temperature, over/ under voltage and over/ under frequency & reverse polarity. The complete operation process & safety instructions should be printed on the sticker & suitably pasted on the near inverters.

Inverter should have safety measures to protect inverter from reverse short circuit current due to lightning or line faults of distribution network.

**Inverter should be suitably placed in covered area on a suitable platform or wall mounted or concrete platform (on rubber mat) with complete safety measure as per norms.**

#### **10. INVERTER/ARRAY SIZE RATIO:**

- The combined wattage of all inverters should not be less than rated capacity of power plant under STC in KW.
- Maximum power point tracker shall be integrated in the inverter to maximize energy drawn from the array

#### **11. AC COMBINER BOX BOARD (ACCB):**

This shall consist of box shall consists of grid interphase panel of good quality FRP/ suitable powder coated metal casing. One Electronic Energy Meter (0.2S Class), ISI make, Single/Three Phase duly tested by DISCOMs (Meter testing Division) with appropriate CT (if required), of good quality shall have to be installed at suitable placed to measure the power generated from SPV Power Plant, as per HERC Net Metering Regulations. Proper rating MCCB & HRC fuse and AC SPDs shall be installed to protect feeders from the short circuit current and surges as per the requirement of the site. **Operation AC Isolator Switch of Grid Connectivity should be such that it can be switched ON or OFF without opening the ACCB.**

#### **12. CABLES/WIRE:**

All cables should be of copper as per IS and should be of 650V/1.1 KV grade as per requirement. All connections should be properly made through suitable lug/terminal

crimped with use of suitable proper cable glands. The size of cables/wires should be designed considering the line losses, maximum load on line, keeping voltage drop within permissible limit and other related factors. The cable/wire should be of ISI/ISO mark for overhead distribution. For normal configuration the minimum suggested sizes of cables are:

|                                     |   |
|-------------------------------------|---|
| Module to module/AJB                | : 4 sq mm (single core) DC Cable  |
| AJBs to MJB/DCCB/Inverter/PCU       | Up to capacity of 10 kWp Solar Plant, minimum 4sq mm (Single/Double core) DC Cable, with respect to current ratings of designing,<br><br>For capacity more than 10 kWp& up to 20 kWp Solar Plant, minimum 6sq mm (Single/Double core) DC Cable, with respect to current ratings of designing,<br><br>For capacity more than 20 kWp Solar Plant, minimum 10sq mm (Single/Double core) DC Cable, with respect to current. |
| Inverter to ACCB/Distribution board | AC Cable as per design & rating   |

The size & rating of the cables may vary depending on the design & capacity of SPV Power Plant.

### 13. **CABLE TRAY:**

All the cables should be laid in appropriate GI cable tray as per the requirement of the site, No cable should be laid directly on ground or wall cable tray should be laid such that there is gap of at least two inches above ground/roof/wall.

### 14. **DISPLAY BOARD:**

The bidder has to display a board at the project site mentioning the following:

- Plant Name, Capacity, Location, Type of Renewable Energy plant (solar), Date of commissioning, details of tie-up with transmission and distribution companies, Power generation and Export FY wise.
- Financial Assistance details from HAREDA/MNRE/Any other financial institution apart from loan. This information shall not be limited to project site but also be displayed at site offices/head quarter offices of the successful bidder
- The size and type of board and display shall be approved by Engineer-in-charge before site inspection.
- **DANGER BOARDS:** Danger boards should be provided as and where necessary as per IE Act. /IE rules as amended up to date.

### 15. **MANUAL DISCONNECTION SWITCH:**

It should be provided to isolate the system from Grid which should be outside of ACCB.

### 16. **AC DISTRIBUTION PANEL BOARD:**

- a) AC Distribution Panel Board (DPB) shall control the AC power from PCU/ inverter, and should have necessary surge arrestors. Interconnection from ACDB to mains at LT Bus bar while in grid tied mode.
- b) All switches and the circuit breakers, connectors should conform to IEC 60947, part I, II and III/ IS60947 part I, II and III.
- c) The changeover switches, cabling work should be undertaken by the bidder as part of the project.
- d) All the Panel's shall be metal clad, totally enclosed, rigid, floor mounted, air - insulated, cubical type suitable for operation on three phase / single phase, 415 or 230 volts, 50 Hz
- e) The panels shall be designed for minimum expected ambient temperature of 45 degree Celsius, 80 percent humidity and dusty weather.
- f) All indoor panels will have protection of IP54 or better. All outdoor panels will have protection of IP65 or better.
- g) Should conform to Indian Electricity Act and rules (till last amendment).
- h) All the 415 AC or 230 volts 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 |

**17. DATA ACQUISITION SYSTEM / PLANT MONITORING (for 10 kWp and above).**

- (i) For systems of capacity 10 kWp and above, web based remote monitoring access of which shall also be provided to HAREDA software monitoring system with latest configuration. If needed access to MNRE shall also be provided.
- (ii) PV array energy production: Digital Energy Meters to log the actual value of AC/ DC voltage, Current & Energy generated by the PV system provided. Energy meter along with CT/PT should be of 0.2S accuracy class. For Hybrid there shall be provision in built in the PCU to measure generated solar energy as there is no option to install separate solar generation meter.
- (iii) String and array DC Voltage, Current and Power, Inverter AC output voltage and current (All 3 phases and lines), AC power (Active, Reactive and Apparent), Power Factor and AC energy (All 3 phases and cumulative) and frequency shall be monitored.
- (iv) All instantaneous data shall be shown on the computer screen.
- (v) Software shall be provided for USB download and analysis of DC and AC parametric data for individual plant.
- (vi) Provision for instantaneous Internet monitoring and download of historical data shall be also incorporated.

**18. PRIORITY FOR POWER CONSUMPTION:**

Regarding the generated power consumption, in case of string inverter, priority need to given for internal consumption first and thereafter any excess power can be exported to grid.

**19. PROTECTIONS**

The system should be provided with all necessary protections like earthing, Lightning, and grid anti- islanding as follows:

(i) **Lightning And Over Voltage Protection:**

The SPV Power Plant shall be provided with lightning and over voltage protection. The principal aim in this protection is to reduce the over voltage to a tolerable value before it reaches the PV or other sub-systems components. The source of over voltage can be lightning or any other atmospheric disturbance. The Lightning Arrestor (LA) is to be made of 1¼" diameter (minimum) and 12 feet long GI spike on the basis of the necessary meteorological data of the location of the projects. Necessary foundation for holding the LA is to be arranged keeping in view the wind speed of the site and flexibility in maintenance in future. Each LA shall have to be earthed through suitable size earth bus with earth pits. The earthing pit shall have to be made as per IS 3043. LA shall be installed to protect the array field, all machines and control panels installed in the control rooms. Number of LA shall vary with the capacity of SPV Power Plant & location. Number of LA should be in such a manner that total layout of solar modules should the effective coverage of LA's.

For systems up to 10 kWp the lightning arrester shall of conventional type and for above 10 kWp systems it should be of Early Streamer Emission (ESE) type.

(ii) **Earthing Protection:**

Each array structure of the PV yard shall be grounded properly. In each array every module should be connected to each other with copper wires, lug teathed washers addition the lightning arrester/masts shall also be provided inside the array field. Provision shall be kept for shorting and grounding of the PV array at the time of maintenance work. All metal casing/shielding of the plant shall be thoroughly grounded in accordance with Indian Electricity Act/IE rules as amended up to date. The earthing pit shall be made as per IS: 3043. All the array structures and equipments/control systems shall be compulsorily connected to the earth, separately. Number of earthing shall vary with the capacity of SPV Power Plant & location. G.I. /Copper strips should be used for earthing instead of G.I. wires. LA should be installed to protect the array field & machines installed in the control rooms. Number of LA shall vary with the capacity of SPV Power Plant & location. Earth resistance shall not be more than 5 ohms.

(iii) **Surge Protection:**

Internal surge protection shall consist of three MOV type surge-arrestors connected from +ve and -ve terminals to earth (via Y arrangement)

(iv) **Grid Islanding:**

- a) In the event of a power failure on the electric grid, it is required that any independent power-producing inverters attached to the grid turn off in a short period of time. This prevents the DC-to-AC inverters from continuing to feed power into small sections of the grid, known as "islands."

Powered islands present a risk to workers who may expect the area to be unpowered, and they may also damage grid-tied equipment. The Rooftop PV system shall be equipped with islanding protection. In addition to disconnection from the grid (due to islanding protection) disconnection due to under and over voltage conditions shall also be provided.

- b) A manual disconnect pole isolation switch beside automatic disconnection to grid would have to be provided at utility end to isolate the grid connection by the utility

personnel to carry out any maintenance. This switch shall be locked, if required, by the utility personnel

**20. CONNECTIVITY:**

The user have to take approval/NOC from the Concerned DISCOM for the connectivity, technical feasibility, and synchronization of SPV plant with distribution network and submit the same to HAREDA before commissioning of SPV plant, however the supplier have to extend all technical help to the user for preparing the documents required for getting the above clearance from DISCOMs.

Reverse power relay shall be provided by bidder (if necessary), as per the local DISCOM requirement.

The maximum capacity for interconnection with the grid at a specific voltage level shall be as specified in the Distribution Code/Supply Code and amended from time to time. Following criteria have been suggested for selection of voltage level in the distribution system for ready reference of the solar suppliers.

| <b>Plant Capacity</b>         | <b>Connecting voltage</b>   |
|-------------------------------|---|
| Up to 10 kWp                  | 240V-single phase or 415V-three phase as per requirement of electric connection of the consumer               |
| Above 10kWp and up to 100 kWp | 415V – three phase  |
| Above 100kWp                  | 415V – three phase or as per site requirement based on the availability of grid level and as per DISCOM rules |

Utilities may have voltage levels other than above, DISCOMS may be consulted before finalization of the voltage level and system shall be designed accordingly.

**21. DRAWINGS & MANUALS:**

- (i) Two sets of Engineering, electrical drawings and Installation and O&M manuals are to be supplied. Bidders shall provide complete technical data sheets for each equipment giving details of the specifications along with make/makes in their bid along with basic design of the power plant and power evacuation, synchronization along with protection equipment.
- (ii) Approved ISI and reputed makes for equipment be used.

**22. SAFETY MEASURES:**

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. All work shall be carried out in accordance with the latest edition of the Indian Electricity Act and rules formed there under and as amended from time to time.

**23. CODES AND STANDARDS**

The quality of equipment supplied shall be controlled to meet the guidelines for engineering design included in the standards and codes listed in the relevant ISI and other standards, such as :

- i. IEEE 928 Recommended Criteria for Terrestrial PV Power Systems.
- ii. IEEE 929 Recommended Practice for Utility Interface of Residential and Intermediate PV Systems.

- iii. IEEE 519 Guide for Harmonic Control and Reactive Compensation of Static Power Controllers.
- iv. National Electrical NEPA 70-(USA) or equivalent national standard.
- v. National Electrical Safety Code ANSI C2- (USA) or equivalent national standard.
- vi. JRC Specification 503 (Version 2.2 March 1991) or JPL Block V standard for PV modules.
- vii. The inverter manufacturer should attach efficiency certificate from Independent Third party Testing laboratory i.e. IEC, TUV, SNL/ERTL & STQC. PCU should confirm to IEC 61683 for efficiency measurements and IEC 60068 2 for environmental testing. MPPT unit should confirm to design qualification IEC 62093.
- viii. IEC 62116 for Anti Islanding
- ix. IEC 62109-1, IEC 62109-2 for safety
- x. IEC 61727 FOR UTILITY INTERFACE.